Combined effect of high stress and job dissatisfaction on long-term sickness absence: a 1-year prospective study of Japanese employees

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Abstract

Objectives: We prospectively examined the combined effect of high stress (i.e., being under great work-related stress), as defined in the Japanese Stress Check Program manual using the Brief Job Stress Questionnaire (BJSQ), and job dissatisfaction on long-term sickness absence lasting 1 month or more.

Methods: Participants were 7,343 male and 7,344 female financial service company employees who completed the BJSQ. We obtained personnel records covering a 1-year period to identify employees with long-term sickness absence, which was treated as a dichotomous variable. Participants were classified into four groups (high-stress + dissatisfied, high-stress + satisfied, not high-stress + dissatisfied, and not high-stress + satisfied groups) to calculate the hazard ratios (HRs) of long-term sickness absence for these groups using Cox's proportional hazard regression analysis. Furthermore, to examine whether the combined effect of high stress and job dissatisfaction is synergistic or additive, we calculated relative excess risk due to interaction (RERI), attributable proportion due to interaction (AP), synergy index (SI), and their 95% confidence intervals (CIs).

Results: After adjustment for covariates, the HR of long-term absence was highest among the high-stress + dissatisfied group (HR 6.49; 95% CI, 3.42–12.3) followed by the high-stress + satisfied group (HR 5.01; 95% CI, 1.91–13.1). The combined effect of high stress and job dissatisfaction was additive (95% CIs of RERI and AP included 0 and that of SI included 1).

Conclusions: Our findings suggest incorporating high stress with job dissatisfaction improves the predictability of long-term sickness absence. However, employees reporting high stress but satisfaction with their jobs may still at increased risk of developing long-term sickness absence.

Keywords: absenteeism, interaction effect, job satisfaction, job stress, longitudinal studies, survival analysis

Introduction

Sickness absence is a major public health and economic concern in Japan1,2, as well as in other countries3-5. In particular, long-term sickness absence (i.e., sickness absence lasting 4 weeks/1 month or more)6 results in high costs for various stakeholders, such as employees, employers, insurance agencies, and society at large7,8. According to a report from the Organization for Economic Co-operation and Development (OECD), its member countries spend around 1.9% of the gross domestic product (GDP) on sickness absence benefits9, which are due in large part to long-term sickness absence10. Furthermore, long-term sickness absence has adverse effects...
on the probability of returning to work\textsuperscript{10,11}, as well as on mortality\textsuperscript{12–14}, therefore, identifying those who are at high risk of long-term sickness absence at an early stage and preventing it are beneficial for both employees and employers.

In Japan, the Industrial Safety and Health Act was partially amended on June 25th, 2014; all workplaces with 50 or more employees were obligated to implement the Stress Check Program annually for employees starting on December 1st, 2015. This program requires employers to (1) conduct a self-administered questionnaire survey (called a “Stress Check”), which measures job stressors, stress responses, and social support; (2) identify employees under great work-related stress (called “high-stress” employees) based on the results of the Stress Check and arrange a physician interview for them (at their own request); and (3) improve working conditions according to physician’s recommendations\textsuperscript{5}.

A recent study has reported that high stress, as defined in the Stress Check Program implementation manual (hereinafter called “Stress Check Program manual” or simply “program manual”)\textsuperscript{10} described below, significantly predicted subsequent long-term sickness absence\textsuperscript{17}. The Ministry of Health, Labour and Welfare has published the Stress Check Program manual\textsuperscript{16}, which proposes that high-stress employees are defined using the job stressors, stress responses, and social support scores of the Brief Job Stress Questionnaire (BJSQ)\textsuperscript{19} (more detailed proposed criteria are described in the Methods section). Although using the BJSQ is not mandatory to conduct the Stress Check or define high-stress employees in the Stress Check Program, it has been widely used in research and practice in the field of mental health in the Japanese workplace and can measure various aspects of job stressors, stress responses, and social support, as well as job and life satisfaction, with a total of 57 items\textsuperscript{18}.

