DOI: 10.7860/JCDR/2014/9480.5252

Original Article

Community Medicine Section

Musculo-skeletal Disorders among Video Display Terminal Users: A Cross-Sectional Study in a Software Company, Kolkata

RIVU BASU[1], APARAJITA DASGUPTA[2], GAUTAM GHOSAL[3]

ABSTRACT

Introduction: IT has revolutionized economies throughout the world, more so in India. West Bengal has also got its share of IT boom. But with this, it has brought in the class of human resource of Video Display Terminal workers operators that and along with that can cause a host of occupational problems in them namely musculoskeletal, ocular and psychological systems. The current study had assessed some of the musculoskeletal disorders occurring due to VIDEO DISPLAY TERMINAL use.

Materials and Methods: An analytical cross-sectional study was done in a Software Company of Sector V, Kolkata, the IT hub of West Bengal. Of all the employees, required sample size of 206 was selected by Simple Random Sampling. After proper permissions and consent, socio-demographic variables were collected by standardized instruments, musculoskeletal morbidity was collected by Nordic questionnaire, and ergonomic practices were obtained by checklists.

Results: 90.78% of population showed some form of musculo skeletal symptoms. They were highest in fingers, elbows, wrist, shoulder, upper, while legs and lower back showed low morbidities. Increasing age, female sex, increasing years of work, repetition of work, poorer ergonomic scores all showed to have increased the symptoms. The regionwise ergonomic scores revealed how the poorer scores affected the musculo skeletal systems adversely. Several individual adverse ergonomic practices were also elicited.

Discussion: The study goes hand to hand with many other studies throughout the world and also in India. However, a much higher morbidity has been found in this study probably due to a symptom based questionnaire. The adverse practices obtained here goes well with other relevant studies.

Conclusion: This study puts occupational health problems of VIDEO DISPLAY TERMINAL users, and upholds the need of future multicentric cohort studies along with implementation of proper measures to ameliorate the effects of this occupational hazard.

Keywords: Computer, Work related musculo skeletal disorders

INTRODUCTION

Since the establishment of India's Information Technology (IT) Services industry in 1967, this industry has grown phenomenally over the years. The Indian Information Technology industry accounts for a 5.19% of the country's GDP and export earnings as of 2009, while providing employment to a significant number of its tertiary sector workforce. More than 2.5 million people are employed in the sector either directly or indirectly, making it one of the biggest job creators in India and a mainstay of the national economy. In 2010-12, annual revenues from IT-BPO sector is estimated to have grown over US$76 billion compared to China with $35.76 billion and Philippines with $8.85 billion [1]. Among other IT destinations in India, Kolkata has secured its place firmly in the IT map. The city's IT sector is growing at a rate of 70% per year—twice the national average [2]. Around 1.2 Lakh people are employed in Sector V, the main hub of IT in Kolkata.

VIDEO DISPLAY TERMINAL, loosely called as a personal computer terminal, along with its benefits, has created some expensive and long term problems. A host of problems like Work Related Musculo-Skeletal Disorders (WRMSDs), ocular problem, psychological problems are already proved morbidities associated with use. Now these problems not only are taking a huge magnitude as the VIDEO DISPLAY TERMINAL use is increasing, but they are significantly impacting the economy too. The compensation claims for these problems are very high in developed countries, and they are causing a significant loss of human resource and decreasing productivity. A host of studies have been done regarding this budding public health issue in the developed country, summarized beautifully in Bergviststst's systematic review [3] but very few and sporadic studies have been done in this part of the world especially in India [2], to address the issue in all its scope. Disorders arising from VIDEO DISPLAY TERMINAL use, as it is entering the Indian Scenario in a big way, should be a matter of utmost importance to gather necessary evidence for policy making, so that it can be defused before the explosion occurs.

AIMS AND OBJECTIVES

With these points in mind the following study was done with the objectives to study the different socio-demographic, ergonomic factors among the study population, and to find out the proportion of musculoskeletal problems among the study population and its association with the above factors.

