

Work Engagement, Productivity, and Self-Reported Work-Related Sedentary Behavior Among Japanese Adults

A Cross-Sectional Study

Kaori Ishii, PhD, Ai Shibata, PhD, and Koichiro Oka, PhD

Objective: The aim of this study was to examine the relationships between work engagement, productivity, and self-reported work-related sedentary behavior in Japanese adults. **Methods:** The present study recruited 2572 Japanese individuals (20–59 years old) via an internet survey and assessed their demographic characteristics, work-related characteristics, and sedentary behavior. Data were analyzed with logistic regression. **Results:** The mean proportion of work days involving work-related sedentary behavior was approximately 70% and the mean number of weekly working hours was approximately 43 hours. Among those aged 40 to 59 years, work-related sedentary behavior was associated with low work vigor (odds ratio: 1.43), dedication (1.61), absorption (1.39), and total score of work engagement (1.49). Among those aged 20 to 39 years, work-related sedentary behavior was associated with low efficiency (1.38). **Conclusion:** Reducing work-related sedentary behavior may improve workers' engagement and productivity.

Keywords: occupational sitting, physical activity, productivity, workplace

Work-related sedentary behavior is strongly associated with an increased incidence in of diseases such as cardiovascular disease, cancer, type 2 diabetes, obesity, as well as mortality.^{1,2} Because occupational activities are generally determined by personal decisions as well as job duties, workers often experience “long and mandatory sitting at work.”² Therefore, work-related sedentary behavior is an important variable in workers' health. Previous studies have shown that physical activity and sedentary behavior outside working hours are associated not only with workers' health but also with work performance, productivity, presenteeism, and work engagement.^{3–7} Work engagement and work performance/productivity are important predictors of work-related well-being.⁸ Low work-related well-being is associated with absenteeism, burnout, and early retirement.^{9–11} Therefore, work-related sedentary time should be reduced for health reasons and to promote positive work-related outcomes.

However, a large proportion of the working population is sedentary.¹² Previous studies have shown that the Dutch working population reportedly sits for 7 hours daily, one-third of which occurs at work.¹³ Reports of workers in a health insurance company

and clerical and professional staff found that office workers spent 76% of their working day sitting.^{12,14} A survey of UK workers found that more than half (54%) of their total daily time spent sitting was attributable to work-time sitting.¹⁵ Recommendations for reducing work-related sedentary behavior involve accumulating at least 2 hours daily of standing and light activity such as walking during working hours; this should eventually progress to 4 hours daily.¹⁶

A recent study found that increased work-related sedentary behavior was associated with low work engagement in civil service office workers at a single site¹⁷; in contrast, Puig-Ribera et al⁴ found no association between work-related sedentary behavior and productivity in university office employees. The associations between work-related sedentary behavior and work engagement/productivity need further investigation, as few evidence is available and studies thus far have been conducted at specific worksites. Thus, the present study examined the relationships between productivity, work engagement, and self-reported work-related sedentary behavior in Japanese adults at various worksites.

METHODS

Participants and Data Collection

The present cross-sectional study analyzed data from an internet-based survey that was conducted in 2015 by a Japanese internet research company. Approximately 1,001,144 individuals from across Japan voluntarily registered themselves in the company's database, which included detailed sociodemographic data. A total of 25,554 workers aged 20 to 59 years were randomly selected as potential respondents from the registered database and were sent an E-mail with a link to participate in an internet-based survey. The respondents were stratified by sex and age bracket (20s, 30s, 40s, and 50s). In total, 3200 Japanese adults answered the survey (response rate, 12.5%): 1600 participants of each sex and 800 participants of each age group.

All participants consented to participate in the study by clicking the “Agree” button. The Ethics Committee of the Faculty of Sports Sciences, Waseda University, Japan, approved the study before its initiation.

Measurements

Sociodemographic and Work-Related Variables

The data obtained included sociodemographic information, such as sex, age, educational level, type of work, marital status, household income, smoking status, and weekly working hours. Participants provided this information by choosing the most suitable response from a set of predetermined categories: education (graduate school, university, ≥ 4 years of university education, 2 years of university education or equivalent, career college, high school, or junior high school); the main type of work tasks (sitting, standing, walking, or physical tasks); marital status (married or unmarried); living conditions (alone or cohabitating); and household income (<3,000,000; 3,000,000 to 4,999,999; 5,000,000 to 6,999,999; 7,000,000 to 9,999,999; or $\geq 10,000,000$ Japanese Yen). The

From the Faculty of Sport Sciences, Waseda University, Saitama, Japan (Drs Ishii, Oka), and Faculty of Health and Sport Sciences, University of Tsukuba, Tokyo, Japan (Dr Shibata).