In the Stress Check Program, information on job dissatisfaction has been underutilized for defining high-stress employees, although it can be measured using the BJSQ and has been reported to significantly and consistently predict long-term sickness absence by several prospective studies in Japan, as well as in other countries (i.e., Norway and the Netherlands\textsuperscript{19–22}). Given the empirical findings introduced above, those who meet the criteria for high stress and are also dissatisfied with their jobs may be at higher risk of a long-term sickness absence. Tsutsumi et al\textsuperscript{21} have pointed out that screening performance of high stress using the definition of the Stress Check Program manual is limited and that the combination of high stress with other related indicators needs to be examined. Furthermore, Asai et al\textsuperscript{24} have reported that more than 80% of high-stress employees did not request employers to arrange a physician interview. If we can better predict long-term sickness absence by incorporating high stress with job dissatisfaction measures, occupational health staff can identify high-stress employees who are more strongly encouraged to request a physician interview. Even with limited resources, the efficiency of physician interviews may be improved and eventually lead to prevention of long-term sickness absence, thereby saving companies money and resources.

The purpose of the present study was to examine the combined effect of high stress, as defined in the Stress Check Program manual using the BJSQ, and job dissatisfaction on long-term sickness absence. We hypothesized that those who met the criteria for high stress and were also dissatisfied with their jobs would be at higher risk of long-term sickness absence.

### Methods

**Participants**

From July 2015 to July 2016, we conducted a 1-year prospective study of employees from a financial service company of Japan. We gathered information on work-related stress, demographic and occupational characteristics, and long-term sickness absence using the BJSQ and the personnel records of the surveyed company. At baseline (July to August 2015), we invited all employees except board members; employees who were temporarily transferred, overseas, and dispatched; and attendees (n = 15,615) to participate in this study; a total of 14,711 employees completed the BJSQ (response rate: 94.2%). After excluding 24 employees who had taken long-term sickness absence in the past 3 years, we studied 14,687 employees (7,343 men and 7,344 women) aged 20–66 years for 1 year (until July 31st, 2016) (see Figure 1). We obtained informed consent from participants using the opt-out method for the secondary analysis of existing anonymous data. Kitasato University Medical Ethics Organization reviewed and approved the study procedure (No. B15-113).

**Exposure:** combination of high stress and job dissatisfaction

High stress was determined and job dissatisfaction was measured using the BJSQ. The BJSQ has high levels of internal consistency reliability and factor-based validity\textsuperscript{10} and comprises nine scales of job stressors (i.e., quantitative job overload [3 items], qualitative job overload [3 items], physical demands [1 item], interpersonal conflict [3 items], poor physical environment [1 item], job control [3 items], skill utilization [1 item], suitable jobs [1 item], and meaningfulness of work [1 item]), six scales of stress responses (i.e., vigor [3 items], anger-irritability [3 items], fatigue [3 items], anxiety [3 items], depression [6 items], and physical complaints [11 items]), three scales of social support (supervisor support [3 items], coworker support [3 items], and support from family and friends [3 items]), and two scales of satisfaction (job satisfaction [1 item]...
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Each item is measured with a four-point response option (1 = Not at all, 2 = Somewhat, 3 = Moderately so, and 4 = Very much so) for job stressors; 1 = Almost never, 2 = Sometimes, 3 = Often, and 4 = Almost always for stress responses; 1 = Not at all, 2 = Somewhat, 3 = Very much, and 4 = Extremely for social support; and 1 = Dissatisfied, 2 = Somewhat dissatisfied, 3 = Somewhat satisfied, and 4 = Satisfied for satisfaction).

The Stress Check Program manual proposes criteria for defining high-stress employees using the BJSQ: those who have a higher level of stress responses (criterion A) or have above a certain level of stress responses together with remarkably higher level of job stressors and/or lower level of social support (criterion B) are defined as high-stress employees. According to the program manual, a total score of stress responses was calculated by summing up the scale scores of vigor (reversed), anger-irritability, fatigue, anxiety, depression, and physical complaints (score range: 29–116). In a similar way, a total score of job stressors and social support was calculated by summing up the scale scores of quantitative job overload, qualitative job overload, physical demands, interpersonal conflict, poor physical environment, job control (reversed), skill utilization (reversed), suitable jobs (reversed), meaningfulness of work (reversed), supervisor support (reversed), coworker support (reversed), and support from family and friends (reversed) (score range: 26–104). For both scores, a higher score indicates worse (or more stressful) situation. Using the proposed cutoff points by the program manual, those who had 77 or more on the stress responses score (criterion A) or 63–76 on the stress responses score together with 76 or more on the job stressors and social support score (criterion B) were classified as “high-stress (HS)” group; and those who did not meet these criteria were classified as “not high-stress (NH)” group (see Figure 2).

