**Relationship Between Work Engagement and the Onset of Long-term Sickness Absence Due to Mental Disorders: A 4-year Retrospective Cohort Study**

Manabu Jinde*, Tomohisa Nagata, Masako Nagata and Koji Mori

*Department of Occupational Health Practice and Management, Institute of Industrial Ecological Sciences, University of Occupational and Environmental Health, Japan. Yahatanishi-ku, Kitakyushu 807-8555, Japan*

**Abstract**: The aim of the present study was to investigate the association between work engagement and long-term sickness absence due to mental disorders such as mood disorders and anxiety, and whether the relationship differs between men and women, during a 4-year follow-up period. Data were obtained from 21,293 workers at four pharmaceutical companies belonging to the Collabo-Health Study Group in 2014. The baseline data were collected by self-administered questionnaires. We obtained information about long-term sickness absence from the personnel records of the surveyed companies from the baseline survey in 2014 until March 2018. Hazard ratios (HRs) and 95% confidence intervals (CIs) using the low work engagement group as a reference were calculated by Cox proportional hazards analysis as the outcome, defined as the period leading to mental health-related sick leave. A total of 12,025 participants had complete data for analysis, and 123 exhibited long-term sickness absence during a 4-year follow-up period. The high work engagement group for men had a significantly lower HR (0.52, 95% CI: 0.31–0.88, \(P = 0.015\)) compared with the low work engagement group. Conversely, among women, the moderate work engagement group had a significantly higher HR (2.44, 95% CI: 1.03–5.84, \(P = 0.043\)) compared with the low work engagement group. Work engagement in men may predict the occurrence of long-term sickness absence due to mental disorders in the subsequent four years, but this relationship was different in women. Further research is needed to clarify this issue.

**Keywords**: work engagement, long-term sickness absence, mental disorders, sex difference, Japan.

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**Introduction**

The burden of mental disorders poses a threat to public health globally, and is expected to be an increasing burden on society in the future [1]. Depression and anxiety, the most common mental disorders, lead to reduced work productivity and economic loss due to sick leave and presenteeism in local communities and at workplaces [2, 3]. Mental disorders are a major problem in Japan, representing one of the most common causes of long-term sickness absenteeism [4].

To date, a substantial amount of research has examined mental health preventive measures at workplaces for primary, secondary, and tertiary prevention of mental disorders. Traditional occupational stress research has also focused on methods for reducing stressors at workplaces. In terms of recent mental health preventive measures, maintaining and promoting better mental health, in addition to the prevention of disorders, is considered increasingly important [5]. The former approach involves preventive measures against negative mental health, whereas the latter approach involves
positive mental health enhancement. Research in the field of occupational health has attracted increasing attention not only on negative mental health preventive measures such as improvement of depressive symptoms but also on positive mental health preventive measures such as improvement of well-being and personal productivity.

Work engagement is one of the representative concepts of positive mental health measures. Work engagement is defined as "a positive and fulfilling work-related state of mind that is characterized by vigor, dedication, and absorption. Rather than a momentary and specific state, engagement refers to a more persistent and pervasive affective cognitive state that is not focused on any particular object, event, individual, or behavior." [6]. Thus, people with a high degree of work engagement are able to work with pride, dedication, and enthusiasm [7]. Work engagement is also correlated with various positive factors, including self-efficacy, self-esteem, and resilience, and strongly negatively correlated with negative outcomes, such as various healthcare appeals and willingness to leave the workplace [6, 8, 9]. It has also been reported that employees with high work engagement have fewer psychological stress reactions such as anxiety and depression, and fewer physical complaints [8, 10]. It has been observed that these work engagements are possibly gender-different [11].

Whether the practice for enhancing work engagement can contribute to reducing mental health disorders in the workplace is an important issue. In fact, independent of psychological distress and negative mediators such as burnout, higher levels of work engagement could be associated with a reduced risk of negative outcomes such as depression and future sickness absence [12, 13]. Compared with the number of studies examining the association between work engagement and positive outcomes, however, a relatively small number of studies have examined the effects of work engagement for negative outcomes [12]. It is necessary, therefore, to clarify the association between work engagement and resulting long-term sickness absence due to mental health disorders.

