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Work-related Musculoskeletal Disorder Symptoms among Computer User Workers of Ethiopian Roads Authority in Addis Ababa, Ethiopia

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Abstract

Background: Computer related health problems and ergonomic disorders are resulted from prolonged computer usage in a maladaptive manner. At least 10 million new cases of computer related human health risks occur each year; posing in reduced life quality and work productivity. This study aims to describe the prevalence of work-related musculoskeletal disorder symptoms among computer user workers of Ethiopian Roads Authority.

Methods: Two hundred thirty three workers were requested for the study from all ten districts of Ethiopian Roads Authority from January 2018 to February 2018. A cross-sectional study was conducted using self-administered questionnaires to collect socio-demographic data, symptoms of musculoskeletal disorders, information regarding ergonomic and computer work station conditions. Chi-square test was used to determine the association between the variables. The odds ratio was calculated using binary logistic regressions. The significance level was considered as $P < 0.05$.

Result: A total of 233 workers were included in this study from Ethiopian Roads Authority; 61% of the respondents were males, whereas; 39% were females. The 12-months prevalence of work related musculoskeletal disorder symptoms among computer users in this study population was 71.2%. The most frequently self-reported symptoms were back pain (46.4%), headache (39.9%), neck pain (31.3%), and wrist pain (12%) among Ethiopian Roads Authority workers ($p < 0.05$). Computing hours per day was significantly associated with the presence of musculoskeletal disorder symptoms.

Conclusion: Ethiopian Roads Authority computer user workers had a high prevalence of work-related musculoskeletal disorders. Daily computer using hours was the most single statistically significant risk factor in this study. There is a need to increase the corrective measures that to be implemented to reduce the impact of computer related symptoms of musculoskeletal disorders.

Keywords: Mmusculoskeletal symptoms, Computer user workers, Ergonomic training, Ethiopian Roads Authority, Work-related musculoskeletal disorders

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Background

In today's age, computer has become a common item; its usage become an integral part of daily life [1]. Appreciably, computers have been changing the working environment, simplifying and speeding up numerous tasks across many work areas. It has increased the work efficiency and communications and has opened access to information like never before [2]. It makes the lifestyle of users too much relaxed. Huge numbers of people use computers excessively and intensively starting from official work to playing video games [3].

Continuous use of computers for long hours [4] in maladaptive manner found to have severe problems; even for few hours per day usage [5], causes various health illness. Scholars [6] have identified health risks developed from usage of computer for three hours per day such as Occupational Overuse Syndrome (OOS), Computer Vision Syndrome (CVS), Musculoskeletal Symptoms (MSSs): low back pain, neck pain, wrist pain; headaches and psychosocial stress. These risks are directly related to prolonged sitting in front of computer screens with poor ergonomic practices [7,8].

Mashige *et al.* [9] and Ranganatha S C *et al.* [10] have listed posture-related symptoms as neck pain, shoulder pain, back pain, wrist pain, knee pain which are collectively named as musculoskeletal symptoms (MSSs).

Work-related musculoskeletal symptoms, MSSs can occur due to improper working conditions and poor work habits. It might be associated with maladapted monotonous use of computers that attributed to poor ergonomic practices [11]. Muscular Skeletal Symptoms, MSS can cause Muscular Skeletal Disorders, MSDs. The MSDs are considered as one of the contemporary health issues. It comprises two percent of global disease burden and the second highest volume of years lived with disability [1,12]; existed in 22% of patients [13]. Part of MSDs categorized under musculoskeletal symptoms includes: headache, neck and back pain, and shoulder, wrist, and finger discomfort [13,14]. These symptoms are well associated with improper placement of computer screen which lead to muscles sprain; affecting head and neck postures when working at a computer [15,16].

Most evidences show that, work-related musculoskeletal disorders have been called the foremost occupational hazard of the 21^{st} century [17]. The studies have identified that 64% to 90% of computer users have health problems [18]. Study of 2014 in US shown that, on average, (45 to 70) million people spend an hour staring into a computer screen. But, recently about 143 million of workers use a computer daily [19] in U.S.A alone and 90% of whom who use three to four hours per day developed computer related illnesses [20]. Global records also estimated that nearly 60 million people suffer [6] and other study estimates that at least 10 million new cases of computer-related human health risks were reported each year [21].