For job dissatisfaction, using the single-item job satisfaction scale of the BJSQ “I am satisfied with my job,” those who answered 1 = Dissatisfied or 2 = Somewhat dissatisfied were classified as the “dissatisfied (D)” group; and those who answered 3 = Somewhat satisfied or 4 = Satisfied were classified as the “satisfied (S)” group.

On that basis, participants were classified into four groups according to the combination of the classification of high stress and job dissatisfaction (i.e., HS + D, HS + S, NH + D, and NH + S groups).

**Outcome:** long-term sickness absence

Long-term sickness absence was treated as a dichotomous variable. We obtained information on the dates of
application for invalidity benefit with medical certification for long-term sickness absence lasting 1 month or more from the personnel records of the surveyed company. In the surveyed company, employees were required to submit medical certification from their attending physician to the human resources/labor department when applying for invalidity benefit. Furthermore, because the personnel records included information on the resignation/retirement dates, those who resigned/retired from the surveyed company during the follow-up period were treated as censored cases. The follow-up started when participants answered the BJSQ and ended when they started to take long-term sickness absence (i.e., applied for invalidity benefit), resigned/retired, or when the study concluded on July 31st, 2016, whichever came first.

Covariates: demographic and occupational characteristics

We also obtained information on the demographic and occupational characteristics from the surveyed company. Demographic characteristics included age (years; continuous variable) and gender. Occupational characteristics included length of service (years; continuous variable), job type (four groups: sales, claims service, administrative, and others), and employment position (five groups: manager, staff, senior employee, temporary employee, and others).

Statistical analysis

First, we conducted descriptive analysis to summarize the basic features of each group on the basis of high stress and job dissatisfaction. Then, taking the NH + S group as a reference, we conducted Cox’s proportional hazard regression analysis to estimate the hazard ratios (HRs) and their 95% confidence intervals (CIs) of the incidence of long-term sickness absence during the follow-up period among the HS + D, HS + S, and NH + D groups. Furthermore, to examine whether the combined effect of high stress and job dissatisfaction is synergistic or additive, we calculated relative excess risk due to interaction (RERI), attributable proportion due to interaction (AP), and synergy index (SI) as well as their 95% CIs as follows:

\[ RERI = \frac{HR_{HS+D} - HR_{HS+S}}{HR_{NH+D} - 1} \]

\[ AP = \frac{RERI}{HR_{HS+D}} \]

\[ SI = \frac{HR_{HS+D} - 1}{(HR_{HS+S} - 1) + (HR_{NH+D} - 1)} \]

If 95% CIs of RERI and AP were greater than 0 and that of SI was greater than 1, the combined effect was determined to be synergistic. Conversely, if 95% CIs of RERI and AP included 0 and that of SI included 1, the combined effect was determined to be additive. In the series of the analyses, we first calculated the crude HRs, RERI, AP, and SI (i.e., without any adjustment) (model 1). Subsequently, we incrementally adjusted for demographic characteristics (i.e., age and gender) (model 2) and occupational characteristics (i.e., length of service, job type, and employment position) (model 3). Furthermore, to be consistent with the main purpose of the Stress Check Program (i.e., primary prevention of mental health problems) and to confirm the robustness of the main results, we conducted a similar analysis taking long-term sickness absence due to mental disorders as an outcome variable. The level of significance was 0.05 (two-tailed).

Most statistical analyses were conducted using Stata 14.0 (Stata Corp., College Station, TX, USA), while 95% CIs for RERI, AP, and SI were calculated using the Excel spreadsheet available from the EpiNET (http://epinet.se/res/xls/epinetcalculation.xls).

Results

Table 1 shows the detailed characteristics of each group on the basis of high stress and job dissatisfaction. Compared to the NH + S group, the other three groups were younger, had a shorter length of service, and had a greater proportion of women, claims service personnel, and staff represented, but a lower proportion of administrative, managerial, and senior employees. Among others, the HS + D group had the highest proportion of women and claims service personnel; and the HS + S group had the highest proportion of staff.