MATERIALS AND METHODS

It was an institution based, cross sectional, analytical epidemiological study conducted over one year period starting from 1st May, 2010 to 30th April 2011 on persons working with Video Display Terminals in Sector V, Salt Lake. Only those who gave consent to participate in the study and who worked in the current job for at least 6 months, were included in the study. Based on a study done by Dr. A.K. Sharma [4] , where the rate of morbidities was found to be 91%, and using the formula Z^2 PQ/L^2 for calculation of sample size when proportions are given, sample size was calculated to be 200. Allowing 10% dropout, the final sample size was fixed at 230. After taking necessary permission from the authority through proper channel. A simple random sampling of the employee list 230 persons were enlisted. Those employees were explained about the study by distributing pamphlets asking for participation, assuring confidentiality of data and anonymity. Two hundred twenty-seven of them were willing to take part in the study and all of them were

Region (any side)	Symptoms in last 12 months	Symptoms in last 7 days (taken as a percentage of those having symptoms in last 12 months)
Finger	139 (67.5)	89 (64.2)
Wrist	121 (58.7)	22 (18.2)
Elbow	110 (53.3)	13 (11.8)
Shoulder	115 (55.8)	19 (16.5)
Neck	112 (54.4)	31 (27.7)
Upper back	77 (37.4)	7 (9)
Lower back	75 (36.4)	7 (9.3)
Leg	90 (43.7)	9 (10)
Total	195	112 (57.4)

[Table/Fig-1]: The region wise musculoskeletal symptoms of the workers (in last 12 months and also in the last 7 (n=206)

Parameter	Total	Number having any musculo-skeletal trouble	Odd's Ratio (95% CI)
Age			
21 - 30	121	108 (89.3)	1 (reference)
31 - 40	68	63 (91.3)	1.5 (0.5-5)
41 and above	17	16 (94.1)	1.93 (0.2-42)
Sex			
Male	112	97 (86.6)	1 (reference)
Female	94	90 (95.7)	3.6 (1-12)*
Years of Working			
lowest quartile (<3)	67	56 (83.6)	1 (reference)
25-50 quartile (3-4)	29	27 (93.1)	2.7 (0.5-18)
50-75 quartile (5-6)	46	43 (93.4)	2.8 (0.7-13)
highest quartile (>6)	64	61 (95.3)	3.99 (0.9-19)
Repetitions			
Present	89	85 (95.5)	3.13(0.9-11)
Musculoskeletal Ergonomic Score			
Best Quartile	33	27 (81.8)	1 (reference)
50-75 quartile	57	50 (87.7)	1.6 (0.4-6)
25-50 quartile	41	38 (92.7)	2.8 (0.6-15)
Poorest quartile	75	72 (96)	5.3 (1.07-29)*

[Table/Fig-2]: The ergonomic, socio demographic and work related risk factors of the musculoskeletal diseases (n=206)

working for 6 months or more in their current positions. Data was collected from all of them. They were given tentative dates for their examinations and interview, to manage with the time-schedule and work pressure of employees as also the time restraint of the researcher. It was also decided that they shall be informed about the poor ergonomic practices and help in adjusting their ergonomic posture after the total exercise was over in a single session.

An instrument was developed to elaborate three things, (i) socio-economic, lifestyle related and a few job-related health behaviors, (ii) Nordic Musculoskeletal Questionnaire [5], used to ascertain the musculoskeletal morbidities. (The reliability of the NMQ, using a test–retest methodology, found the number of different answers ranged from 0 to 23%. Validity tested against clinical history and the NMQ found a range of 0 to 20% disagreement. The authors concluded this was acceptable in a screening too) (iii) Ergonomic checklists (which were self filled) were developed to evaluate office workspace (Several office ergonomic questionnaires, checklists, like Occupational Health Clinics for Ontario Workers, WISHA Services Division, Washington State Department of Labor and Industries, MMERT were consulted and then the questionnaire was compiled). The schedules were judged by a group of experts of All India Institute of Hygiene and Public Health, Kolkata and the

