

# Association between Duration of Daily Visual Display Terminal Work and Sleep Disorders among Statistics Center Staff in Iran

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## Abstract

**Background:** Computers have become ubiquitous in the workplace offices and since computerized jobs are more sedentary, requiring more cognitive processing, mental attention and less physical expenditure of energy, many jobs that require heavy computer use have been found to be stressful.

**Methods:** Three hundred and sixty two clerks of national statistics centre of Iran participated in this analytic cross-sectional study. All the employees that had worked with computer during the previous three months were enrolled. The subjects with diseases affecting the patient's sleep were excluded. In addition to demographic variables, for assessment of insomnia, we designed a questionnaire consisting of 20 items.

**Results:** Among 362 subjects, Male and female distribution was equal (Mean age: 35.27±8.48 years, range: 20-65 years). The most common degree was bachelor (40.6%). We couldn't find any significant changes with respect to well-being during the day, final awakening earlier than desired, functioning during the day and with increasing the hours of working with computer.

**Conclusion:** An association was observed between the duration of daily visual display terminal work and each of the eight sleep-related symptoms on the AIS, such as difficulty in falling asleep and early awakening.

**Keywords:** Computers; Insomnia; Awakening; Visual display terminal

## Introduction

Computers have become ubiquitous in the workplace offices and their use is growing.<sup>1,2</sup> Due to the widespread use of personal computers, visual display terminal (VDT) work has become very common. According to a report by the US Department of Labor, in 1976 only 675,000 VDTs were in use in the US offices, but by 1986 an estimated 28 million VDTs were in use. The number of VDTs has been growing rapidly, and by the 1990s, the number of VDTs in the workplace was estimated from 40 to 80 million.<sup>3,4</sup>

Computers have many advantages for inventory management, record management, complex systems control, document preparation, electronic communications, and office automation. They provide efficiency, competitive advantages, and the ability to carry out work that would be impossible or less effective without their use. Since computerized jobs are more sedentary and requiring more cognitive processing and mental attention and less physical expenditure of energy, many jobs that require heavy computer use have been found to be stressful.<sup>5-8</sup>

According to a survey by the Japanese Ministry of Labor in 1998, 36.3% of the workers involved in VDT operation reported experiencing mental fatigue and as many as 77.65 experienced physical fatigues.<sup>9</sup> Various disturbances have been found to be related to video display terminal (VDT) work. With the spread of this type of work and the associated appearance of

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health complaints in workers, a vast amount of research has aimed at identifying the possible causes of the health problems associated with VDT work.<sup>10-12</sup>

Moreover, there have been reports about the adverse health effects in VDT users, especially concerning physical symptoms, such as eyestrain or musculoskeletal symptoms, or headache.<sup>13-16</sup>

In contrast to these physical symptoms, to date, only a few studies have investigated the associations between VDT work and sleep disturbances.<sup>17</sup> There have been a few reports indicating an association between the duration of daily VDT work and sleep-related symptoms, such as difficulty in falling asleep and halfway awakening.

The World Health Organization published a report investigating the psychosocial aspects and health of VDT users at workplace and provided some recommendations concerning the use and system design of VDTs. This report indicated the need to minimize the duration of VDT use but did not define a limitation of daily VDT use<sup>18</sup> probably because of a few investigations on duration of daily VDT work and sleep disorders. Considering that, long time insomnia could impress the operators' quality of work and individual life. This study was conducted to clarify the association between the duration of daily VDT work and sleep disturbances, using the Athens Insomnia Scale (AIS), for which reliability and validity have been globally confirmed.

## Materials and Methods

Three hundred and sixty two clerks of national statistics centre of Iran participated in this analytic cross-sectional study. All the employees that had worked with computer during the previous three months entered the study. The subjects with diseases affecting the patient's sleep were excluded.

The study was approved by the Ethics Committee of Iran University of Medical Sciences, and all the subjects provided written informed consent to participate.