Work-related musculoskeletal disorders (WMSDs) lead to economic costs and affect organizational effectiveness and efficiency. Excessive use of technology [22]; duration of occupation [23]; lack of ergonomic training for workers to implement safe practices at their work place [24] have led to increase prevalence of WMSDs. Since MSSs places an unusual strain on workers physical well-being, it decreases the quality of life [25], reduces employees' effectiveness, and significantly causes a resultant loss of productivity [26].

So, MSDs can be considered as a significant rising non-communicable disease having the capacity of global public health threat unless serious attention is paid to it [27]. It has affected most computer users from various occupations that attract attentions of researchers from both developed and developing world.

Many studies have been conducted to address

questions concerning safety and health for computer users. Most of these studies reported prevalence of WMSDs ranged from 40-73.3% [13,28-31]. However, they were centered in Western and Middle East regions focusing on assessing knowledge, practice and magnitude of eye related problems of computer usage targeted on university communities as their study population [32-41]. But, every individual using computer for longer time without rest at their office or home can develop work-related MSSs or WMSDs [28-31].

To the author's best knowledge, there is limited study focusing on workers using computers in African region including Ethiopia. Few studies were conducted in limited states or districts: Debre Tabor and Gonder in Ethiopia [42,43]; Abuja in Nigeria [44] assessed the prevalence of CVS among computer users. Academic and financial institutions were the subject of a few studies conducted in Ethiopia [42,43,45] to assess computer-related health issues. These studies do not go far enough to investigate the existence of computer-related health risks and predictor variables across various groups of computer users.

As a result, computer users in other broad representative federal organizations, such as the Ethiopian Roads Authority, which employs a large number of people with varying levels of computer usage, should be included in such studies. Furthermore, no single study has attempted to determine the magnitude of MSDS and its related factors among Ethiopian computer users. Posture related symptoms which are also a growing, but neglected health risks among computer users was excluded. Also evidences show that work-related MSSs lead to complicated MSDs. Therefore, the aim of this study was to determine the prevalence of work related symptoms of MSDs and their associated factors among Ethiopian Roads Authority computer users.

Methods and Materials

Study Design and Period

A cross-sectional study design was used from January 2018 to February 2018.

Study Area

The study was conducted in Addis Ababa, the capital city of Ethiopia. The government institution at which this study conducted was Ethiopian Roads Authority, which consist about 34 departments (work units) with a total of 2928 workers as ERA's census of April, 2017 [47].

Source and Study Population

All computer users who worked in Ethiopian Roads Authority were the source population, whereas all workers who were using computer in their day-to-day working activities for at least twelve months were taken as study population. Any type of duties carried out by employees was considered.

Eligibility Criteria

The research included all ERA computer users, with the exception of those who had used a computer for fewer than twelve months. ERA employees who had a history of known musculoskeletal disorders prior to starting computer use were also ineligible.

Sample Size Determination

The sample size (n) was first estimated using the single population proportion formula with the following assumptions: a margin of error (D) of 5%, a proportion (P) of health risk in frequent computer users 73.3 percent [21], and a confidence interval of 95 percent; $Z_{\alpha/2}$=1.96

$$\mathrm{n} = \frac{(Z_{\alpha/2})^2 p(1-p)}{D^2}$$

$$\mathrm{n} = \frac{(1.96)^2(0.73)(1-0.73)}{(0.05)^2} = 301$$

$$\mathrm{n}_f = \frac{n}{1+\frac{n}{N}} = \frac{301}{1+\frac{301}{2928}} = 272$$

Sampling Procedure

A pre-determined sample size was allocated to 34 work units of ERA offices. A random sampling technique was used to select participants. Then, from each selected office, study subjects were selected proportionally to their size by random sampling technique.

Operational Definition

Musculoskeletal Disorders, MSDs: will be considered if the respondents have experienced a variety of symptoms such as discomfort in the neck, pain in the shoulders, elbows, hands, fingers, hips and knees as a result of repetitive movements, doing work in awkward postures and static postures while prolonged seating at works [28].

Computer user workers: employees those using computer for their day-to-day life activities to perform different tasks [42] at least for twelve months and who were staff at ERA.

Ergonomically nonadjustable chairs: Non-ergonomic chairs usually have a fixed and non-adjustable backrest, which means you can't adjust it to suit your needs [23].

