Relationship between Transitions in Self-rated Health and Health Indicators in Japanese Workers

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Objective: Self-rated health (SRH) reflects lifestyle habits, chronic disease, and psychosocial conditions. The aim of this study was to examine the relationship between transitions in SRH and health indicators among Japanese white-collar workers.
Methods: Three-year medical examination data from an occupational field was used. The distribution of data related to SRH, lifestyle habits, treatment of chronic disease, laboratory data abnormalities, job stress, and sickness absences were compared using ridit analysis, and the odds ratios and 95% confidence intervals were calculated using the first year of observation as a reference.
Results: During the observation period, the proportion of workers with poor SRH, self-rated lifestyle habits, sleep, dietary habits, and body mass index increased. Particularly, high job stress (heavy job burden and low job control) and few sickness absences were strongly related to poor SRH.
Conclusions: Unfavorable lifestyles and work-related conditions worsened as SRH declined among workers. The results suggest that health indicators related to SRH are different according to the population. Tracking changes in SRH using indices related to SRH is useful for evaluating the health status in a target group.

Key words: self-rated health, lifestyle, job stress, sickness absence, health examination.

INTRODUCTION

In public health, it is important to evaluate the overall health status of target groups and to make precise measurements. Although indicators such as mortality and average life expectancy have been used to evaluate the health condition of groups, these are not necessarily appropriate indicators for evaluating relatively healthy groups such as workers or younger people. Definitive and comprehensive health indicators still need to be determined.

Self-rated health (SRH) has been considered an index of health primarily in the fields of gerontology and public health [1]. SRH is a subjective perception of health based on a response to the question, "How do you feel about your health?" SRH is utilized in social surveys and large-scale statistical analyses in which objective evaluations are difficult, such as medical studies, and items concerning SRH have been introduced as survey items in the US National Health Interview Survey since 1972 as well as in the Comprehensive Survey of Living Conditions of the People on Health and Welfare in Japan since 1986 [2, 3].

Many studies have shown that SRH is a powerful predictor of disability onset and mortality, independent of other medical conditions and psychosocial status [4, 5]. Previous studies have found that physical inactivity, smoking, alcohol intake, and overweight were strongly related to poor SRH [6, 7]. Additionally, chronic diseases such as obesity, hypertension, diabetes, and dyslipidemia rise significantly as SRH becomes poorer [8].

SRH is strongly correlated with psychosocial stress [9]. The combination of high job demands and low job control is detrimental to workers' health [10]. Furthermore, job insecurity appears to have a negative effect on health [11]. The SRH of a worker who is exposed to such work-related stress is likely to be poor [12], and the risk of developing cardiovascular disease or mental diseases such as depression in the long term is greater [13].

SRH is useful as a comprehensive indicator of health status [14] and is related to various health statuses including lifestyle and psychosocial conditions. Thus, it serves a means of evaluating the transition in health status in a target population. However, as most previous studies have been cross sectional, it is not apparent what kind of health indicators are related to transitions in SRH. Because many studies about the association between SRH and lifestyle-related factors have been conducted with elderly people, it is possible that SRH transitions in younger workers are associated with different health indicators.

The aim of this study was to investigate the relationship of transitions in SRH with lifestyles, clinical parameters and treatment of chronic disease, and work-related conditions and to clarify the significance of SRH as an indicator of health status.

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SUBJECTS AND METHODS

Subjects

We compiled annual health check-up data for white-collar employees aged 21–72 years (mean, 46.5 years, 44.6% females) of an insurance company in Japan over 3 years, beginning in 2002. The numbers of subjects recruited in 2002, 2003, and 2004 were 4,513, 5,574, and 5,415 respectively. Medical examinations in this study were targeted at all employees under the Industrial Safety and Health Law. Each year's consultation rate was 90–95%. The medical examinations were carried out at the medical institution with which each branch office had a cooperative relationship. Each individual completed a medical interview sheet and sealed it. Then, each branch office collected the sheets and sent them to the head office.

This study used only data collected by periodic medical examinations based on the Industrial Safety and Health Law, and the data were anonymous and could not be linked to individual participants. Thus, the data contained no personal information. This study was performed according to Declaration of Helsinki, and we obtained permission to use the data from the Health and Safety Committee of the corporation.