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The present methods were carried out in accordance with the STROBE statement. The authors declare that there are no conflicts of interest.

Address correspondence to: Kaori Ishii, PhD, Faculty of Sport Sciences, Waseda University, 2–579–15 Mikajima Tokorozawa, Saitama 359–1192, Japan (ishiiikaori@waseda.jp).

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participants' body mass index (BMI) was calculated from their self-reported height and weight.

Work Engagement and Productivity

To measure work engagement, the present study used the Japanese version of the Utrecht Work Engagement Scale¹⁸. The scale has three dimensions: vigor (characterized by high levels of energy and mental resilience while working), dedication (being strongly involved in one's work and experiencing a sense of significance and pride), and absorption (being fully concentrated and happily engrossed in one's work). The internal consistency of the scale was sufficiently high ($\alpha = 0.92$), and the test–retest reliability with an interval of 2 months was 0.66.¹⁸

To estimate productivity, the present study used a part of the Health and Work Questionnaire, which has good reliability.¹⁹ Productivity was assessed from a scale of 1 (worst ever) to 10 (best possible) with this question: "Think of your worst level of efficiency ever and your best possible efficiency, then rate how efficient you felt you were this week compared to your worst ever and best possible efficiency." Participants were asked to rate their highest and lowest levels of efficiency in the week of testing.

Work-Related Sedentary Behavior and Physical Activity

The present study utilized part of the Worker's Sitting- and Walking-Time Questionnaire to estimate work-related sedentary behavior.²⁰ This is a self-administered questionnaire that measures the time spent sitting and walking (including standing) separately in three different domains covering a worker's typical weekly life: (1) working time, (2) nonworking time such as leisure time on a workday, and (3) non-workday time. This scale had good reliability and validity as demonstrated in another study.²⁰ Study participants were asked, "What proportion of a typical day do you spend sitting during your working hours?"

Physical activity was assessed using the Japanese version of the short form of the International Physical Activity Questionnaire (IPAQ).²¹ This self-administered questionnaire assesses the frequency and duration of walking for all purposes such as work, transport, and recreation; moderate physical activity; vigorous physical activity; and sedentary activity over the course of a typical week. The test–retest reliability ($r = 0.72$ to 0.93) and criterion validity ($r = 0.39$) of the scale, measured using an accelerometer, were confirmed in a previous study of the Japanese population.²¹ The total number of weekly metabolic equivalents of task (METs) * hours of moderate-to-vigorous physical activity (MVPA) was computed according to the IPAQ scoring manual.

Statistical Analyses

Analyses were performed for two age groups: 20 to 39 years old and 40 to 59 years old. This decision was based on the fact that 2.6% and 11.2% of the Japanese corporation board members were aged 20 to 39 years and 40 to 59 years, respectively,²² and job roles are likely to differ between these two age groups because of the Japanese work culture; an interaction was observed between age and vigor, dedication, and total score of work engagement. Responses were scored for each work engagement factor and dichotomized into high or low groups based on the median for each age group and measure. For the 20 to 39-year-old-group, the median score for vigor, dedication, absorption, and total score of work engagement were 21.3, 18.7, 21.9, and 62.2, respectively; for the 40 to 59-year-old-group, these values were 22.5, 19.5, 23.0, and 65.3, respectively. For productivity, responses were dichotomized into high (1 to 5) and low (6 to 10) categories, considering the intermediate level between "worst ever" and "best possible" on a 10-point scale. The proportion of the time spent on sedentary behavior was dichotomized into low and high levels based on the median of 78.4% per day

for individuals aged 20 to 39 years and 80.0% per day for those aged 40 to 59 years.

Logistic regression analyses were conducted to examine the independent relationships between work engagement, productivity, and work-related sedentary behavior, adjusted for sex, age, educational level, type of work, marital status, household income, smoking status, BMI, weekly working hours, and MVPA by age. BMI, weekly working hours, and MVPA were used as continuous variables and the other were used as categorical variables. All statistical analyses were performed using SPSS 22.0J for Windows (Statistical Package for the Social Sciences; SPSS Inc. Chicago, Illinois). A *P* value of less than 0.05 was considered statistically significant.