Anatomical Area	Total	Number having respective poorer ergonomic scores (by median split)	Odds Ratio (95% CI)
Finger	139	105 (75.5)	1.61 (0.8-3.2)
Wrist	121	101 (83.5)	5.17 (2.6-10.4)*
Elbow	110	92 (83.6)	3.1 (1.6-5.9)*
Shoulder	115	72 (62.6)	1.9 (1.1-3.4)*
Neck	112	69 (61.6)	1.2 (0.7-2.2)
Back	119	98 (82.4)	3.14 (1.6-6.3)*

[Table/Fig-3]: The association of region wise ergonomic scores with regionwise musculoskeletal symptoms (n=206)

Ergonomic Scores	Cut Off
Repetition	3 (Median)
Musculoskeletal Score	
50-75 quartile	15-16
25-50 quartile	13-14
worst quartile	<13
Finger Score	5 (Median)
Wrist Score	5 (Median)
Elbow Score	6 (Median)
Neck Score	7(Median)

[Table/Fig-4]: Shows the cut off value of different ergonomic scores

latter made necessary corrections to enhance face validity, content validity and consensual validity. After proper ethical clearance by Institution Ethics Committee, the schedules were piloted among 10 individuals of the company to correct any comprehension problems. After necessary modifications the data collection was started.

After filling up the informed consent, the socio-demographics of the subjects were asked, and the morbidities were evaluated by the schedule. Weight, height, Blood Pressure were measured using standard instruments. Then the ergonomics checklists were was handed to the person, after explaining how to fill that up.

Data was entered and analysed using Epi Info. The checklists were analysed by giving a score of 1 to the good postures and 0 to the poorer postures. Then they were added up for composite scores, total scores were thus obtained separately for each region, and the musculoskeletal disorders as a whole. Median splits of the ergonomic scores were considered for analysis in the absence of any standard cut off values, to convert differential misclassification into non differential misclassification.

RESULTS

Fifteen subjects either left the company or did not participate even after consenting initially. Thus dropout rate was 6.6%. The 212 remaining population duly participated in the study. While entering data it was found that 6 of them have not filled the self-report form correctly/completely. So they were also eliminated from the analysis. Thus analysis was done with 206 subjects. Out of them, 54.4% were males and 45.6% were females. Mean age of male population was found to be 30.27 (±6.7) yrs and female was 31 (±6.2) years. Throughout age ranges, the males and the females were more or less equally distributed, with predominantly younger distribution.

[Table/Fig-1] shows the different musculoskeletal disorders found in the study population. One hundred eighty seven (90.78%) showed some form of musculoskeletal problem by Nordic Questionnaire. Problems were found mostly in the finger (67.5%), wrist (58.7%), elbow (53.3%), neck (54.4%). There were also problems in the upper back, lower back and legs. Among those who were having some problems in the fingers in the past (last 12 months), 64.2% continued to have their problems showing that the latter had become persistent and chronic.

[Table/Fig-2] shows the risks associated with different factors with any musculoskeletal disorders. The risk is higher in females, and significantly so (OR=3.6, CI:1-12), increases in higher quartiles of years of working with the risk as high as fourfold (OR=3.99, CI: 0.9-1.99) in the highest quartile (years of working >6 years). When there is self reported repetition of jobs, there is higher risk of musculoskeletal symptoms, (OR= 3.13: CI: 0.9-11). From the ergonomics checklists, those pertaining to musculoskeletal disorders were separated and it was seen that with higher scores (i.e., higher adverse factors), had significantly higher musculoskeletal problems, with the highest quartile having as high as OR=5.3 risk than the best quartile and this is statistically significant (CI: 1.07-29).

Also area wise ergonomic scores [Table/Fig-3,4], split by median, showed consistently higher risks in the different areas like finger (OR=1.6: CI:0.8-3.2), Wrist (OR=5.17, CI:2.6-10.4), elbow (OR=3.1, CI:1.6-5.9), shoulder (OR=1.9, CI:1.1-3.9) and back (OR=3.14, CI:1.6-6.3).