Measurement of SRH

Information about SRH of the subjects was provided by a multiple-choice health survey questionnaire. In response to the statement: "Considering your present health condition, choose only one response from the options," the subjects selected responses from among four options: healthy, relatively healthy, relatively unhealthy, and unhealthy.

Measurement of Health Indicators

We also asked subjects to respond to the health survey questionnaire in relation to self-rated lifestyle habits, medical history, treatment of diseases, and information about sleep and physical activity, alcohol and smoking, job stress, and sickness absences. Subjects selected responses that corresponded to their lifestyle habits at the time of measurement from among the following: healthy, relatively healthy, relatively unhealthy, and unhealthy. With respect to treatment of chronic diseases (hypertension, dyslipidemia, diabetes, and hyperuricemia), responses were chosen from among the options no disorder, cured, left untreated, under observation, and under treatment. The frequency with which the individual reportedly engaged in exercise for more than 30 minutes was used as a measure of leisure-time physical activity. The frequency of drinking per week and average daily alcohol consumption (1 unit [180 ml] of sake considered equal to 25 g of ethanol) was provided. The presence or absence of smoking and the number of cigarettes smoked per day were provided for smoking habits. To measure job stress, participants responded to statements such as "I find work a heavy burden and painstaking" and "I feel incapable to work at my own pace." Responses for sickness absences indicated the numbers of days a worker could was absent from work over 1 year. Laboratory data (body mass index [BMI], systolic and diastolic blood pressure, total cholesterol, high-density lipoprotein cholesterol, uric acid, and fasting plasma glucose) were stratified into six levels for analysis.

Statistical Analysis

All data are given as number (%). The distributions of health indices including SRH among subjects in each observation year were compared by ridit analysis using the first observation year as the reference (mean ridit = 0.5) [15, 16]. The Mantel-extension method was used as the trend test [17]. Odds ratios (ORs) based on the health indicators in the first observation year, and 95% confidence intervals (CIs) were calculated and compared for each indicator over 2 years. All differences were assessed with a two-tailed test. A p-value < 0.05 was considered significant.

RESULTS

Table 1 shows participants' subjective SRH and lifestyle habits, job stress, and annual sickness absences for each year. The proportions of poor SRH (relatively unhealthy or unhealthy) were 10.2% in 2002, 11.2% in 2003, and 11.6% in 2004. The respective proportions of subjects with poor self-rated lifestyle habits (relatively unhealthy or unhealthy) were 34.8%, 36.4%, and 37.0%. The proportions of those with insomnia (difficulty sleeping well or incapable of sleeping at all) were 28.3%, 29.4%, and 31.2%, the proportions with a tendency to skip meals (two or fewer meals per day) were 21.5%, 22.5%, and 23.5%, and the percentages of those with little physical activity (twice or less per month) were 72.3%, 72.2%, and 72.2%. The percentages of drinkers who consumed an intermediate amount of alcohol (50 g ethanol each time) were 22.7%, 23.8%, and 24.5%, and the percentages of heavy smokers (21 or more cigarettes per day) were 44.5%, 42.9%, and 39.7%. The percentages of workers with a heavy job burden (frequently) were 13.6%, 15.4%, and 17.3%, and the percentages of those who felt low job control (often incapable or incapable of working at own pace) were 37.7%, 42.1%, and 42.3%. The percentages of those who did not take off from work for sickness were 37.1%, 38.1%, and 40.1%. The proportions of workers under treatment for hypertension were 3.7%, 4.2%, and 4.7%. The ratio of subjects with dyslipidemia was about 3% and that for diabetes and hyperuricemia was about 1.5% throughout the 3 years. No significant yearly trends were observed in the treatment conditions for chronic diseases or in laboratory data abnormalities as SRH declined, except for hypertension ($p < 0.05$) (data not shown).

