Influence of Work Duration or Physical Symptoms on Mental Health among Japanese Visual Display Terminal Users

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Abstract: The present study examined the relationship of work duration or physical symptoms to the mental health of visual display terminal (VDT) workers in Japan. The mental health status of 2,327 VDT users at an administrative office was investigated using the 12-item General Health Questionnaire (GHQ-12). Subjects were asked about their age, sex, hours of daily VDT use, rest and breaks during VDT work, eyestrain, and musculoskeletal pain. Logistic regression analysis was used to evaluate the associations with mental health status (GHQ-12 scores). The mean age of subjects was 39.5 yr (SD=10.3). Among all subjects, 36.7% could rest during VDT work and 66.9% received breaks during VDT work. The proportion of subjects who reported eyestrain and musculoskeletal pain were 19.6% and 25.7%, respectively. Eighteen percent of subjects were classified into a GHQ-12 high score group. Logistic regression analysis showed that age less than 40 yr, not receiving breaks during VDT work, and the presence of eyestrain and musculoskeletal pain were significantly associated with poor mental health status (high GHQ-12 scores). Using a VDT for more than 5 h/d and being female were also marginally associated with high GHQ scores ($p<0.1$). In conclusion, the management of physical health as well as work duration is important for good mental health status among VDT users.

Key words: Visual Display Terminals, Health control, Japanese administrative workers, Mental health, 12-item General Health Questionnaire

Introduction

Visual display terminals (VDTs) are standard equipment for many workers in industrialized societies, and their use

can have psychological and physiological effects. Various conditions have been found to be related to VDT work⁽¹⁾. Poor workstation design coupled with high workload, postural demands, and job demands have been found to contribute to shoulder, neck, back, and wrist-hand discomfort or pain^(2–4). Furthermore, improper illumination and glare,

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work demands, computer screen design, and task characteristics have been found to contribute to visual discomfort^{5,6}. Since computerized jobs are more sedentary, and require more cognitive processing and mental attention, many jobs that require heavy daily computer use have been found to be stressful^{7,8}. According to an “Actual Condition Survey on Technological Innovation and Labor” conducted by the Japanese Ministry of Labor in 1998, 36.3% of workers involved in VDT operations reported experiencing mental fatigue and as many as 77.6% experienced physical fatigue⁹.

To protect workers from the adverse effects of VDT work, the Japanese Ministry of Labor published guidelines for VDT work¹⁰. The World Health Organization also published a report investigating the health and psychosocial aspects of VDTs in the workplace and provided some recommendations concerning the use of VDTs and system design¹¹.

Previous studies investigated the relationship of VDT use to physical or mental symptoms^{4,8}. Although physical symptoms such as pain were found to be related to mental disorders^{12,13}, the role of physical symptoms in the mental health of VDT users has yet to be elucidated. Therefore, we conducted a survey evaluating mental health status, and examined the relationship of the duration of daily VDT use, rest and breaks during VDT work, eyestrain, and musculoskeletal pain to the mental health of VDT users in Japan.

Subjects and Methods

This research was approved by the Ethics Committee of Nagasaki University Graduate School of Biomedical Sciences. The study population consisted of 2,573 VDT users at a prefectural administrative office in which most VDT operations, according to the category of VDT operation⁹, were interactive (i.e. creating or editing documents), simple-input (i.e. entering data or typing documents), or technical tasks (i.e. programming or technical drawing). On average, the subjects used VDTs 19.3 d (SD=3.9) per month. After obtaining informed consent, the survey was carried out in 2003 using self-administered questionnaires. Health administrators distributed questionnaires to all VDT users during the yearly health check-up. The subjects completed the questionnaires and returned them in sealed envelopes to the health administrators. Questionnaires without missing values were received from 2,327 (90.4%) subjects.

Subjects were asked about their age, sex, hours of daily VDT use, and the presence/absence of rest and breaks during VDT work. We defined “rest” and a “break” according to

the guidelines for VDT work published by the Japanese Ministry of Labor⁹. Regarding “rest”, subjects were asked, “One continuous operation time must not exceed one hour, do you take an operation downtime of 10–15 min before subsequent continuous operation?” Regarding a “break”, subjects were asked, “Do you take one or two short breaks within one continuous operation time?” Data regarding current eyestrain and musculoskeletal pain were also collected. Eyestrain was defined as the presence of blurred vision, blinking, ocular soreness, itching of the eyes, heaviness of the eyes, and double vision during or soon after completing work. Regarding musculoskeletal pain, subjects were asked to report whether pain was present in the following sites: neck and shoulder, back, arm, and hand. When a subject reported pain in at least one site, the subject was classified as having musculoskeletal pain. Respondents chose answers from the four categories of “no symptoms”, “mild symptoms, but not bothersome”, “moderate symptoms, and bothersome” and “severe symptoms affecting my life and work”. Each symptom was dichotomized into “yes” (“moderate symptoms, and bothersome” and “severe symptoms affecting my life and work”) and “no” (“no symptoms” and “mild symptoms, but not bothersome”) responses. The frequencies of these symptoms were not investigated.