In addition to demographic variables, for assessment of insomnia, we designed a questionnaire consisting of 20 items. AIS is based on International Classification of Diseases, 10th Revision (ICD-10) criteria and was validated by Soldatos *et al.*<sup>18</sup> Five items evaluated difficulty of sleep, awakening during the night, final awakening earlier than desired, total sleep duration, and overall quality of sleep. Three items were about the effect of insomnia on the quality

of the next-day's work (sense of well-being during the day, functioning during the day, and sleepiness during the day). Each item was rated from 1 (no problem at all) to 4 (very serious problem). The responders were requested to rate the scores if they experienced any problem in sleep at least three times a week during the previous month. The total score ranged from 8 to 32 and was divided between " $\geq 14$ " (presence of insomnia) and " $< 14$ " (absence of insomnia). The remaining items consist of education (Diploma or lower, bachelor, master or higher), using glasses or lenses (classified as "yes" or "no"), drinking coffee or tea (each divided into four groups: not used to drink coffee or tea, 1-4, 5-7, 8 or more times a day), having exercise (categorized as: never, once a week, twice a week, three times or more a week; one time means 20 minutes), smoking (classified as "yes" or "no"), occupational stress (classified as: low, moderate, severe, very severe), the hours of working with computer (categorized in four groups: less than 2 hr, 2-4 hr, 4-6 hr, and more than 6 hr), the total hours of work in a week (grouped in four categories: less than 40 hr, 40 hr to 44 hr, 45 hr to 49 hr, and 50 hr or more.), the number of days off in a month (grouped into three categories: 5 days or less, 6-9 days, and 10-12 days), having a certain disease (classified as "yes" or "no", with the name of disease), and administration of a certain drug (classified as "yes" or "no", with the name of disease).

The data were analyzed, using SPSS v.16 software for Windows (SPSS Inc, Chicago, IL, USA). Parameters such as frequency, mean and standard deviation (S.D.) were reported. The change of sleeping difficulty and quality of next day's work according to the time of computer working was evaluated, using Chi-square test. We also used Independent t-tests to find any relationship between the males and females AIS. A 5% probability of a type I error (two-tailed) was considered in the analysis. All the reported p-values are two-tailed. The questionnaire in our study had of reliability of 0.741, using Cranach's alpha.

## Results

From all 362 subjects, 181 were male (50%) and 181 female (50%). The mean age was 35.27 (SD=8.48) years ranging between 20 to 65 years. The most common degree was bachelor in 40.6% of all the cases. The number of glasses or lens users was 213 (59%) cases. Thirty three subjects (9.2%) were ciga-

rette smokers. The analysis using Chi-Square test showed that there were significant changes in difficulty of sleep, awakening during the night, total sleep duration, and sleepiness during the day in the subjects with increasing the hours of working with computer with the *P* value of 0.027, 0.002, 0.031, and 0.009, respectively as shown in Table 1.

But we couldn't find any significant changes in the sense of well-being during the day, final awakening earlier than desired, functioning during the day and with increasing of the hours of working with computer (all  $p > 0.05$ ). We found that the difficulty of sleep, awakening during the night, final awakening earlier than desired, total sleep duration, sense of well-being during the day, and sleepiness during the day have a significant difference between subjects with different exercises times (never, once a week, twice a week, three times or more a week; one time means 20 minutes) with a *p* value of 0.018, 0.022, 0.013, 0.012, 0.005 and 0.003, respectively. There were not any significant changes of overall quality of sleep and functioning during the day between exercise groups (never, once a week, twice a week, three times or more a week, one time means 20 minutes). We could see that occupational stress affects all AIS criteria in subjects (all  $p < 0.001$ ), except difficulty of sleep with a *p* value of 0.077. We listed the results of Chi-square test for subjects with or without insomnia (with AIS of  $\geq 14$  and  $< 14$ , respectively.) The results for other items are shown in Table 2.

### Discussion

We examined the association between the duration of daily VDT work and insomnia by a unique approach using a self-administered questionnaire with confirmed reliability and validity. Our study is also one of the first researches that examined the association between the duration of daily VDT work and each of the eight sleep-related symptoms on AIS, such as difficulty in falling asleep and early awakening. Also, we considered for the first time exercise, drinking coffee or tea and, and occupational stress as confounding factors.

The foregoing analysis indicated that those who spent 6 hr/day or longer on VDT work were more likely to suffer from insomnia than those who spent less than 2 hr/day. With regard to the association between the duration of daily VDT work and each of the AIS items, those who spent 6 hr/day or longer on VDT work were more likely to have sleep-related problems in four aspects, of difficulty of sleep, awakening during the night, total sleep duration, and sleepiness during the day than those who spent less than 2 hr/day. The similar results of the study by Yoshioka *et al.*<sup>3</sup> in 2008 uphold our results, suggesting that VDT work of 6 hr or longer per day was related to insomnia. Their study was assessed by a reliability- and validity-confirmed measurement, before and after adjustment with confounding factors, such as drinking and occupational stress like our study.