The results of the ridit analysis for each health index are shown in Table 2. Mean ridit values for SRH in the subjects in 2004 were significantly higher than those of subjects in 2002, and the distribution of SRH shifted toward the poor end of the scale. The mean ridit values for self-rated lifestyle habits, sleep condition in 2004 were significantly higher, and the number of meals per day was significantly lower than those of subjects in 2002, and the distribution shifted toward poor lifestyle habits such as insomnia and skipping meals. No significant differences were found in the annual distributions for physical activity or drinking habits, whereas significant differences were found for

Table 1 Subject's self-rated health, lifestyles, and health indices

	2002 (n = 4,513)		2003 (n = 5,574)		2004 (n = 5,415)	
	n	%	n	%	n	%
Self-rated health						
Healthy	1,666	37.4	2,031	36.7	1,815	33.8
Relatively healthy	2,332	52.4	2,882	52.1	2,926	54.6
Relatively unhealthy	391	8.8	550	9.9	543	10.1
Unhealthy	62	1.4	72	1.3	79	1.5
Self-rated lifestyle habit						
Healthy	580	12.9	719	12.9	634	11.7
Relatively healthy	2,354	52.2	2,820	50.7	2,765	51.2
Relatively unhealthy	1,268	28.1	1,648	29.7	1,627	30.1
Unhealthy	304	6.7	371	6.7	375	6.9
Sleep condition						
Sleep well	3,229	71.7	3,925	70.6	3,720	68.8
Unable to sleep well	1,216	27.0	1,551	27.9	1,575	29.1
Unable to sleep at all	60	1.3	84	1.5	110	2.0
Number of meals per day						
Four times or more	14	0.3	20	0.4	18	0.3
Three times	3,509	78.2	4,290	77.2	4,092	76.1
Two times or less	965	21.5	1,250	22.5	1,264	23.5
Frequency of physical activity						
Three times or more per week	301	6.6	393	7.1	383	7.1
Once or twice per week	943	20.9	1,156	20.7	1,123	20.8
Twice or less per month	1,559	34.5	1,996	35.8	1,965	36.3
None	1,707	37.8	2,029	36.4	1,937	35.9
Drinking habit						
No drinking habit	972	21.5	1,198	21.5	1,185	21.9
Quit drinking	29	0.6	47	0.8	30	0.6
Once a week or less	2,174	48.1	2,760	49.5	2,648	49.0
Two or three days per week	838	18.6	1,013	18.2	1,055	19.5
Four to six days per week	440	9.7	530	9.5	490	9.0
Almost every day	1,061	23.5	1,270	22.8	1,222	22.6
Intake of ethanol per day						
< 25 g	2,451	66.4	2,970	65.1	2,813	63.8
50 ~ 74 g	838	22.7	1,085	23.8	1,081	24.5
75 ~ 99 g	311	8.4	374	8.2	364	8.9
100 g ≤	87	2.4	132	2.9	120	2.7
Smoking habit						
No smoking habit	2,297	51.2	2,735	49.5	2,644	49.3
Quit smoking	619	13.8	800	14.5	816	15.2
Current smoking	1,569	35.0	1,989	36.0	1,904	35.5
Number of cigarettes per day						
< 10	202	14.3	251	13.7	236	13.7
11 ~ 20	580	41.2	794	43.4	805	46.6
21 ≤	627	44.5	786	42.9	687	39.7

Physical activity: frequency of exercising for more than 30 minutes.

smoking between 2002 and 2003, showing a shifted toward more smokers (current or quitting smoking) and more intermediate smokers. The mean ridit values in 2003 and 2004 were significantly higher for job stress than those in 2002, and the distribution of stress shifted toward a heavy job burden and low job control.

As shown in Figure, the mean ridit values for job burden and job control preceded the change in SRH and rose significantly from 2003. The mean ridit values in 2004 for sickness absences were significantly lower than those in 2002, and the distribution of absences shifted toward no days absent from work.