Regarding the relationship between work engagement and mental health disorders, a higher degree of work engagement was associated with significantly fewer episodes of depression, as ascertained by self-administered questionnaires in a 3-year cohort study based on a questionnaire survey, suggesting a negative association between work engagement and depression [14]. Regarding the relationship between work engagement and sick leave, Schaufeli et al conducted a cohort study at a Dutch telecommunications company and reported that a higher degree of work engagement reduced the frequency of sick leave in the following year [15]. Roelen et al also reported that low work engagement moderately predicted the occurrence of mental health-related sick leave of more than 42 days during the following year after administration of the questionnaire [13, 16].

As described above, although an association between work engagement and negative outcomes such as long-term sickness absence has been suggested, to the best of our knowledge, no studies have performed follow-up examinations of participants for more than 1 year. Furthermore, no specific mental disorders have been evaluated in terms of their relationship with work engagement, including mood disorders and anxiety, which are considered to be strongly associated with workplace factors, nor has this relationship been analyzed according to sex. The present study aimed to investigate the association between work engagement and long-term sickness absence due to mental disorders such as mood disorders and anxiety, and whether the relationship differs between men and women, during a 4-year follow-up period.

Methods

This retrospective cohort study was conducted with datasets from four pharmaceutical companies belonging to the Collabo-Health Study Group. The study population was defined as workers belonging to the four companies on April 1 2014. Initially, 21,293 subjects were identified as the study population. We conducted a baseline self-administered questionnaire from June to September 2014, and respondents to the survey (13,137 out of 21,293) were included in this study. We analyzed 12,025 subjects after excluding 1,112 subjects with incomplete questionnaires (Figure 1).

The baseline self-administered questionnaire included work engagement, current history of mental disorders, and demographic characteristics such as occ-
Work engagement was assessed by the shortened version of the Japanese 9-item Utrecht Work Engagement Scale (UWES) in the baseline survey [17]. This scale is comprised of three aspects (vigor, dedication, and absorption), and contains nine items. The validity of these aspects was verified by Shimazu et al [18]. Each item was scored on a 7-point scale from 0 (never) to 6 (always), and the scores of the nine items were summed and calculated out of a maximum score of 54 points. Higher scores indicated a higher degree of work engagement.

Demographic characteristics and current history of mental disorders were set as potential confounders. Demographic characteristics included sex (male or female), age (≤29, 30–39, 40–49, 50–59, and ≥60 years), occupation (e.g., clerical, sales, research and development, production technology, production line), position (managerial/non-managerial), affiliated company, educational background (high school, vocational school, junior college, university, and graduate school), and annual income (<¥6 million, ¥6–7.9 million, ¥8–9.99 million, ¥10–14.99 million, and >¥15 million).

Subjects were followed up from the baseline survey in 2014 until March 31, 2018. Enrollment status in the companies and the occurrence of long-term sickness absence due to mental disorders were confirmed through the companies’ personnel information. Long-term sickness absence due to mental disorders was defined as sick leave for at least 30 days, and data on the actual start date of sick leave and the type of sickness, as revealed by the company, were recorded. In the case of short-term sick leave, employees in Japan typically use their own paid leave, and companies do not manage the process, but all of the companies in this study required employees to submit medical certificates if they took more than 30 days of leave. Sickness absence of 30 days or more was used as an outcome because the four companies examined in this study could determine the exact number of long-term sickness absences of 30 days or more without omission. According to the ICD-10 criteria (ICD-10 Version: 2019), the researchers extracted F32–F39 as mood disorders and F40–F48 as the mental and behavioral disorders (ICD-10, chapter V) based on the type of disease specified on the medical certificate submitted to the company by the attending physician. F30 and F31 were excluded because these disorders can be endogenous. If a medical certificate was submitted multiple times, the latest one was used. When two or more disease names were listed on the medical certificate, the two researchers independently determined the name of the main illness. If there was a disagreement, they had a discussion and another researcher joined in the discussion to determine the name.

The number of person-years in the follow-up was counted from the date of the baseline survey until the date of occurrence of long-term sickness absence due to mental disorders, the date of no confirmed enrollment in the companies, or the end of the study period.
whichever came first. We ascertained whether the baseline research subjects were enrolled in a company by means of the employee registers as of April 1, 2015, April 1, 2016, April 1, 2017, and April 1, 2018. If they had left the company at each point in time, we set the day before (March 31, 2015, March 31, 2016, March 31, 2017 and March 31, 2018) as the censoring date.