Data Collection

Self-administered questionnaires were used to collect socio-demographic data, symptoms of MSDs, information regarding ergonomics and lightening, and potential risk factors (computer work station conditions or workplace/environment) of workers on safety measures of MSDs. The questionnaires were initially prepared in English language and translated into Amharic language for obtaining information about socio-demographic characteristic and factors for MSDs and then translated back into English language for data entry and analysis. The purpose and objectives of the study was briefed for participants before taking consent from them. The pre-designed questionnaires were distributed to each work units among the study population; completeness of the questionnaires was checked and/then collected back.

Data Analysis

Data was entered to Excel spread sheet and imported to predictive analytics software 20 version software for statistical analysis (IBM SPSS Statistics 20). The prevalence of computer related disorders was expressed as percentage. Chi-square test was used to determine the association between the variables. The odds ratio (OR) was determined using logistic regressions. The significance level was considered as $P < 0.05$.

Ethical Approval

The study was approved by the Ethics committee of the Ethiopian Roads Authority and therefore been performed in accordance with the ethical standards.

Results

Socio-demographic Characteristics

A total of 233 computer user ERA workers who met the criteria were included in the study with a response rate of 85.7%. This is due to incorrect response of 39 participants. Male participants were 142 (61%) and 91 (39%) of them were females. Majority (40.4%) of the study population belonged to between 21-30 years of age categories followed by 31-40 years (33.3%) age groups. Most of the respondents (141, 60.5%) were BA/BSc holders; about (33, 14.2%) of them were MA/MSc holders, and the rest (59, 25.3%) were college diploma. The majority (42.5%) of respondents were engineers.

Just about 6 out of 10 (59.7%) of the respondents reported having worked between one (1) year to five (5) years; about 24% of them worked between six to ten years, and the rest (16.3%) were worked above ten years. Nearly three-fourth (74.7%) of the participants were using computer for more than 6 hours a day; that is in the range of working hours. Hence, this is in agreement with the normal office hours in Ethiopia. About 14.2% were using computer for 3 to 5 hours a day and the rest 11.2% were using for less than 2 hours a day.

Table 1 Socio-demographic Characteristics of Computer User Workers of ERA in Addis Ababa, 2018

Variables		**All(N=233)**	**Does MSD Symptoms Exist?**	
			Yes	No
Gender				
	Male	142(61%)	101(71.1%)	41(28.9%)
	Female	91(39%)	65(71.4%)	26(28.6%)
Age				
	21-30 years	96(41.2%)	66(39.8%)	30(44.8%)
	31-40 years	77(33.3%)	60(36.1%)	17(25.4%)
	41-50 years	40(17.2%)	25(15.1%)	15(22.4%)
	51-60 years	20(8.6%)	15(9.0%)	5(7.5%)
Education level				
	Diploma	59(25.3%)	37(22.3%)	22(32.8%)
	BA/BSc degree	141(60.5%)	105(63.3%)	36(53.7%)
	MA/MSc degree	33(14.2%)	24(14.5%)	9(13.4%)
Occupation type				
	Engineer	99(42.5%)	78(47.0%)	21(31.3%)
	Finance officer	38(16.3%)	23(13.9%)	15(22.4%)
	Human resource officer	35(15.0%)	26(15.7%)	9(13.4%)
	Office manager/secretary	38(16.3%)	29(17.5%)	9(13.4%)
	Others	23(9.9%)	10(6.0%)	13(19.4%)
Service year on current job				
	1-5 years	139(59.7%)	103(62.0%)	36(53.7%)
	6-10 years	56(24.0%)	36(21.7%)	20(29.9%)
	11-15 years	16(6.9%)	13(7.8%)	3(4.5%)
	Above 15 years	22(9.4%)	14(8.4%)	8(11.9%)
Ergonomic training				
	Yes	29(12.4%)	17(10.2%)	12(17.9%)
	No	204(87.6%)	149(89.8%)	55(82.1%)
Daily computer usage time				
	More than 6 hours	174 (74.7%)	141 (84.9%)	33(49.3%)
	3 to 5 hours	33(14.2%)	19(11.4%)	14(20.9%)
	1 to 2 hours	26(11.2%)	6(3.6%)	20(29.9%)
Adjusting screen				
	Yes	203(87.1%)	151(91.0%)	52(77.6%)
	No	30(12.9%)	15(9.0%)	15(22.4%)

Prevalence of MSD Symptoms

A total of 166 workers reported a history of one or more symptoms of MSD. Consequently, the 12-month prevalence of MSD in the study population was found to be 71.2% (166/233). The most commonly reported work-related musculoskeletal disorder (WMSD) complaint was back pain (46.4%); followed by headache (39.9%), neck pain (31.3%) and Wrist pain (12%) among musculoskeletal symptoms, MSSs (Figure 1). The prevalence of symptoms ranged from the least frequently reported (4.3%) for shoulder pain to (46.4%) for back pain among ERA workers. Almost there was no difference in cumulative prevalence of WMSD symptoms among male (71.1%) and female (71.4%) workers ($p > 0.05$).