The mean ridit value for BMI was significantly higher in 2004 than that during the other 2 years, and the BMI distribution shifted toward obesity. Significant differences in mean ridit values for systolic blood pres-

Table 1 (continued) Subject's self-rated health, lifestyles, and health indices

	2002 (n = 4,513)		2003 (n = 5,574)		2004 (n = 5,415)	
	n	%	n	%	n	%
Job stress						
Sence of job burden						
None	986	22.0	1,198	21.5	1,117	20.7
Occasionaly	2,892	64.4	3,509	63.1	3,346	62.0
Frequently	611	13.6	857	15.4	933	17.3
Sence of job control						
Capable	716	15.9	854	15.3	768	14.2
Often capable	2,085	46.4	2,370	42.6	2,351	43.5
Often incapable	1,458	32.4	1,965	35.3	1,910	35.3
Incapable	238	5.3	376	6.8	375	6.9
Sickness absence per year						
None	1,675	37.1	2,124	38.1	2,173	40.1
1 ~ 3 days	2,066	45.8	2,540	45.6	2,361	43.6
4 ~ 7 days	557	12.4	668	12.0	641	11.8
8 ~ 14 days	135	3.0	149	2.7	161	3.0
≥ 15 days	77	1.7	91	1.6	79	1.4

Table 2 Distribution of self-rated health and health indices according to observation period

	Mean ridit	
	2003 (n = 5,574)	2004 (n = 5,415)
Self-rated health	0.507	0.521††
Self-rated lifestyle habit	0.505	0.513††
Sleep condition	0.506	0.515††
Number of meals per day	0.496	0.490†
Physical activity for more than 30 minutes	0.494	0.491
Drinking habit	0.493	0.494
Intake of ethanol per day	0.501	0.504
Smoking habit	0.508*	0.508
Number of cigarettes per day	0.495	0.482††
Job stress (job burden)	0.509*	0.520††
Job stress (job control)	0.522**	0.526††
Annual sickness absence	0.493	0.485††
Body mass index (BMI)	0.507	0.509†
Systolic blood pressure (SBP)	0.483**	0.490†
Diastolic blood pressure (DBP)	0.499	0.502
Total cholesterol (TC)	0.507	0.502
High density lipoprotein cholesterol (HDLC)	0.501	0.501
Tryriglyceride (TG)	0.499	0.502
Uric acid (UA)	0.501	0.508
Fasting plasma glucose (FPG)	0.502	0.502

Reference: 2002. *2002 vs.2003 ($^{*}p < 0.05$, $^{**}p < 0.01$), † 2002 vs.2004 ($^{\dagger}p < 0.05$, $^{\dagger\dagger}p < 0.01$)

sure were observed in 2003 and 2004, with shifts in the distributions toward fewer subjects with systolic blood pressure ≥ 140 mmHg. No significant differences were found in the distributions for the other laboratory data in each year.

Table 3 shows the ORs and 95% CIs for SRH, lifestyle habits, job stress, and sickness absences using the indicators in the first observation year as a reference. The ORs for poor SRH, poor self-rated lifestyle habits, insomnia, skipping meals, no physical activity, intake