The outcome of the study was defined as long-term sickness absence due to mental disorders newly occurring during the study period. We divided the workers into three groups according to the UWES score using tertile values: the low work engagement group, the moderate work engagement group, and the high work engagement group. Next, hazard ratio (HR) and 95% confidence interval (CI) values were calculated with the low work engagement group as a reference, using Cox proportional hazards analysis as the outcome, defined as the period leading to mental health-related sick leave. Subsequently, the three characteristics for evaluating work engagement (vigor, dedication, and absorption) were further divided into three groups based on the tertile method in order of score, and the same analysis was performed. For each analysis, age and sex were adjusted for first (model 1), followed by adjustment for age, sex, occupation, position, affiliated company, educational history, and annual income (model 2). The history of mental disorders was added to model 2 and adjusted for to obtain model 3. The interaction test was used to examine sex differences in work engagement. In an analysis separating the data by sex, age was adjusted for in model 1, whereas age, occupation, position, affiliated company, educational history, and annual income were adjusted for in model 2. The analysis as adjusted by adding the current medical history due to mental disorders to model 2 was designated as model 3. All statistical data were analyzed using Stata v.16 software (Stata Corp., College Station, Texas, USA), and two-sided P values of <0.05 were considered to indicate statistical significance.

Ethical approval

The research protocol was approved by the Ethics Committee of Medical Research, University of Occupational and Environmental Health, Kitakyushu, Japan (H26–026).

Informed consent

Informed consent was obtained from all individual participants included in the study.

Results

During a follow-up of 47,581 person-years for 12,025 subjects (9,045 men and 2,980 women), a total of 123 cases of newly long-term sickness absence due to mental disorders (93 men and 30 women) were identified and included in the analyses.

The characteristics of the workers at the time of the baseline survey are shown in Table 1. The mean age (standard deviation) was 42.6 (10.0) years. The proportion of men was 75%, and, of the age groups, the proportion of workers in their 40s was the highest, at 36%. The proportion of workers with an occupation in sales was the highest, at 36%, followed by those in research and development at 23%. Regarding educational background, approximately 76% of the workers were university graduates or higher. The average UWES score was 27.6 in total, with average scores of 28.3 for men and 25.5 for women.

Figure 2 shows the survival curves for long-term sickness absence due to mental disorders of each work engagement group. A total of 51 (1.3%) in the low work engagement group, 42 (1.1%) in the moderate work engagement group, and 30 (0.7%) in the high work engagement group took long-term sickness absence due to mental disorders (trend test: $P = 0.004$). The median of days per long-term sickness absence due to mental disorders was 142 days (men: 137 (63–307) days, women: 166 (91–356) days). Table 2 shows the Cox proportional hazards analysis findings from the age-adjusted model 1 to the fully adjusted model 3 for mental health-related sick leave among the groups, divided by tertiles according to the UWES score for work engagement at baseline. When the low work engagement group was used as a reference, the high work engagement group had a significantly lower HR in model 1 and model 2 (0.57, 95% CI: 0.36–0.90, $P = 0.017$), but in model 3, the high work engagement group showed a lower HR than in the low work engagement group, but no significant difference was observed.

Analysis of the three aspects of work engagement (vigor, dedication and absorption) revealed that, in terms
of vigor, when the low work engagement group was used as a reference, the high work engagement group in model 1, model 2 (0.49, 95% CI: 0.30–0.80, \( P = 0.005 \)) and model 3 (0.60, 95% CI: 0.37–0.99, \( P = 0.045 \)) showed a significantly low HR. In terms of dedication, HR was significantly lower in the high work engagement group when the low work engagement group was used as the reference in model 1, model 2 (0.53, 95% CI: 0.34–0.83, \( P = 0.005 \)) and model 3 (0.61, 95% CI: 0.39–0.96, \( P = 0.029 \)). Regarding absorption, model 1 showed a significantly low HR in the medium and high work engagement groups compared with the low work engagement