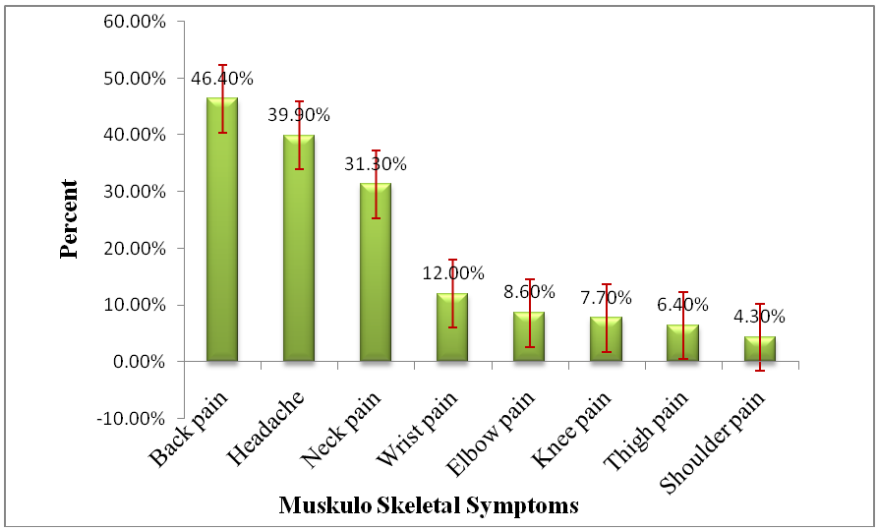

Figure 1 Musculoskeletal Symptoms of Computer User Workers in ERA

Table 2 One Year Prevalence of MSD Symptoms among Computer User Workers of Ethiopian Roads Authority, 2018

Symptoms	All prevalence %	Male prevalence %	Female prevalence %	*p-value*
Does MSSs or MSDs exist?				
Yes	166(71.2%)	101(71.1%)	65(71.4%)	.54
No	67(28.8%)	41(28.9%)	26(28.6%)	
Musculoskeletal symptoms reported				
Headache	93(39.9%)	60(42.3%)	33(36.3%)	.41
Neck pain	73(31.3%)	49(34.5%)	24(26.4%)	.20
Elbow pain	20(8.6%)	12(8.5%)	8(8.8%)	.55
Wrist pain	28(12.0%)	10(7.0%)	18(19.8%)	.004*
Shoulder pain	10(4.3%)	8(5.6%)	2(2.2%)	.33
Back pain	108(46.4%)	70(49.3%)	38(41.8%)	.29
Thigh pain	15(6.4%)	13(9.2%)	2(2.2%)	.051
Knee pain	18(7.7%)	12(8.5%)	6(6.6%)	.63

Workstation environs and Ergonomics related Problems Triggers MSSs

The ergonomic hazards were part of the assessment conducted during the survey. Almost more than half of the respondents 120 (51.5%) were used ergonomically nonadjustable chairs. More than half (54.1%) of the participants usually used desktop computers. Nearly half of them 114 (48.9%) were reported inadequate free space near to their computer work station.

About 12.9% of respondents reported that they were not adjusting their computer screen. On the other hand, 87.6% of the participants did not attend any ergonomic training related to computer usage (Table 1 and 2).