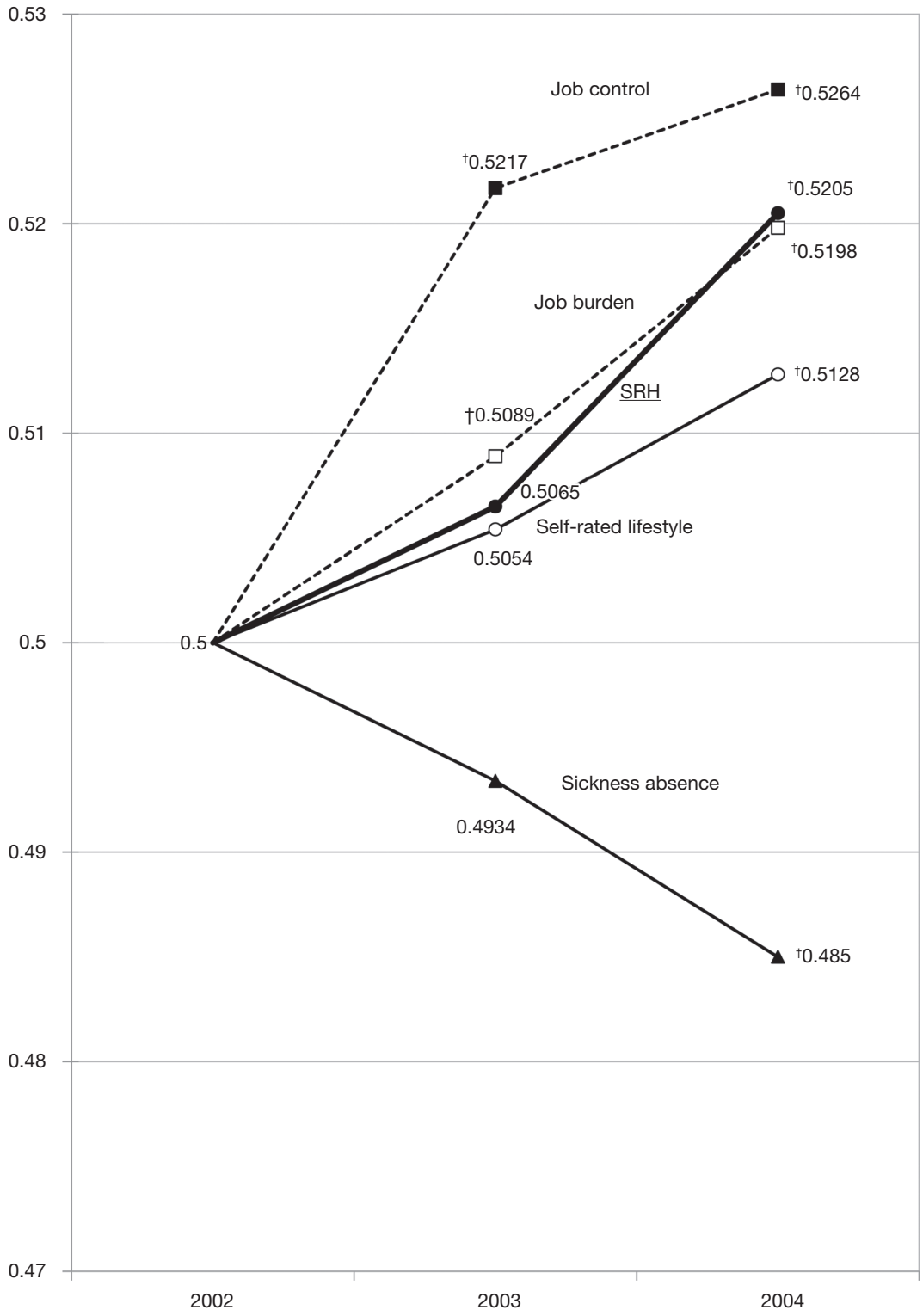

Figure Mean ridit values of self-rated health, self-rated lifestyle, job stress and sickness absences.
† Mean ridit values for each health index changed significantly in comparison with those in 2002.

of 50 g or more of ethanol per day, and a sense of job burden with poor job control increased significantly from 2002 to 2004. Significant increases in job burden and decreases in job control were observed from year to year. The OR for no sickness absences increased significantly from 2002 to 2004.

The ORs and 95% CIs for chronic diseases under treatment and laboratory data abnormalities are shown in Table 4. Although the ORs for hypertension and uric acid elevation increased significantly between 2002 and 2004, other diseases and laboratory data abnormalities did not change.

DISCUSSION

The SRH of the target group deteriorated during the study period. Accordingly, changes in lifestyle (self-

Table 3 Odds ratios and 95% confidence intervals for self-rated health, lifestyle habits, job stress, and sickness absences

	2003		2004	
	OR (95% Cl)	*p*	*OR* (95% Cl)	*p*
Poor self-rated health	1.12 (0.98–1.27)	n.s	**1.16 (1.02–1.32)**	0.025
Poor self-rated lifestyle	0.94 (0.87–1.02)	n.s	**1.10 (1.01–1.19)**	0.025
Insomnia	1.05 (0.97–1.15)	n.s	**1.15 (1.05–1.25)**	0.002
Skip of meals	1.06 (0.96–1.16)	n.s	**1.12 (1.02–1.23)**	0.017
No exercise habit	0.99 (0.91–1.08)	n.s	0.99 (0.90–1.08)	n.s
Drinking habit	0.95 (0.88–1.02)	n.s	1.04 (0.96–1.13)	n.s
Intake of 50 g or more of ethanol per day	1.06 (0.97–1.16)	n.s	**1.12 (1.03–1.23)**	0.013
Current smoking	1.05 (0.96–1.14)	n.s	1.02 (0.94–1.11)	n.s
Smoking 21 or more per day	1.05 (0.86–1.29)	n.s	0.91 (0.79–1.05)	n.s
Presence of job burden	**1.16 (1.03–1.29)**	0.012	**1.33 (1.19–1.48)**	< 0.0001
Poor job control	**1.20 (1.11–1.30)**	< 0.0001	**1.21 (1.12–1.32)**	< 0.0001
No sickness absence	**1.04 (0.96–1.13)**	n.s	**1.13 (1.05–1.23)**	0.002