### Table 1. Characteristics of participants

|                         | Total  | Men     | Women  |
|-------------------------|--------|---------|--------|
| Sex (%)                 | 12,025 | 9,045 (75) | 2,980 (25) |
| Mean age at baseline survey (SD) | 42.6 (10.0) |         |        |
| Age class (%)           |        |         |        |
| ≥29                     | 1,541 (13) | 1,052 (12) | 489 (16) |
| 30–39                   | 2,796 (23) | 1,999 (22) | 797 (27) |
| 40–49                   | 4,401 (36) | 3,306 (36) | 1,095 (37) |
| 50–59                   | 3,091 (26) | 2,506 (28) | 585 (19) |
| ≥60                     | 196 (2) | 182 (2) | 14 (1) |
| Occupation (%)          |        |         |        |
| Office staff            | 1,700 (14) | 1,026 (11) | 674 (22) |
| Sales staff             | 4,333 (36) | 3,796 (42) | 537 (18) |
| Research and development | 2,727 (23) | 1,844 (20) | 883 (30) |
| Technical and professional | 441 (4) | 323 (4) | 118 (4) |
| Production line         | 1,854 (15) | 1,144 (13) | 710 (24) |
| Others                  | 970 (8) | 912 (10) | 58 (2) |
| Position (%)            |        |         |        |
| Manager                 | 2,219 (18) | 2,100 (23) | 119 (4) |
| Non-manager             | 9,806 (82) | 6,945 (77) | 2,861 (96) |
| Education (%)           |        |         |        |
| Junior high school and high school | 1,931 (16) | 1,046 (11) | 885 (30) |
| Junior college and vocational school | 976 (8) | 352 (4) | 624 (21) |
| University              | 6,008 (50) | 5,117 (57) | 891 (30) |
| Graduate school         | 3,110 (26) | 2,530 (28) | 580 (19) |
| Income (× million Japanese yen/year) (%) |        |         |        |
| <8                      | 4,845 (40) | 3,212 (35) | 1,633 (55) |
| ≥8                      | 7,180 (60) | 5,833 (65) | 1,347 (45) |
| Mean UWES score (SD)    | 27.6 (8.0) | 28.3 (8.0) | 25.5 (7.8) |
| Number of LTSA          | 123 | 93 | 30 |
| Mean days for mental LTSA | 219.5 | 205.7 | 262.3 |

UWES: Utrecht work engagement scale, LTSA: long term sickness absence.

![Figure 2. Kaplan-Meier survival curves for long-term sickness absence due to mental disorders of each WE group. *WE: Work Engagement](image-url)
group, but model 2 and model 3 showed a lower HR in the moderate and high work engagement groups, but it was not significant. A significant tendency was observed between each work engagement group and onset of long-term sickness absence due to mental disorders. The same significant tendency was shown in three aspects of work engagement (Table 2).

In models 1 and 2, a significant interaction between sex and work engagement on long-term illness leave for mental illness was observed (model 1: 1.06, 95% CI: 1.01–1.12, P = 0.024, model 2: 1.06, 95% CI: 1.00–1.11, P = 0.035). In model 3, although a tendency of the interaction was observed (1.05, 95% CI: 0.99–1.10, P = 0.080), it was not significant.

Table 3 shows the results regarding the relationship between work engagement and long-term sickness absence due to mental disorders in men. The moderate (model 2: 0.58, 95% CI: 0.36–0.95, P = 0.030) and high (model 2: 0.44, 95% CI: 0.26–0.74, P = 0.002) work engagement groups in model 1 and model 2 showed a significantly lower HR compared with the low work engagement group, and the high work engagement group in model 3 showed a lower HR (0.52, 95% CI: 0.31–0.88, P = 0.015) than in the low work engagement group. Analysis of the three aspects of work engagement also showed that, compared with those in the low work engagement group, the high work engagement group exhibited a significantly low HR in vigor, dedication, and absorption in all the models, except in model 3 of absorption. A significant tendency between work engagement and onset of long-term sickness absence due to mental disorders was observed. The same significant tendency was also shown in the three aspects of work engagement (Table 3).

For women, in contrast to the results for all participants and men, the moderate work engagement group showed a significantly higher HR than did the low work engagement group in all the models. There were no significant differences in vigor, dedication, and absorption in the moderate and high work engagement groups compared with the low work engagement group. No significant tendency between work engagement and onset of long-term sickness absence due to mental disorders was observed (Table 4).