The Japanese version of the 12-item General Health Questionnaire (GHQ-12) was used to identify potential poor mental health status. The GHQ-12 is a valid, internationally comparable measure of mental health status in a population. It is brief, easy to administer, has a straightforward scoring system, and its validity characteristics have been found to be stable and not influenced by gender, age, or educational level¹⁴. High GHQ-12 scores have frequently been used to identify the possible presence of psychological disorders. The 12 items assessed by the GHQ-12 are lost sleep, feelings of being under strain, inability to concentrate, feeling unable to play a useful role, inability to face problems, inability to make decisions, inability to overcome difficulties, feeling unhappy, lack of enjoyment in day-to-day activities, feeling depressed, lack of confidence, and feelings of worthlessness. For the GHQ-12, a 4-point response scale (corresponding to symptoms present: “not at all,” “same as usual,” “slightly more than usual,” or “much more than usual”) was used, and responses were scored in a bimodal fashion (0-0-1-1). Total scores ranged from 0 to 12, with higher scores indicating that a respondent experiences more symptoms of psychological distress. Subjects with GHQ-12 scores of 4 or more were classified as the GHQ-12 high score group, and subjects with GHQ scores of 3 or less were classified as the GHQ-12 low score group¹⁵.

Mean age was compared between the GHQ-12 high and low score groups using a *t*-test. A χ -square test was conducted in order to analyze the relationship of sex, rest and breaks during VDT work, or presence of physical symptoms (eyestrain and musculoskeletal pain) with the frequency of high GHQ-12 scores. The Cochran-Armitage trend test was used to analyze the relationship between the duration of daily VDT use and the frequency of high GHQ-12 scores. Logistic regression analysis was used to evaluate the simultaneous effects of the above-mentioned factors on the frequency of high GHQ-12 scores. In the logistic regression model, the duration of daily VDT use was coded as ≥ 5 and < 5 h, according to the results of Nakazawa *et al.*¹⁶⁾. The maximum likelihood estimation of the regression model parameters was carried out. The odds ratio and its 95% confidence interval were calculated for each parameter in the model. All statistical analyses were performed using SAS software, version 8.2 (SAS Institute Inc., Cary, NC, USA).

Results

Table 1 summarizes the characteristics of the subjects. The mean age was 39.5 yr (SD=10.3), and there were more men (79%) than women (21%). Among all subjects, 36.7% could rest during VDT work and 66.9% received breaks during VDT work. The proportion of subjects who reported eyestrain and musculoskeletal pain was 19.6% and 25.7%, respectively.

Table 2 shows the results of a comparison of subjects classified according to sex and GHQ-12 scores. In total, 18% of subjects had GHQ-12 scores of 4 or higher, with a higher frequency observed in females than in males (22.3% vs. 16.3%, $p=0.002$). Although male subjects with high GHQ-12 scores (mean age, 36.8; SD, 9.8) were significantly younger than male subjects with low scores (mean age, 40.4; SD, 10.1), no significant age-related difference was observed among females. For male subjects, longer hours of daily VDT use were associated with high GHQ-12 scores, but this was not the case for female subjects. Taking a "rest" and receiving a "break" were associated with low GHQ-12 scores for male subjects. For female subjects, receiving a "break" was significantly associated with low GHQ-12 scores, but taking a "rest" was not. In comparison with male subjects with low GHQ-12 scores, male subjects with high GHQ scores had a significantly lower frequency of taking a "rest" (26.0% versus 38.1%) or receiving a "break" (57.0% versus 69.1%) during VDT work, and reported more eyestrain (29.7% versus 14.4%) and musculoskeletal pain (35.6% versus 19.6%). Female subjects with high GHQ-

Table 1. Selected characteristics of VDT users (n=2327)

Characteristics	Mean	SD	Range
	Number	%	
Age (yr)	39.5	10.3	18–67
Sex			
Male	1838	79.0	
Female	489	21.0	
Duration of daily VDT use (h)			
<1	59	2.5	
1–3	739	31.7	
3–5	767	33.0	
5–7	488	21.0	
7<	274	11.8	
Rest during VDT work	854	36.7	
Break during VDT work	1557	66.9	
Physical symptoms			
Eyestrain	456	19.6	
Musculoskeletal pain*	598	25.7	

*Musculoskeletal pain: neck, shoulder, back, arm, or hand pain.