Table 2 shows the results of the Cox’s proportional hazard regression analysis and the combined effect of high stress and job dissatisfaction. During 5,258,910

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**Table 1**: Detailed characteristics of each group on the basis of high stress and job dissatisfaction

<table>
<thead>
<tr>
<th>Group</th>
<th>Age (years)</th>
<th>Length of Service (years)</th>
<th>Gender (%)</th>
<th>Job Type (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NH + S</td>
<td>45</td>
<td>10</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>NH + D</td>
<td>40</td>
<td>5</td>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td>HS + D</td>
<td>35</td>
<td>2</td>
<td>70</td>
<td>30</td>
</tr>
<tr>
<td>HS + S</td>
<td>42</td>
<td>8</td>
<td>65</td>
<td>35</td>
</tr>
</tbody>
</table>

**Table 2**: Results of the Cox’s proportional hazard regression analysis and the combined effect of high stress and job dissatisfaction

**Parameter**  | **NH + S** | **NH + D** | **HS + D** | **HS + S** | **RERI** | **AP** | **SI** |
<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>HR</td>
<td>1.2</td>
<td>1.5</td>
<td>1.8</td>
<td>2.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>95% CI</td>
<td>1.0-1.5</td>
<td>1.3-1.8</td>
<td>1.6-2.0</td>
<td>1.8-2.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RERI</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SI</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
person-days (mean: 358 days, range: 3–373 days), a total of 62 employees (32 men and 30 women) took a long-term sickness absence (mental disorders: 51 cases, musculoskeletal disorders: 6 cases, cerebrovascular disease: 3 cases, and cardiovascular disease: 2 cases). In the crude model (model 1), the HS + D group had the highest HR of long-term sickness absence (HR 5.70; 95% CI, 3.08–10.5) followed by the HS + S group (HR 4.44; 95% CI, 1.72–11.5) and then the NH + D group (HR 2.03; 95% CI, 1.05–3.92). For the combined effect of high stress and job dissatisfaction, RERI and AP were small and SI was close to 1; none of the indicators were statistically significant. These patterns were unchanged after adjustment for demographic and occupational characteristics (models 2 and 3).

When we conducted similar analysis taking long-term sickness absence due to mental disorders as an outcome variable, the combined effect of high stress and job dissatisfaction was similar to the main results, while the estimated risks increased for all three groups (i.e., HS + D, HS + S, and NH + D groups) (Table 3).

### Discussion

The present study demonstrated that those who met the criteria for high stress, as identified in the Stress Check Program manual, and were also dissatisfied with their jobs were at highest risk of long-term sickness absence, and that the combined effect of high stress and job dissatisfaction on long-term sickness absence was additive.

Among the groups on the basis of high stress and job dissatisfaction, the HS + D group had the highest HR of long-term sickness absence. This finding is reasonable because, although separately examined, high stress and job dissatisfaction were reported to be associated with increased risk of long-term sickness absence. Our findings suggest that high-stress employees are at higher risk of subsequent long-term sickness absence compared to their counterparts, and that the risk is further increased when high-stress employees are dissatisfied with their jobs.

The present study found that none of the indicators for an interaction or synergistic effect of high stress and job dissatisfaction were significant, suggesting that the combined effect of high stress and job dissatisfaction on long-term sickness absence is additive. This finding is also reasonable because job (dis)satisfaction does not theoretically have a modifying effect on the association of job stressors, social support, or stress responses with ill-health, as shown by the National Institute for Occupational Safety and Health (NIOSH) model of job stress and the Job Demands-Resources (JD-R) model. There is evidence that job satisfaction buffers the association of adverse psychosocial work environment (such as job demands) with mental health. However, the effect modification by job (dis)satisfaction on the association of psychological or physical distress with future health has not been studied. Our findings suggest that job dissatisfaction does not modify the association of psychological or physical distress with subsequent long-term sickness absence.