Table 2. Relative risks (hazard ratios) of long-term sickness absence for mental health disorder during 4-year follow-up associated with the work engagement scale at baseline

| UWES score | Participant | Absent | Model 1 | Model 2 | Model 3 |
|------------|-------------|--------|---------|---------|---------|
|            |             |        | HR  | 95% CI | P-value | HR  | 95% CI | P-value | HR  | 95% CI | P-value |
| Total      |             |        |      |        |         |      |        |         |      |        |         |
| Low        | 3,818       | 51     | Reference |   |         | Reference |   | Reference |         |   |
| Moderate   | 3,904       | 42     | 0.80 | 0.53–1.21 | 0.298 | 0.83 | 0.55–1.26 | 0.386 | 0.99 | 0.65–1.50 | 0.955 |
| High       | 4,303       | 30     | 0.52 | 0.33–0.81 | 0.004 | 0.57 | 0.36–0.90 | 0.017 | 0.66 | 0.41–1.04 | 0.077 |
| Vigor      |             |        |      |        |         |      |        |         |      |        |         |
| Low        | 3,470       | 48     | Reference |   |         | Reference |   | Reference |         |   |
| Moderate   | 4,501       | 49     | 0.79 | 0.53–1.18 | 0.244 | 0.81 | 0.54–1.21 | 0.316 | 0.94 | 0.63–1.41 | 0.759 |
| High       | 4,054       | 26     | 0.47 | 0.29–0.75 | 0.002 | 0.49 | 0.30–0.80 | 0.005 | 0.60 | 0.37–0.99 | 0.045 |
| Dedication |             |        |      |        |         |      |        |         |      |        |         |
| Low        | 2,798       | 45     | Reference |   |         | Reference |   | Reference |         |   |
| Moderate   | 4,421       | 41     | 0.58 | 0.38–0.88 | 0.011 | 0.60 | 0.39–0.92 | 0.019 | 0.70 | 0.45–1.07 | 0.104 |
| High       | 4,806       | 37     | 0.48 | 0.31–0.74 | 0.001 | 0.53 | 0.34–0.83 | 0.005 | 0.61 | 0.39–0.96 | 0.029 |
| Absorption |             |        |      |        |         |      |        |         |      |        |         |
| Low        | 3,723       | 51     | Reference |   |         | Reference |   | Reference |         |   |
| Moderate   | 4,194       | 38     | 0.65 | 0.43–0.99 | 0.047 | 0.67 | 0.44–1.02 | 0.064 | 0.79 | 0.52–1.21 | 0.276 |
| High       | 4,108       | 34     | 0.59 | 0.38–0.91 | 0.018 | 0.66 | 0.42–1.03 | 0.066 | 0.73 | 0.47–1.14 | 0.172 |

UWES: Utrecht work engagement scale, CI: confidence interval, HR: hazard ratios. Model 1: Adjustment: age and sex, Model 2: Adjustment: age, sex, occupation, position, company, education, and wage, Model 3: Adjustment: age, sex, occupation, position, company, education, wage, and history of mental disorders.
Table 3. Relative risks (hazard ratios) of long-term sickness absence for mental health disorder in men during 4-year follow-up associated with the work engagement scale at baseline

| UWES score | Participant (Men) | Absent | Model 1 | Model 2 | Model 3 |
|------------|-------------------|--------|---------|---------|---------|
|            |                   |        | HR 95% CI | P-value | HR 95% CI | P-value | HR 95% CI | P-value |
| Total      |                   |        |          |         |          |         |          |         |
| Low        | 3,001             | 46     | Reference | Reference | Reference |
| Moderate   | 2,851             | 25     | 0.55 0.34–0.90 0.016 | 0.58 0.36–0.95 0.030 | 0.72 0.44–1.18 0.192 |
| High       | 3,193             | 22     | 0.39 0.23–0.64 <0.001 | 0.44 0.26–0.74 0.002 | 0.52 0.31–0.88 0.015 |
| Vigor      |                   |        |          |         |          |         |          |         |
| Low        | 3,370             | 48     | Reference | Reference | Reference |
| Moderate   | 3,305             | 31     | 0.63 0.40–0.99 0.046 | 0.66 0.41–1.04 0.076 | 0.78 0.49–1.24 0.293 |
| High       | 2,370             | 14     | 0.35 0.20–0.60 <0.001 | 0.38 0.22–0.67 0.001 | 0.48 0.27–0.85 0.011 |
| Dedication |                   |        |          |         |          |         |          |         |
| Low        | 3,811             | 55     | Reference | Reference | Reference |
| Moderate   | 2,369             | 17     | 0.42 0.25–0.69 0.001 | 0.45 0.27–0.74 0.002 | 0.56 0.34–0.94 0.028 |
| High       | 2,865             | 21     | 0.40 0.25–0.65 <0.001 | 0.47 0.29–0.78 0.003 | 0.56 0.34–0.91 0.020 |
| Absorption |                   |        |          |         |          |         |          |         |
| Low        | 3,598             | 51     | Reference | Reference | Reference |
| Moderate   | 3,002             | 23     | 0.51 0.31–0.84 0.008 | 0.53 0.32–0.87 0.012 | 0.65 0.40–1.08 0.097 |
| High       | 2,445             | 19     | 0.49 0.30–0.80 0.004 | 0.58 0.35–0.95 0.032 | 0.68 0.41–1.12 0.128 |