12 scores had a higher prevalence of musculoskeletal pain than those with low GHQ-12 scores (49.5% versus 35.8%); however, no significant difference was observed in the prevalence of eyestrain (35.8% versus 28.2%). With regard to musculoskeletal pain, subjects with high GHQ-12 scores reported more neck and shoulder pain (33.0% versus 17.6%), back pain (19.8% versus 11.5%), arm pain (3.2% versus 1.8%), and hand pain (5.8% versus 2.5%) compared to subjects with low GHQ-12 scores, when both sexes were combined.

Table 3 shows the results of a multiple logistic regression analysis. Subjects less than 40 yr of age had an increased risk of having a high GHQ-12 score when compared with those aged 40 yr and over (OR=1.34, 95%CI 1.07 to 1.68). Receiving breaks during VDT work was found to be protective against high GHQ-12 scores (OR=0.67, 95%CI 0.52 to 0.86). The presence of eyestrain (OR=1.54, 95%CI 1.17 to 2.03) and musculoskeletal pain (OR=1.77, 95%CI 1.37 to 2.29) were significantly associated with high GHQ-12 scores. Using VDTs for more than 5 h/d (OR=1.25, 95%CI 0.98 to 1.58) and being female (OR=1.24, 95%CI 0.96 to 1.60) were also found to be marginally associated with high GHQ-12 scores ($p<0.1$). Since age and sex were associated with high GHQ-12 scores in a multiple logistic regression model, we conducted a regression analysis adjusted for these variables. Adjusted odds ratios (95%CI) for using VDTs more than 5 h/d, taking a rest during VDT work, receiving breaks during VDT work, having eyestrain, and having

Table 2. Comparison of VDT users according to sex and GHQ-12 scores (n=2,327)

	Male (n=1838)			Female (n=489)		
	GHQ-12			GHQ-12		
	Low score (n=1,538)	High score (n=300)	<i>p</i> value	Low score (n=380)	High score (n=109)	<i>p</i> value
Mean (SD)						
Age (yr)	40.4 (10.1)	36.8 (9.8)	<0.001	37.9 (10.8)	37.0 (12.0)	0.49
Frequency (%)						
Duration of daily VDT use (h)						
<1	37 (2.4)	4 (1.3)		16 (4.2)	2 (1.8)	
1–3	495 (32.2)	72 (24.0)		128 (33.7)	44 (40.4)	
3–5	526 (34.2)	96 (32.0)		121 (31.8)	24 (22.0)	
5–7	310 (21.2)	72 (24.0)		80 (21.1)	26 (23.9)	
7<	170 (11.1)	56 (18.7)	<0.001	35 (9.2)	13 (11.9)	0.58
Rest during VDT work	586 (38.1)	78 (26.0)	<0.001	152 (40.0)	38 (34.9)	0.33
Break during VDT work	1,062 (69.1)	171 (57.0)	<0.001	265 (69.7)	59 (54.1)	0.002
Physical symptoms						
Eyestrain	221 (14.4)	89 (29.7)	<0.001	107 (28.2)	39 (35.8)	0.13
Musculoskeletal pain*	301 (19.6)	107 (35.6)	<0.001	136 (35.8)	54 (49.5)	0.009

*Musculoskeletal pain: neck, shoulder, back, arm, or hand pain.

Table 3. Odds ratios (ORs) and 95% confidence intervals (CI) for high GHQ-12 scores among VDT users in a logistic regression model (n=2327)

Independent variable	Unit	OR	95% CI
Age (yr)	<40/≥40	1.34	1.07–1.68
Sex	female/male	1.24	0.96–1.60
Duration of daily VDT use (h)	≥5/<5	1.25	0.98–1.58
Rest during VDT work	yes/no	0.88	0.67–1.15
Break during VDT work	yes/no	0.67	0.52–0.86
Physical symptoms			
Eyestrain	yes/no	1.54	1.17–2.03
Musculoskeletal pain*	yes/no	1.77	1.37–2.29

*Musculoskeletal pain: neck, shoulder, back, arm or hand pain.

musculoskeletal pain were 1.42 (1.13–1.78), 0.66 (0.52–0.84), 0.59 (0.47–0.73), 2.16 (1.69–2.75), and 2.18 (1.73–2.74), respectively. Similar results were obtained when the analyses were repeated after excluding subjects who use VDTs less than 1 h per day (data not shown).