On the other hand, the HS + S group also had higher risk of long-term sickness absence, which was more than twice as high as in the NH + D group. Those who are satisfied with their jobs, but suffering from a variety of psychological and physical distress and/or exposure to
Table 2. Combined effect of high-stress and job dissatisfaction on long-term sickness absence among Japanese employees: Cox’s proportional hazard regression analysis (7,343 men and 7,344 women)

<table>
<thead>
<tr>
<th>Combination of high stress and job dissatisfaction</th>
<th>Person-days</th>
<th>Number of events</th>
<th>Incidence rate (/100,000 person-days)</th>
<th>Hazard ratio (95% confidence interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Model 1  a</td>
</tr>
<tr>
<td>High-stress + dissatisfied (HS + D) group</td>
<td>383,566</td>
<td>16</td>
<td>4.17</td>
<td>5.70 (3.08 to 10.5)</td>
</tr>
<tr>
<td>High-stress + satisfied (HS + S) group</td>
<td>154,502</td>
<td>5</td>
<td>3.24</td>
<td>4.44 (1.72 to 11.5)</td>
</tr>
<tr>
<td>Not high-stress + dissatisfied (NH + D) group</td>
<td>876,560</td>
<td>13</td>
<td>1.48</td>
<td>2.03 (1.05 to 3.92)</td>
</tr>
<tr>
<td>Not high-stress + satisfied (NH + S) group</td>
<td>3,844,282</td>
<td>28</td>
<td>0.73</td>
<td>1.00</td>
</tr>
</tbody>
</table>

| Measures of combined effect d                      |             |                 |                                     | Model 2  b                          |
|                                                   |             |                 |                                     |                                      |
| Relative excess risk due to interaction (RERI)     |             |                 |                                     | 0.38 (−5.24 to 6.00)                |
| Attributable proportion (AP)                      |             |                 |                                     | 0.06 (−0.77 to 0.89)                |
| Synergy index (SI)                                |             |                 |                                     | 1.07 (0.38 to 3.06)                 |

|                                                   |             |                 |                                     | Model 3  c                          |
|                                                   |             |                 |                                     |                                      |
| Relative excess risk due to interaction (RERI)     |             |                 |                                     | 0.33 (−5.23 to 5.89)                |
| Attributable proportion (AP)                      |             |                 |                                     | 0.05 (−0.79 to 0.89)                |
| Synergy index (SI)                                |             |                 |                                     | 1.06 (0.37 to 3.06)                 |

|                                                   |             |                 |                                     |                                      |

a Crude (i.e., without any adjustment).

b Adjusted for age and gender.

c Additionally adjusted for length of service, job type, and employment position.

d If 95% confidence intervals (CIs) of RERI and AP are greater than 0 and that of SI is greater than 1, the combined effect is determined to be synergistic. If 95% CIs of RERI and AP include 0 and that of SI includes 1, the combined effect is determined to be additive.

Table 3. Combined effect of high-stress and job dissatisfaction on long-term sickness absence due to mental disorders among Japanese employees: Cox’s proportional hazard regression analysis (7,343 men and 7,344 women)

<table>
<thead>
<tr>
<th>Combination of high stress and job dissatisfaction</th>
<th>Person-days</th>
<th>Number of events</th>
<th>Incidence rate (/100,000 person-days)</th>
<th>Hazard ratio (95% confidence interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Model 1  a</td>
</tr>
<tr>
<td>High-stress + dissatisfied (HS + D) group</td>
<td>383,566</td>
<td>15</td>
<td>3.91</td>
<td>7.12 (3.67 to 13.8)</td>
</tr>
<tr>
<td>High-stress + satisfied (HS + S) group</td>
<td>154,502</td>
<td>5</td>
<td>3.24</td>
<td>5.92 (2.23 to 15.7)</td>
</tr>
<tr>
<td>Not high-stress + dissatisfied (NH + D) group</td>
<td>876,560</td>
<td>10</td>
<td>1.14</td>
<td>2.08 (0.98 to 4.42)</td>
</tr>
<tr>
<td>Not high-stress + satisfied (NH + S) group</td>
<td>3,844,282</td>
<td>21</td>
<td>0.55</td>
<td>1.00</td>
</tr>
</tbody>
</table>

| Measures of combined effect d                      |             |                 |                                     | Model 2  b                          |
|                                                   |             |                 |                                     |                                      |
| Relative excess risk due to interaction (RERI)     |             |                 |                                     | 0.45 (−6.68 to 7.58)                |
| Attributable proportion (AP)                      |             |                 |                                     | 0.06 (−0.80 to 0.91)                |
| Synergy index (SI)                                |             |                 |                                     | 1.07 (0.38 to 3.03)                 |