UWES: Utrecht work engagement scale, CI: confidence interval, HR: hazard ratios. Model 1: Adjustment: age, Model 2: Adjustment: age, occupation, position, company, education, and wage, Model 3: Adjustment: age, occupation, position, company, education, wage, and history of mental disorders.

Table 4. Relative risks (hazard ratios) of long-term sickness absence for mental health disorder in women during 4-year follow-up associated with the work engagement scale at baseline

| UWES score | Participant (Women) | Absent | Model 1 | Model 2 | Model 3 |
|------------|---------------------|--------|---------|---------|---------|
|            |                     |        | HR 95% CI | P-value | HR 95% CI | P-value | HR 95% CI | P-value |
| Total      |                     |        |          |         |          |         |          |         |
| Low        | 931                 | 8      | Reference | Reference | Reference |
| Moderate   | 1,023               | 14     | 2.49 1.01–5.64 0.047 | 2.44 1.02–5.81 0.044 | 2.44 1.03–5.84 0.043 |
| High       | 1,026               | 8      | 1.46 0.53–4.04 0.462 | 1.48 0.53–4.16 0.455 | 1.51 0.54–4.25 0.428 |
| Vigor      |                     |        |          |         |          |         |          |         |
| Low        | 1,146               | 9      | Reference | Reference | Reference |
| Moderate   | 1,127               | 14     | 1.56 0.68–3.60 0.298 | 1.60 0.69–3.72 0.272 | 1.61 0.69–3.74 0.270 |
| High       | 707                 | 7      | 1.20 0.45–3.22 0.721 | 1.20 0.43–3.24 0.739 | 1.28 0.47–3.49 0.632 |
| Dedication |                     |        |          |         |          |         |          |         |
| Low        | 889                 | 8      | Reference | Reference | Reference |
| Moderate   | 1,193               | 15     | 1.39 0.59–3.27 0.455 | 1.37 0.58–3.27 0.472 | 1.33 0.56–3.17 0.522 |
| High       | 898                 | 7      | 0.83 0.30–2.29 0.717 | 0.81 0.29–2.28 0.694 | 0.81 0.29–2.28 0.695 |
| Absorption |                     |        |          |         |          |         |          |         |
| Low        | 813                 | 7      | Reference | Reference | Reference |
| Moderate   | 888                 | 9      | 1.28 0.56–2.90 0.555 | 1.31 0.58–3.00 0.515 | 1.35 0.59–3.09 0.475 |
| High       | 1,279               | 14     | 1.06 0.93–2.73 0.911 | 1.06 0.40–2.79 0.900 | 1.00 0.38–2.65 0.996 |

UWES: Utrecht work engagement scale, CI: confidence interval, HR: hazard ratios. Model 1: Adjustment: age, Model 2: Adjustment: age, occupation, position, company, education, and wage, Model 3: Adjustment: age, occupation, position, company, education, wage, and history of mental disorders.
Discussion

This 4-year retrospective cohort study examined whether differences in work engagement at baseline could affect long-term sickness absence due to mental disorders. The results revealed that during a 4-year follow up, a total of 123 participants (men: 93, and women: 30) took a long-term sickness absence due to mental disorders.

Men showed a lower incidence of long-term sickness absence due to mental disorder as the UWES score was higher. The relationship between work engagement and long-term sickness absence due to mental disorders was linear, with higher scores exhibiting an association with lower risk of sick leave. This trend was similar after adjustment for the current history of mental disorders. A similar analysis was performed when the data were stratified by three aspects, and men showed a lower incidence of long-term sickness absence due to mental disorders when the UWES score was moderate and high.