Discussion

To our knowledge, this is the first study that has used the GHQ-12 to examine mental health among VDT users; however, several previous studies have investigated associations between the duration of VDT use and users' mental health. Lindström¹⁷⁾ reported a relationship between

extensive VDT use and psychological symptoms or fatigue in a cross-sectional study. Nakazawa *et al.*¹⁶⁾ showed that the prevention of mental disorders and sleep disorders requires the restriction of VDT use to less than 5 h/d. In a multiple regression model we detected a borderline association ($p<0.1$) between the duration of daily VDT use (≥5 versus <5 h) and high GHQ-12 scores, suggesting that longer daily VDT use results in the deterioration of mental health status.

Previous investigations suggested that rest and breaks during VDT work increase productivity and reduce discomfort^{18, 19)}. The findings of our univariate model indicated that rest and breaks during VDT work are required. Furthermore, breaks during VDT work were found to be a protective factor in the multiple regression model (OR=0.67, 95%CI 0.52–0.86). Although a number of improvements in work design and work and social environments can facilitate the reduction of poor mental health status associated with VDT use⁸⁾, rest and breaks during VDT work are effective and can easily be applied.

The stress effects of VDT tasks vary among VDT users in different job strata. Previous research has shown that employees in the lowest job stratum reported a higher intensity of job demands, less job stability, and more stress effects associated with the introduction of computers into offices, while managers and supervisors reported more control over their work, higher variety in task content, and less frequent psychiatric symptoms and fatigue¹⁷⁾. In the

present study, VDT users younger than 40 yr of age reported more high GHQ-12 scores. This observation can be partially explained by these employees' positions in the lowest job stratum in Japanese offices, where promotions are often said to be seniority-based.

In this study, we found a tendency for a higher prevalence of high GHQ-12 scores among women. It has been speculated that due to differences in muscle fiber distribution, anthropometry, and hormones, women are more likely than men to report psychological symptoms and fatigue¹⁷⁾, as well as physical symptoms^{3, 20)}. Therefore, it appears to be important to improve the work environment in consideration of the differences in vulnerability between women and men.

The GHQ-12 has been used to measure the possible presence of psychological disorders among workers in some studies and it has been reported that GHQ-12 scores vary with age and gender. For example, a previous study in Japan reported that females more frequently exhibited high GHQ-12 scores, while no significant differences were found among different age groups²¹⁾. In contrast, Shimizu *et al.*²²⁾ reported that older age was significantly associated with lower GHQ-12 scores. In the present study, both age and gender showed some association with GHQ-12 scores. Further study is needed to clarify the effect of age and gender on GHQ-12 scores.

There is a growing consensus that poor work design and work and social environments can contribute to physical disorders, such as eyestrain^{1, 5, 6)} and work-related musculoskeletal disorders^{16, 20, 23)}. In our study, physical symptoms, such as eyestrain and musculoskeletal pain, were found to be related to poor mental health status. This suggests that physical symptoms can contribute to poor mental health status. Therefore, when proposing improvements for healthier VDT work, the poor mental health status that results from physical symptoms should not be neglected.

This present study has some limitations. First, information on mental health status and explanatory variables was obtained by self-reporting. Therefore, the effect of the explanatory variables on mental health status may have been over- or underestimated. Second, some work-related aspects^{7, 24, 25)} (e.g. daily working hours, sleeping hours, details of VDT tasks, workstation design, job demands, job contents, career opportunities, and social support) as well as non-work-related aspects (e.g. household burdens, frequency of the symptoms, presence of major mental diseases, presence of skeletal and eye diseases, and the use of anti-inflammatory and anti-depressants) that influence mental health were not available in our study. Third, there were fewer female subjects than male subjects; therefore, some associations in univariate

analyses might not have reached significance. Fourth, the cross-sectional design of the study cannot assess a causal relationship between mental health status and explanatory variables. Nevertheless, advantages of our study include the relatively large sample size and the high completion rate (90%), which can provide a reliable estimate.

In conclusion, our findings indicate that longer daily VDT use, not receiving breaks during VDT work, eyestrain, and musculoskeletal pain are associated with higher scores on the GHQ-12. Thus, the management of physical health, as well as work pressure, appear to be important for the mental health of VDT users. Understanding the mental health status of VDT users may contribute to the development of preventive measures for protecting workers from the adverse effects of VDT work, and to the facilitation of VDT users' well being.

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