OR, odds ratio; CI, confidence interval. Reference: 2002.
Poor self-rated lifestyle: Total of unhealthy or relatively unhealthy lifestyle habits.
Insomnia: Total of inability to sleep well and incapable of sleeping at all.
Skipping meals: Two meals per day or fewer.
No exercise habit: No fitness habit of more than 30 minutes per occasion or only once or twice per month.
Drinking habit: A drinking habit of 2 days or more per week.
Current smoking: Smoke occasionally or every day.
Presence of job burden: Frequently feel a heavy burden due to work.
Poor job control: Feel incapable to work at one's own pace.
No sickness absences: No days absent from work due to ill-health.

Table 4 Odds ratios and 95% confidence intervals for chronic disease (under treatment) and laboratory data abnormalities

	2003		2004	
	OR (95% Cl)	*p*	*OR* (95% Cl)	*p*
Hypertension	1.15 (0.92–1.42)	n.s	**1.29 (1.04–1.59)**	0.020
Diabetes	0.86 (0.61–1.23)	n.s	1.01 (0.71–1.42)	n.s
Dyslipidemia	1.07 (0.85–1.36)	n.s	0.83 (0.64–1.07)	n.s
Hyperuricemia	1.01 (0.72–1.42)	n.s	0.92 (0.70–1.40)	n.s
BMI ≥ 25 kg/m^2	1.05 (0.95–1.16)	n.s	1.10 (1.00–1.21)	n.s
SBP ≥140 mmHg	0.92 (0.80–1.07)	n.s	1.07 (0.80–1.07)	n.s
DBP ≥ 90 mHg	1.07 (0.92–1.25)	n.s	1.13 (0.97–1.31)	n.s
TC ≥ 240 ml/dl	1.07 (0.92–1.25)	n.s	1.13 (0.97–1.31)	n.s
HDLC ≤ 40 mg/dl	1.05 (0.85–1.19)	n.s	0.96 (0.84–1.09)	n.s
TG ≥ 150 mg/dl	0.86 (0.92–1.25)	n.s	1.13 (0.97–1.31)	n.s
UA ≥ 7.0 mg/dl	1.01 (0.90–1.13)	n.s	**1.14 (1.02–1.27)**	0.018
FPG ≥ 110 mg/dl	1.06 (0.92–1.22)	n.s	1.05 (0.91–1.21)	n.s

OR, odds ratio; CI, confidence interval.
BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; TC, total cholesterol; HDLC, high density lipoprotein cholesterol; TG, triglycerides; UA, uric acid; FPG, fasting plasma glucose.

rated lifestyle habits, sleeping, and diet), job stress, and sickness absences were associated with changes in SRH. Thus, SRH may be an useful indicator, reflecting the comprehensive health condition of the group. Job stress particularly became worse prior to the change in SRH. Those results suggest that changes in SRH and other health indicators were possibly induced by aggravation of job stress. However, these possibilities still need to be examined in longitudinal studies using individual data to investigate any causal relationship between SRH and job stress.

According to the national statistics in Japan, work-related stress is the highest stress factor for workers, and the percentage of people reporting job-related stress is higher than that for health-related concerns [3]. Job stress among employees can be explained by a component based on job demand, job control, and job decision latitude (demand-control model) [18–20] or by the imbalance between effort and compensation (effort-reward imbalance model) [21, 22]. The statement regarding job stress used in the questionnaire was intended to ask about job burden and a sense of

control about work, which nearly matches Karasek's demand-control model. In either model, job stress correlates with the onset of chronic diseases such as cardiovascular disease, diabetes, and mental disorders including depression [18–23].