**Table 1:** Insomnia rate according to AIS criteria

The AIS criteria	Working with computer (hr/day)				Total	P value
	<2 hr	2-4 hr	4-6 hr	>6		
Difficulty of sleep	2 (12.5%)	20 (32.2%)	15 (10%)	26 (14.5%)	63 (17.4%)	0.027
Awakening during the night	3 (18.7%)	17 (27.4%)	14 (9%)	19 (10%)	53 (14.6%)	0.002
Final awakening earlier than desired	2 (12.5%)	9 (14.5%)	19 (12.6%)	18 (10%)	48 (13.2%)	0.155
Total sleep duration	2 (12.5%)	10 (16.1%)	26 (17.3%)	29 (16%)	67 (18.5%)	0.031
Overall quality of sleep	2 (12.5%)	11 (17.7%)	21 (14%)	28 (15.6%)	62 (17%)	0.112
Sense of well-being during the day	3 (18.7%)	19 (30.6%)	17 (11.3%)	34 (18.9%)	73 (20.1%)	0.313
Functioning during the day	2 (12.5%)	14 (22.5%)	17 (11.3%)	37 (20.6%)	70 (19.3%)	0.095
Sleepiness during the day	3 (18.7%)	20 (32.2%)	21 (14%)	44 (24.5%)	88 (24.3%)	0.009

**Table 2:** The relationship between insomnia and demographic indexes

Factors		Total	Non-insomniacs group	Insomniacs group	P value
No		360	170	190	
Sex	Male	180	95	75	0.035
	Female	180	85	105	
Age		359	169	190	0.202
Education	Diploma or lower	50	20	30	0.401
	Bachelor	188	86	102	
	master or higher	124	65	59	
Wearing glasses or lenses	Yes	170	74	74	0.378
	No	190	96	116	
Exercises more than 20 minutes(times a week)	Never	190	70	120	<0.001
	1	89	49	40	
	2	45	26	19	
	3 or more	36	24	12	
Body mass index		358	169	189	0.192
Drinking tea(times a day)	No	20	9	11	0.049
	1-4	272	132	140	
	5-7	48	26	22	
	8 or more	21	4	17	
Drinking coffee (times a day)	No	303	140	163	0.154
	1-4	55	31	24	
	5-7	0	0	0	
	8 or more	2	0	2	
Cigarette smoking(pack/year)	Yes	33	16	27	<0.001
	No	324	162	162	
Working with computer (hr/day)	<2	16	13	3	0.013
	2-4	62	30	32	
	4-6	105	54	51	
	>6	179	74	105	
Past diseases	No	285	139	146	0.396
	Yes	74	32	42	
Drug history	No	288	140	148	0.240
	Yes	71	29	42	
Occupational stress	Low	120	81	39	<0.001
	Intermediate	135	55	80	
	High	76	32	44	
	Very high	31	3	28	
Working hours (hr/week)	<40	42	16	26	0.494
	41-44	217	104	113	
	45-50	54	25	29	
	>50	46	25	21	
Days off (per month)	10-12	35	13	22	0.372
	6-9	195	97	98	
	<5	132	61	71	

Tachibana *et al.* (1996, 1998)<sup>17</sup> reported a significant relationship between subjective VDT work overload and sleep-related symptoms; however, they did not use a reliability- and validity-confirmed measurement of insomnia. In addition, they did not consider important putative confounding factors related to insomnia, such as drinking and occupational stress.

Soldatos *et al.* [2005]<sup>20</sup> reported the results of an epidemiological study of insomnia assessed by AIS. Their study examined 35,327 subjects (male= 49.8%), comprising adults from 10 countries representing different continents with clear variations in lifestyle. 64.1% of the subjects were in the workforce (employed or currently unemployed but looking for

work). The results of their study indicated that 31.6% of the subjects were insomniacs. Our study demonstrated a higher prevalence of insomniacs (53%) than those in the preceding study. We supposed that the higher prevalence of insomniacs in our study was related to VDT work. In contrast with other study, the results of our research indicate a dose-response relationship between sleep disturbances and the duration of daily VDT use.

Our study revealed that clerks who spent longer durations each day on VDT work tended to have sleep disturbances, especially problems in changes in difficulty of sleep, awakening during the night, total sleep duration, and sleepiness during the day. It has been shown that sleep disturbances not only cause various illnesses but also seriously affect productivity

in the society.<sup>21</sup> Even if the cause-effect relationship of sleep disturbances to VDT work remain unclear, management of sleep disturbances for workers who perform VDT work over a long duration each day must be considered in terms of public health. Further prospective studies and intervention trials are required to clarify whether appropriate management of VDT work reduces insomnia and other health problems.

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**Conflict of interest:** None declared.

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