Table 3 Working Station Environs and Percentage of MSSs among Computer Users in Ethiopian Roads Authority (n = 233), 2018

Variables (working station environment)										
Symptoms of	Computer type used				Using adjustable chair			Free space availability		
MSD	Dt	Dt & Lt	Lt	P-value	Yes	No	P-value	Yes	No	P-value
Headache	34.9	47.7	38.1	.17	42.5	37.5	.43	47.9	31.6	.01*
Neck pain	30.2	31.4	38.1	.78	31.0	69.0	1.0	31.1	68.9	.52
Elbow pain	4.8	11.6	19.0	.04	8.0	92.0	.81	7.6	92.4	.36
Wrist pain	8.1	15.1	9.5	.31	11.5	88.5	.84	14.3	85.7	.18
Shoulder pain	2.4	8.1	0.0	.10	7.1	92.9	.054	5.9	94.1	.33
Back pain	46.0	48.8	38.1	.68	47.8	52.2	.69	47.9	52.1	.69
Thigh pain	4.8	9.3	4.8	.48	5.3	94.7	.59	5.9	94.1	.79
Knee pain	9.5	5.8	4.8	.61	7.1	92.9	.80	8.4	91.6	.81

Dt=Desktop; Lt=Laptop

Factors Associated with MSDs Symptoms

Job category, ergonomic training, computing hours per day and adjusting computer screening were candidate variable with the occurrence of MSSs ($p < 0.25$). However, among all candidate variables only patterns of computer usage per day was significantly associated with occurrence of MSDs ($p < 0.05$).

Results of the Logistic Regression Analysis

From binary logistic regression analysis: computing hours per day was significantly associated with the presence of MSD symptoms. When compared to workers who use the computer for more than 6 hours a day, using the computer for 1 to 2 hours a day substantially reduced the incidence of MSD symptoms by 16.4 times (AOR=16.401; 95% CI: 5.371-50.086).

Table 4 Factors Associated with MSD Symptoms among Computer User ERA Workers (n=233), 2018

Variables		COR (95% CI)	AOR (95% CI)	*P-value*
Job category				
	Engineer®			
	Finance and accountant	2.42 (1.08-5.44)*	2.16 (0.90-5.21)	0.085
	Human resource officer	1.29 (0.52-3.16)	1.10 (0.39-3.07)	0.861
	Office manager/secretary	1.15 (0.47-2.81)	0.47 (0.16-1.38)	0.168
	Others	4.83 (1.86-12.55)*	2.89 (0.34-24.94)	0.334
Ergonomic training				
	Yes®			
	No	0.52 (0.24-1.17)	0.84 (0.31-2.26)	0.730
Computer usage per day				
	More than 6 hours®			
	3 to 5 hours	3.15 (1.43-6.92)*	3.814 (1.65-8.84)	0.002
	1 to 2 hours	14.24 (5.30-38.25)*	16.40 (5.37-50.09)	0.000
Adjusting computer screen				
	Yes®			
	No	2.90 (1.33-6.35)*	0.98 (0.15-6.23)	0.983

Note: ® = Reference; *= indicates candidate variables for multivariable

Discussion

In the present study 71.2% of ERA workers had one or more than one symptoms of MSDs, which is very high computer related health risk. This finding is higher than studies reported prevalence of MSD symptoms ranged from 40-70% [22,24,33-35,42-45].

The higher prevalence observed in this study is possibly due to the higher sample size in reference with similar studies reviewed. Then again, most respondents in this study were engineers, who were experienced on daily usage of computers for long period of time as evidenced by Logaraj *et al.* [34]. Hence, these inconsistencies might be a possible justification for the determined higher prevalence in present study.

The main work-related musculoskeletal disorder symptoms of this study were back pain (46.4%), headache (39.9%), neck pain (31.3%) and wrist pain (12%) among ERA workers. This is aligned with a study done by other scholars [34,40].

In gender wise, almost there was no difference in general prevalence of MSD symptoms among male (71.1%) and female (71.4%) workers ($p > 0.05$). But, in particular wrist ($p=0.004$) pain were observed symptoms of MSDs associated to gender ($p < 0.05$) and more prevalent among female participants which is similar to Pandey *et al.* [12].

The possible justification might be due to the proportion of female in job categories. Out of 91 (39%) female participants in current study, the majorities were office secretaries 38 (41.8%) who have higher chance to develop wrist/finger pain since their job is related to comprehensive usage of computers. Strengthening this fact, Dessie et al found that secretaries were significantly impacted by MSDs compared to other workers [42].

Out of all, 233, respondents met the criteria and participated in this study, the majority 96 (40.4%) of them belonged to age category of 21-30 years old followed by age groups between 31-40 years 77 (33.3%). No significant association was found between the ages of workers with MSDs development in present study. Nevertheless, it might be revealed that most computer based work was dominated by younger generation. This is in line with other study conducted by Abudawood *et al.* in King Abdulaziz University, Jeddah, Saudi Arabia [40]. The current finding disagree with the study by Alemayehu *et al.* [45] who reported that older aged were at higher risk of developing computer related health problems within their study population.