RESULTS

Sociodemographic Characteristics of the Participants

Data of 2572 adults who completed the survey were included in the analysis. The present study excluded data of those who did not answer questions on work-related sedentary behavior. Table 1 presents the sociodemographic characteristics of the study participants. Their mean age with standard deviation (SD) was 31.2 ± 5.0 years in the 20 to 30-year-old group and 49.2 ± 5.5 years in 40 to 50-year-old group. Approximately, 30% participants in 20 to 30-year-old group and half of the respondents in 40 to 50-year-old group were married; 70.4% and 80.7% were cohabiting; and 88.2% and 82.6% and 54.4% and 66.3% had high educational and household income levels in 20 to 30-year-old and 40 to 50-year-old groups, respectively. Tasks at work were mainly sitting tasks, followed by walking tasks, standing tasks, and physical tasks. The mean proportion of participants engaged in daily work-related sedentary behavior, that is, they sat for approximately 30.3 to 30.5 hours per week as estimated from weekly working hours, was $69.2\% \pm 25.5\%$ and $70.6\% \pm 25.2\%$ in 20 to 30-year-old and 40 to 50-year-old groups, respectively. Mean weekly working hours were 43.8 ± 11.3 and 43.2 ± 13.0 , and weekly MVPA METs * hours were 15.2 ± 27.7 and 16.4 ± 27.4 in the 20 to 30-year-old and 40 to 50-year-old groups, respectively. The mean BMI of the study participants was 21.3 ± 3.2 and 22.5 ± 3.6 kg/m² in the 20 to 30-year-old and 40 to 50-year-old groups, respectively.

Association Between Work Engagement and Work-Related Sedentary Behavior

Table 2 summarizes the association between work engagement and work-related sedentary behavior based on the adjusted logistic regression analysis. Individuals aged 40 to 59 years with higher levels of sedentary behavior at work were significantly more likely to report low vigor [odds ratio (OR): 1.43; 95% confidence interval (95% CI): 1.09 to 1.86], dedication (OR: 1.61; 95% CI: 1.23 to 2.11), absorption (OR: 1.39; 95% CI: 1.07 to 1.81), and total work engagement score (OR: 1.49; 95% CI: 1.14 to 1.94) than those who were less sedentary at work. No significant associations were observed in workers aged 20 to 39 years for these variables.

Association Between Productivity and Work-Related Sedentary Behavior

Table 3 summarizes the relationship between productivity and work-related sedentary behavior based on the adjusted logistic regression analysis. Participants of the 20 to 39 years age group who were more sedentary at work were significantly more likely to be less efficient (OR: 1.38; 95% CI: 1.05 to 1.81). Among those aged 40 to 59 years, no significant association was observed between work-related sedentary behavior and productivity.

TABLE 1. Characteristics of the Participants

| | 20–30 Years Old | | 40–50 Years Old | |
|--|-----------------|-------------|-----------------|-------------|
| | <i>n</i> | % | <i>n</i> | % |
| Overall | 1,227 | 100 | 1,345 | 100 |
| Sex | | | | |
| Men | 578 | 47.1 | 655 | 48.7 |
| Women | 649 | 52.9 | 690 | 51.3 |
| Age, years | | | | |
| 20–29 | 585 | 47.7 | – | – |
| 30–39 | 642 | 52.3 | – | – |
| 40–49 | – | – | 664 | 49.4 |
| 50–59 | – | – | 681 | 50.6 |
| Mean ± SD | | 31.2 ± 5.0 | | 49.2 ± 5.5 |
| Marital status | | | | |
| Unmarried | 848 | 69.1 | 549 | 40.8 |
| Married | 379 | 30.9 | 796 | 59.2 |
| Living condition | | | | |
| Living with others | 864 | 70.4 | 1086 | 80.7 |
| Living alone | 363 | 29.6 | 259 | 19.3 |
| Educational level | | | | |
| 4 years of university or higher | 874 | 71.2 | 777 | 57.8 |
| 2 years of university or equivalent | 209 | 17.0 | 333 | 24.8 |
| High school or junior high school | 144 | 11.8 | 235 | 17.4 |
| Household income level | | | | |
| <3,000,000 yen | 194 | 15.8 | 132 | 9.8 |
| 3,000,000–4,999,999 yen | 365 | 29.7 | 322 | 23.9 |
| 5,000,000–6,999,999 yen | 277 | 22.6 | 315 | 23.4 |
| 7,000,000–9,999,999 yen | 236 | 19.2 | 325 | 24.2 |
| ≥10,000,000 yen | 155 | 12.6 | 251 | 18.7 |
| Tasks at work | | | | |
| Sitting | 951 | 77.5 | 1049 | 78.0 |
| Standing | 114 | 9.3 | 115 | 8.6 |
| Walking | 140 | 11.4 | 169 | 12.6 |
| Physical | 22 | 1.8 | 12 | 0.9 |
| Duration of working hours, hours/week | | | | |
| Mean ± SD | | 43.8 ± 11.3 | | 43.2 ± 13.0 |
| Work-related sedentary behavior, percentage of working hours | | | | |
| Mean ± SD | | 69.2 ± 25.5 | | 70.6 ± 25.2 |
| Moderate to vigorous physical activity, METs*hours/week | | | | |
| Mean ± SD | | 15.2 ± 27.7 | | 16.4 ± 27.4 |
| Body mass index | | | | |
| Mean ± SD | | 21.3 ± 3.2 | | 22.5 ± 3.6 |