The SRH and job stress of workers in this study grew consistently worse during the observation period, and it is possible that some kind of labor situation changed for these participants. A recent study utilizing a comprehensive national survey in Japan reported that SRH and the prevalence of medical consultations among workers worsened during the same time period as this study (2001–2007) [24]. Economic recession and rising global competition have contributed to uncertainty about job security since 1990, with potential consequences for workers' health. [25, 26]. In this study, clinical parameters of chronic disease were not associated with SRH. However, it is possible that prolonged high job stress worsens the health indices.

It has often been reported that poor SRH is related to undesirable lifestyle habits, chronic disease, and healthcare use [5–9]. However, the results are not always consistent depending on the subject group. For example, poor SRH is related to physical inactivity and smoking in younger adults; however, poor SRH among middle-aged or elderly people is more strongly related to sleep dissatisfaction, physical symptoms, disease, or functional impairments [27]. Additionally, studies on the general population have reported that SRH is determined by disease status and socioeconomic factors [25]; however, according to studies with groups of workers, poor SRH is related to the work environment such as job stress even if socioeconomic factors are adjusted [26]. Therefore, it is necessary to clarify what kind of health index is associated with SRH in a target population to evaluate the health status of the group based on SRH.

Health behaviors such as smoking and alcohol consumption have been found to be associated with poor SRH in previous studies [6, 7]; however, other studies of workers have not confirmed these associations [28]. In the present study, SRH had no clear relationship with smoking or drinking habits, suggesting that the association between SRH and smoking or drinking habits among workers is different from that in the general population as a whole. Due to measures that have reduced smoking such as nonsmoking areas in the workplace, the number of cigarettes smoked per day may have decreased, even though the smoking rate itself has shown no change among workers. In Japan, drinking is often used as a means of face-to-face communication. Therefore, it is possible that workers who have many opportunities to drink with colleagues have good relationships at the workplace and are sufficiently supported in their work. This might have acted as a confounding factor to weaken the relationship between drinking and poor SRH.

In this study, poor SRH was not associated with disease-related indices except hypertension. Previous studies focusing on elderly people reported that chronic disease and physical disabilities have a strong relationship with SRH [4, 5]. Considering that the target of this study was the working population, it was inferred that the effect of chronic disease on daily life would not be as significant in this population as in elderly people. It might be that disease conditions were not related to SRH due to the healthy-worker effect [29]. As many abnormal laboratory data are asymptomatic, they are probably not reflected in subjective SRH. Nevertheless, deterioration in an index such as blood pressure, which can be measured individually and can be verified, is clearly related to poor SRH.

Fewer workers had poor SRH in this study than were reported in the labor statistics of Japan, which were at their highest during the observation period (11.6% vs. 19.0%) [30]. The prevalence of chronic diseases in our study was 8.9% for hypertension, 6.8% for dyslipidemia, and 3.9% for diabetes; these values were also lower than those in a previous survey (19%, 16% and 9%; data not shown). Therefore, workers evaluated in the present study are a cohort with comparatively good health. The subjects of this study were white-collar workers in an insurance company; therefore their socio-economic condition and income were presumably better than those of ordinary workers. For that reason, it is conceivable that the SRH of the present subjects was more affected by psychosocial factors such as job stress than by chronic disease status.

This study has some limitations. First, causal relationships between the transitional change in SRH and health indicators on an individual basis are not obvious because this study analyzed only aggregate data of the target group. Thus, additional analyses using individual data are necessary. Second, because this study did not survey the same workers longitudinally, it is possible that differences among the subjects responding each year might have caused sampling bias. However, because there were few worker transfers (such as workers entering or leaving the company) during the observation period, the effects of bias were probably small. Additionally, information on socioeconomic variables such as income, education, and marital status could not be obtained. Because socioeconomic factors affect SRH [25, 26], it is necessary for a future research to include such information.

In conclusion, the SRH shifted in conjunction with job stress, sickness absences, and lifestyle factors such as sleep and diet among Japanese white-collar workers during a 3-year observation period. Tracking the change in SRH with the indices relevant to SRH for a target population increases the usefulness of SRH as a means to evaluate health status characteristics in a particular group.

CONFLICTS OF INTEREST

The authors declare no competing interests.

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