In women, however, the moderate work engagement group showed a higher risk of sick leave compared to the low work engagement group, in contrast to men. An interaction between sex and work engagement in long-term illness leave for mental illness was observed. Due to the large difference in the relationship between work engagement and mental health illness leave between men and women, the overall result shows that the tendency of HR was similar to the results of men, but it was difficult to determine a significant difference. Therefore, the association between work engagement and long-term sickness absence due to mental disorders were considered by sex.

The rate of the number of long-term sickness absences due to mental disorders in men was similar to a previous study in Japan [4]. At baseline, the low work engagement group exhibited the highest risk of long-term sickness absence due to mental disorders over the next four years. This result is consistent with previous studies reporting that work engagement predicts mental health disorders over the following year [13, 16].

This finding is also in accord with the results of a previous study reporting that work engagement can predict the onset of depression even if psychological distress is excluded [14]. It has been reported that work engagement is related to individual resources, such as self-efficacy [19], and a previous study found that employees with low job resources [20], such as job control, may suffer from depressive symptoms, which also supports the results of the current study. To the best of our knowledge, however, there is no study of these relationships by sex. The current study is the first to show that low work engagement in men might be an important predictor of long-term sickness absence over a long period of time, such as four years, due to mental disorders based on objective indicators such as a doctor's certificate and company personnel data.

In the current study, the HR of long-term sickness absence due to mental disorders in men decreased as the work engagement score was higher. This relationship was different from that reported in previous studies examining the association between work engagement, stress, and depression-related leave. In a previous study of work engagement and mental health sick leave, a 3-year prospective cohort study reported a U-shaped association between work engagement and new onset depression [14].

One potential reason for this finding is the involvement of workaholism [21]. Workaholism is defined as "a tendency to work excessively hard and to be obsessed with work, which manifests itself in working compulsively [22]", and is commonly considered to be a distinct concept from work engagement, but some researchers have suggested that there are similarities between the two [21, 23]. In particular, absorption (a state of being completely concentrated on work while experiencing time as passing quickly), which is an element of work engagement, has been proposed to overlap with the concept of workaholism [24].

Considering each of the three aspects individually, among the three elements of work engagement, vigor was linearly negatively associated with long-term sickness absence due to mental disorders, similar to total work engagement. Vigor is characterized by high levels of energy at work, psychological resilience, and persistence in the face of difficulties [17]. Previous studies have suggested that vigor may reduce the risk of future depression and anxiety disorders [25], consistent with the results of the current study. Dedication and absorption also showed that higher work engage-
ment had a lower HR of long-term sickness absence due to mental disorders than lower work engagement, but showed an L-shaped relationship with absence, unlike the linearity of vigor. Dedication is characterized by a sense of work, enthusiasm for work, pride, and willingness to take on challenges, and absorption is characterized by being fully concentrated and deeply engrossed in one's work [17]. Dedication is also negatively associated with cynicism [26]. Workers with lower dedication levels have higher levels of cynicism and require longer periods of absence because higher levels of cynicism are associated with greater distance from the workplace, less competence and a greater loss of self-confidence [27]. It has also been suggested that engaged workers with high absorption scores exhibit poorer health [23, 24]. The above factors may be the reason why the HR of the subordinate items like dedication and absorption score did not show a linear shape.

Work engagement is considered to be a state in which all three elements are present [17, 18], but the current results suggest that each element may have different functions in relation to long-term sickness absence due to mental disorders. It is necessary to consider not only the total score but also the bias in the three subscale scores.

In this study, the high work engagement group in the total and the three aspects had a significantly lower HR even after adjusting for the current history of mental health illness, although negative emotions have been shown to be strong predictors of depression [28, 29]. The relative risk of onset of long-term sickness absence was low, and its tendency did not change from that before adjustment. This result suggests that work engagement may be a predictor of long-term sickness absence due to mental disorders.

In the present study, stratification of the data by sex revealed that moderate work engagement in women had the highest risk of long-term sickness absence due to mental disorders, contrary to the results in men. This finding suggests that there is a difference between men and women in the effects of work engagement on the onset of mental disorders and the occurrence of long-term sick leave. An interaction between sex and work engagement on long-term illness leave for mental illness was also observed, suggesting that sex may influence the link between work engagement and long-term sick leave due to mental disorders. A small number of previous studies have reported sex differences in work engagement. Schaufeli et al reported that sex differences in work engagement vary from country to country, and weak effects remain unclear [17]. In contrast, Banihani et al reported sex differences in work engagement, which were influenced by biased perception of sex in the workplace, such as the organizational structure, culture, and psychological state of the workplace [11]. It is possible that factors outside the workplace may also cause different effects of work engagement on long-term sickness absence due to mental disorders.