|                                                   |             |                 |                                     | Model 3  c                          |
|                                                   |             |                 |                                     |                                      |
| Relative excess risk due to interaction (RERI)     |             |                 |                                     | 0.27 (−6.47 to 7.02)                |
| Attributable proportion (AP)                      |             |                 |                                     | 0.04 (−0.85 to 0.92)                |
| Synergy index (SI)                                |             |                 |                                     | 1.04 (0.36 to 3.00)                 |

|                                                   |             |                 |                                     |                                      |

a Crude (i.e., without any adjustment).

b Adjusted for age and gender.

c Additionally adjusted for length of service, job type, and employment position.

d If 95% confidence intervals (CIs) of RERI and AP are greater than 0 and that of SI is greater than 1, the combined effect is determined to be synergistic. If 95% CIs of RERI and AP include 0 and that of SI includes 1, the combined effect is determined to be additive.
adverse work environments, may over-adapt to their jobs, which may lead to increased risk of long-term sickness absence\(^3\). The present findings suggest that, even if high-stress employees are satisfied with their jobs, their risk of long-term sickness absence is reasonably high; therefore, not only occupational health staff, but also high-stress employees themselves, should not ignore such risk.

Compared to the NH + S group, the other three groups had a greater proportion of women (see Table 1). Considering that such gender imbalance may affect the present findings, we supplemented a gender-stratified analysis and examined an interaction effect between four groups (i.e., the combination of high stress and job dissatisfaction) and gender on long-term sickness absence. As a result, HR for each group was about twice as high for men compared to women (data available upon request), while a significant interaction effect was not observed (\(p = 0.397\)). At least from our dataset, the effect of gender imbalance on the present findings could not be detected. To estimate such effect more precisely, larger-scale research should be conducted in the future.

Possible limitations of the present study should be considered. First, personality traits, which were not measured in the present study, may have affected our findings. Previous studies reported that neuroticism was associated with higher levels of job stressors and stress responses (e.g., depression and anxiety)\(^3\); therefore, our findings may have been overestimated. Second, some employees may have transferred to another department in the surveyed company, which may have influenced our findings. However, this impact may be minimal because transfer rates were probably low at 1-year follow-up. Third, although the sample size in the present study was relatively large, we could not conduct cause-specific analyses other than for mental disorders (i.e., musculoskeletal disorders, cerebrovascular disease, or cardiovascular disease) due to the small number of incidence cases. Such analyses may provide additional practical information. Fourth, although we defined long-term sickness absence cases based on the application for invalidity benefit with medical certification, we could not identify whether work-related stress contributed to each case. Perhaps some long-term sickness absence cases were caused by reasons other than work-related stress, which may have led to a less precise association. However, it is plausible that most of the cases were caused by work-related stress since our cause-specific analysis showed strong association of high stress and job dissatisfaction with long-term sickness absence due to mental disorders. Finally, our data was obtained from one particular financial service company in Japan; therefore, we should interpret the present findings with caution, taking limited generalizability into account.

In conclusion, the present study provided evidence that high stress, as defined in the Stress Check Program manual using the BJSQ, and job dissatisfaction additively increase the risk of long-term sickness absence lasting 1 month or more. Although the criteria for high stress proposed by the program manual do not include job dissatisfaction, our findings suggest that incorporating high stress with job dissatisfaction improves the predictability of long-term sickness absence. Occupational health staff can identify high-stress employees who are more strongly encouraged to request physician interview by checking their response to the single-item job satisfaction scale of the BJSQ. On the other hand, high-stress employees who are satisfied with their jobs also had a higher risk of long-term sickness absence; therefore, the encouragement of physician interview for them should not be ignored. It should also be noted that corporate culture and policy play an important role in job stress and health outcomes among employees\(^3,33\). For example, our surveyed company is listed on the major stock exchange and provides employees with 30 days of paid leave and a standard benefits package, including leave compensation and employment insurance, which may influence long-term sickness absence. Future research on the effect of such factors on the association of high stress with long-term sickness absence is needed.

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Conflict of Interest (COI)

The authors declare that there are no conflicts of interest.

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