MET, metabolic equivalents of task; SD, standard deviation.

TABLE 2. Association Between Work Engagement and Category of Work-Related Sedentary Behavior

| | Vigor | | | Dedication | | | Absorption | | | Total Score | | |
|-------------|-------|-----------|----------|------------|-----------|----------|------------|-----------|----------|-------------|-----------|----------|
| | OR* | 95% CI | <i>P</i> | OR | 95% CI | <i>P</i> | OR | 95% CI | <i>P</i> | OR | 95% CI | <i>P</i> |
| 20–39 years | | | | | | | | | | | | |
| High | 1.20 | 0.91–1.57 | 0.19 | 1.30 | 0.99–1.70 | 0.058 | 1.08 | 0.82–1.42 | 0.58 | 1.23 | 0.94–1.61 | 0.14 |
| Low | Ref | | | Ref | | | Ref | | | eRef | | |
| 40–59 years | | | | | | | | | | | | |
| High | 1.43 | 1.09–1.86 | 0.01 | 1.61 | 1.23–2.11 | 0.00 | 1.39 | 1.07–1.81 | 0.01 | 1.49 | 1.14–1.94 | 0.00 |
| Low | Ref | | | Ref | | | Ref | | | Ref | | |

Low work engagement was used as the reference category.

CI, confidence interval; OR, odds ratio.

*Odds ratios were adjusted for sex, age, educational level, type of work, marital status, household income, smoking status, BMI, and weekly working hours, as well as moderate-to-vigorous physical activity.

TABLE 3. Association Between Productivity and Work-Related Sedentary Behavior

| | Highest Level of Efficiency | | | Lowest Level of Efficiency | | |
|---|-----------------------------|-----------|------|----------------------------|-----------|------|
| | OR | 95% CI | P | OR | 95% CI | P |
| Percentage of work-related sedentary behavior | | | | | | |
| 20–39 years | | | | | | |
| High | 0.89 | 0.67–1.17 | 0.40 | 1.38 | 1.05–1.81 | 0.02 |
| Low | Ref | | | Ref | | |
| 40–59 years | | | | | | |
| High | 0.98 | 0.74–1.29 | 0.87 | 1.03 | 0.79–1.33 | 0.84 |
| Low | Ref | | | Ref | | |

Low productivity was used as the reference category.
CI, confidence interval; OR, odds ratio.

DISCUSSION

The present study examined the relationships between work engagement, productivity, and self-reported work-related sedentary behavior in randomly selected Japanese adults. Work-related sedentary behavior was reported to account for 70% of the study participants' workday. This is similar to, though slightly lower than, the findings of previous studies from Australia, which showed that work-related sedentary behavior accounted for 77% to 82% of working hours.^{12,14}

The present study demonstrated that among those aged 40 to 59 years, sedentary behavior at work was associated with low work engagement in terms of vigor, dedication, absorption, and total score of work engagement. In contrast, no association was observed between work-related sedentary behavior and work engagement among those aged 20 to 39 years and between work-related sedentary behavior and productivity among those aged 40 to 59 years. The present study could not identify the reasons behind these age-related differences; however, differences in job level and responsibilities, which were shown to be the major age-related differences among corporation board members in Japanese work culture,²² may have been the reason for the observed differences. These findings imply that it may be necessary to implement age-specific approaches for reducing sedentary behavior: ones that are aimed at improving work engagement in workers aged 40 to 59 years and different ones that are designed to improve productivity in workers aged 20 to 39 years. Recent studies on reducing work-related sedentary behavior have shown that standing desks or workstations combined with lifestyle interventions are beneficial.²³ Further research is needed to examine whether a reduction in work-related sedentary behavior can improve work engagement and productivity.