Women typically perform more housework, parenting, and elderly care work than men in many countries [30]. In Japan, the burden of family responsibilities, including housework and childcare participation, is strongly biased toward women [31]. Tsuno et al suggested that the difference in the labor burden at home is due to work engagement and long-term sickness absence [32]. Shimazu et al reported that the association between family-work or work-family conflict and psychological distress was greater among wives than husbands [33]. Thus, for women, environmental factors other than the workplace may directly or indirectly affect the onset of long-term sickness absence due to mental disorders, in addition to sex differences in work engagement. As a result, the relationship between work engagement and the onset of long-term sickness absence due to mental disorders in women may have been opposite to that in men. There are not many studies on gender differences in work engagement, so further research is needed to confirm this result.

Strengths and weaknesses

To the best of our knowledge, the current study is the first cohort study stratified by sex to investigate the prediction of long-term sickness absence due to mental disorders and anxiety with work engagement over a long period (four years) in Japan. A measurement with a high level of objectivity was set as the outcome; the disease classification was based on medical certificates from attending doctors, and personnel data held by the company was used for the onset and period of
absence. Second, this study was derived from a relatively large population of employees \((n = 12,025)\) who participated in the study. During follow-up, there were 123 episodes of long-term sickness absence due to mental disorders, which provided a sufficient sample size to perform regression analysis. Third, this study analyzed each element of work engagement in detail, including sex-related differences.

Several limitations involved in the current study should be considered. First, the companies and study subjects were not necessarily representative of the Japanese labor force. Therefore, there is a possibility that the sample was biased. Specifically, because the participants are only regular employees of large companies, most of the non-regular employees were not evaluated, and no temporary employees or contract employees were evaluated. Thus, generalization of the present findings to the entire working population is limited. Second, the number of long-term sickness absences due to mental disorders among women was small, and it is possible that the results were strongly affected by the small number of employees on sickness absence and variability. Third, long-term sickness absence was defined in the current study as 30 days or more, but paid holiday was not counted. In Japan, the rate of employees taking paid holidays under normal circumstances is relatively low, and many employees carry forward a substantial amount of paid holiday leave. Thus, the actual number of sick leave days may have been longer than that reflected in the results because of using this carried-over paid holiday during long-term sickness absence. Fourth, work engagement scores were measured by a self-administered questionnaire, so they may have been influenced by contextual factors regarding the participants’ workplaces when responding to the questionnaire. Fifth, this study excluded those who resigned from the company, so selection bias may have been at work. However, work engagement is negatively correlated with negative outcomes, such as willingness to leave the workplace \([6]\), so although it is possible to underestimate the results of this study, it is unlikely that they may be overestimated. Moreover, the companies that participated in this study have good leave allowances, and when employees retire due to illness, no one suddenly retires without the leave period, so the impact is expected to be extremely small. Sixth, although the name of the illness was derived from the medical certificates from the doctors, it is possible that the exact disease name could not be grasped because the attending physician might not have described the exact illness name for mental health diseases. We tried to ensure the validity of the disease name by using the latest one when a medical certificate was submitted multiple times. Seventh, there is no information on the history of mental health disorders in this study. People with a history of mental health illness are at increased risk of recurrence and may have lower work engagement, but in this study, information on the current medical history of mental health diseases was obtained and reflected in the analysis. People with mental health illnesses often continue to visit the hospital for a long period of time after returning to work, so the impact of having no medical history information is unlikely. Eighth, this study did not consider occupational stress and psychological distress, so it may have overestimated the impact of work engagement on long term sick leave due to mental disorders. Further cohort studies should be conducted to investigate whether work engagement can predict the occurrence of long-term sickness absence due to mental disorders.

**Conclusion**

Work engagement in men may predict the occurrence of long-term sickness absence due to mental disorders such as mood disorder and anxiety in the subsequent four years, and suggests that improving work engagement may result in a reduction in mental health disorders. However, the opposite relationship held for women. Further research is needed to clarify this finding.

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**Conflict of Interest**

We have no conflict of interest.
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