Daily computer using time was the most statistically significant risk factor in this study. Workers who used computers for 3 to 5 hrs per day (AOR: 3.8; 95% CI=1.6-8.8, p=0.002) were 3.8 times less likely to develop MSD symptoms as compared to those who used computers more than 6 hours per day. On the other hand, computer user workers using for 1 to 2 hours per day (AOR: 16.4; 95% CI=5.37-50.08, p=0.000) were 16.2 times less likely to develop symptoms of MSDs comparing to those who used more than 2 hours per day. This finding is in agreement with numbers of the previous findings [22,23,36,38].

Moreover, Noreen *et al.* [22] and Logaraj *et al.* [34] reported that users who spent continuously without rest more than four hours were significantly at higher risk of developing computer related health problems than who spent less than four hours. Other similar studies also shown that the longer the time spent on computer, the more prevalent and extent are risks of MSDs symptoms appreciably [4,24]. Additionally, Logaraj *et al.* [34] observed that the longer the duration, the longer the complaint last even after work. Hence, either reducing daily exposure time spent on computer or taking mini breaks [23] are important to prevent and control MSDs.

Neck pain was more prevalent among laptop users (40%) (table 3), this might be resulted from view distance which was revealed by scholars in previous studies [33,46]. Users who viewed computers at a distance of less than arm and forearm length ($>$ 50 cm), resulted in more symptoms significantly [46]. Shantakumari *et al.* [33] added that the prevalence of headache decreased in students who viewed the screen at a distance more than 50 cm.

A well-designed chair may favorably affect the posture, circulation and the extent of strain on the spine. The chair should allow the feet firmly on the floor or a footrest should be used to support the feet. Most chairs used by computer users in properly designed computer facilities and institutions have adjustments to make them comfortable to sit on and therefore preventing back pains [23]. However, almost 5 out of 10 (51.5%) of ERA workers were sitting on non-adjustable chair in present study. This revealed that only 48.5% of the workers used adjustable chair which was inconsistent with Logaraj *et al.* [34] who reported that 61.5% of respondents in their study used chairs with adjustable backrest while working on their computer.

Despite it was non-significant in this study, sitting on inappropriate chair in front of computer screen cause muscle stiffness, headache, and back pain as muscles and tendons become inflamed due to prolonged sitting [12]. Strengthening this, evidence explaining that musculoskeletal symptoms are well related to improper seating posture and placement of the screen [16]. Additionally, just 48.9% of the respondents were complaining about free space availability near to their working station.

Although, this is not significant in present study, it may be one factor that triggers for 46.4% back; 39.9% headache; 31.3% neck; 12% wrist, 8.6% elbow; 7.7% knee, 6.4% thigh and 43% shoulder pains among study participants. That's why, American Optometric Association recommend that proper ergonomic design and adjustment

of computer in an adequate workstation can increase productivity and workers comfort by decreasing the demands of the task [15].

Limitation of study

The major limitation to this study was that, only self-reported symptoms were considered excluding ergonomic examinations using cross-sectional study design. Besides to this, other ergonomic parameters such as workstation furniture and viewing distance of computer screen might be associated with MSSs were not taken into consideration.

Conclusion

Ethiopian Roads Authority computer user workers had a high prevalence of work-related musculoskeletal disorder symptoms. Computing hours per day was significantly associated with the presence of musculoskeletal disorder symptoms. Multi-programmed approaches; decreasing the number of hours per day at the computer screen, increasing frequent rest (mini breaks) with motivation for exercises (to stand, stretch, and move around) at workplace and proper positioning is needed to prevent Work-related Musculoskeletal Disorder Symptoms (WMSDSs). Ergonomic interventions should be considered to prevent the computer related health problems.

Assertions

Abbreviations

CVS	Computer Vision Syndrome
CI	Confidence Interval
ERA	Ethiopian Roads Authority
MSSs	Muscular Skeletal Symptoms
MSDs	Musculoskeletal Disorders
WMSDs	Work-related Musculoskeletal Disorders
OOS	Occupational Overuse Syndrome
SPSS	Statistical Package for Social Sciences

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Consent for publication - Not applicable

Availability of data and materials

The datasets underlying the study are available from the corresponding author up on request.

Competing interests

The author declares that there is no competing interest.

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