A study in an Australian population (mean age, 40.7 years) showed that office employees who spent a long time sitting before and after work experienced loss of productivity.⁵ Moreover, Puig-Ribera et al⁴ examined the association between self-reported at-work sitting time and productivity in office employees (mean age, 42.0 years) and found no significant association between productivity and occupational sitting time. The present study indicates that those aged 20 to 39 years with higher levels of sedentary behavior at work are significantly more likely to have low productivity. One of the reasons for the differences between the results of this and previous studies is the age of the study population. The present study used two age categories (20 to 39 years and 40 to 59 years) because job roles are likely to differ between these two age groups. In contrast, previous studies were conducted in one population group with a mean age in the 40s. Another difference was how the variables were measured. One previous study measured productivity using the Work

Limitation Questionnaire to assess performance and the degree to which health problems interfered with the ability to perform job roles.^{4,24} On the contrary, the present study measured productivity based on the study participants' worst and best possible levels of efficiency by asking them to rate their efficiency for the previous week, regardless of health problems.¹⁹ The associations between work-related sedentary behavior and current productivity compared with past own productivity in the present study indicate that strategies for reducing work-related sedentary behavior are needed to improve productivity.

Prolonged and nonprolonged sedentary behavior have different effects on work engagement. A previous study found that occupational sitting time was associated with vigor and dedication in men and women; however, absorption was not noted among women.¹⁷ This reported association between high levels of occupational sitting and high absorption levels in women suggests that women who are absorbed in their work are less likely to take breaks, stand up, or move around.¹⁷ Further research is needed to determine whether workers who are absorbed in their work are more likely to have higher levels of sedentary behavior because they are less likely to take breaks, or if workers who are more sedentary are less likely to be absorbed in their work.

The present study was conducted with a wide range of randomly selected Japanese workers, and valid and reliable scales were used. However, there are also several limitations. First, the cross-sectional nature of the study limits the conclusions that can be drawn about the cause and effect of the observed relationships between work-related sedentary behavior, work engagement, and productivity. Second, the present study did not measure some confounding factors such as occupational position, details of the worksite, and the workers' office setting, all of which might have affected the results. Third, the internet-based setting of the study is associated with generalization issues caused by selection bias arising from the nonrepresentative nature of the internet population and self-selection of survey participants.²⁵ Another potential limitation of internet surveys is that respondents tend to be young, highly educated, and have a high income.²⁶ Fourth, although the present study estimated the representativeness of the participants' responses by adjusting for age and marital status and compared these to data from the Japanese Population Census Survey of 2010,²⁷ the demographics of the respondents in the present study were slightly different from those of the general population; the prevalence of participants who were married was 53.7% and 34.1% for men and 38.3% and 26.1% for women in the present study and in census data, respectively. Furthermore, the response rate in the present study was low. Moreover, participants with a sedentary behavior who are more engaged in work may have opted not to respond to the questionnaire;

this may have further declined the response rate and added a selection bias about work engagement and productivity. Nevertheless, the present study tried to select participants who were representative of the general Japanese population. The internet research service organization had details of 1,001,144 individuals, and the present study had conducted the survey using randomly selected participants from the sample with equal representation of both sexes and age brackets. The participants had diverse sociodemographic characteristics (eg, they were residents of several geographical regions and had varying occupations). Finally, the present study relied on a self-administered questionnaire; such measures inherently possess the potential for errors in judgment, recall difficulties, and the possibility of respondents providing socially desirable responses. However, the reliability and validity of the scale had previously been comprehensively examined and confirmed.

Despite these limitations, the present study offers new evidence on the relationship between work-related sedentary behavior, work engagement, and productivity in Japan. To the best of our knowledge, no other study of the Japanese population has analyzed this topic. The present findings will be important for the development of intervention strategies for worker's health promotion and will contribute to improving work engagement and productivity.

CONCLUSION

The present study of a random sample of the Japanese population showed that sedentary behavior at work was associated with low work engagement in terms of vigor, dedication, and absorption in 40 to 59-year-old workers and low productivity in those aged 20 to 39 years. These findings imply that intervention strategies to reduce work-related sedentary behavior may be needed to improve workers' engagement and productivity.

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