Assessment of individual ergonomic factors revealed that poor practices like improper placement of elbow (not parallel to ground), improper placement of mouse/keyboard, non-location of the input in the same surface, non-comfortable placement of the low back support, inadequate space under the table are some of the most important factors causing musculoskeletal disorders. Non neutral position of wrist increased finger problems by 1.13 times (CI: 0.6-2.1), wrist symptoms by 1.03 times (CI:0.6-1.9), but not significant. In fact the factors like improper placement of elbow had significantly increased finger symptoms (OR=4.74, CI:2.5-9.1). Not working with a neutral position of wrist increases risk of elbow disorders significantly by 3.04 (CI:1.6-5.7). Not placing the shoulder by the side of the body increases neck trouble by 1.85 (1.01-3.4), which is significant and also shoulder trouble by 1.6 (CI:0.9-2.9), though not significantly. Low back pain was more with uncomfortable backrest (OR=2.11, CI: 1.1-4.2), with poor screen character (OR=2.05, CI 1.1-3.7), with non-placement of monitors parallel to light sources (OR=2.1, CI:1.1-3.8). Too far or too near monitor has increased shoulder problems drastically (OR=11.25, CI:5.3-24. Risk of leg pain over last 12 months was significantly more with inadequate space under table (OR=2.73, CI:1.2-6.5) .

DISCUSSION

In this study, 90.78% showed some form of musculoskeletal problem. Problems were found mostly in the finger (67.5%), wrist (58.7%), elbow (53.3%), neck (54.4%). There were also problems in the upper back, lower back and legs. From various other studies of the world, it was known that VDU workers suffered from upper extremity predominant symptoms, like pain, numbness, aches in fingers, wrists, shoulders, elbow. Like Brandt et al., [6] did a cohort study in which, Tension neck syndrome incidence was found to be 1.4%, and Rotator cuff syndrome was found to be 0.5%, Right shoulder myalgia was found to be 0.01%. in another cohort study by Gerr et al., [7], Radial pain syndrome was found to be 0.2%, Bicipital tendonitis was found to be 0.2%, any neck/shoulder disorders was found to be 5.9% , and Hand/arm disorders were found to be 2.2%. Obtaining such high results in this study should be interpreted cautiously, as here no confirmation of specific disease was done by experts or by imaging and only the symptoms were noted. The study by Sharma et al., [4] revealed muscular symptomatic as high as 76.5% in NCR. A study done in Kolkata [8] revealed that low back problem was the main problem among VIDEO DISPLAY TERMINAL workers.

Many of the factors like non-placement of the keyboard at the level of working surface, non placement of the keyboard and mouse on the same surface, non usage of wrist rest causes prolonged use of wrist, elbow fingers , proper adjustable chair loads the low back, by mechanism of static loading as evident from literature [9]. In the current study, factors like improper placement of elbow, not working with a neutral position of wrist, not placing the shoulder by the side of the body were all found to be significant risk factors of musculoskeletal disorders.

Awkward postures also significantly increase the various WRMSDs among VDU users. Like, non neutral position of wrist increased finger, wrist symptoms but not significantly. However, for the elbow, the risk is significant. There is evidence of extreme wrist flexion/extension, ulnar/radial deviation of wrist and its association with pain in finger, wrist and elbow [10]. Improper placement of monitors (neither to far nor too near) as well as poor characters of the monitor will make the worker adjust continuously to a host of WRMSDs [11]. Like here too near monitor has hugely increased the risk of shoulder trouble and significantly too. Also placement of monitors at right angles to bright light sources cause glare, which drive the workers to adjust to get a clear view of the screen continuously. This gives rise to low back pain, as is also evident from the study, which is significant.

Another very important factor is force. The forces applied to the computer mouse and keyboard may be a risk factor for musculoskeletal symptoms [12]. It is not known if the forces applied to the sides and button of the computer mouse is associated with increased risk for developing musculo-skeletal symptom. Musculoskeletal disorders among the subjects in this study were related to movement of the mouse, non-presence of lose grips on the keyboard surface, and non-usage of the software of the mouse to customize the need of the worker giving undue force on the fingers, wrist and elbow of the worker.

Another important ergonomic factor causing WRMSDs is the contact stress. Here also lack of comfortable space between edge of seat and back of knee increases leg trouble significantly. Like a previous study [13], lack of proper padding of armrest proved to be causing more finger, wrist discomforts as also lack of contact with desktop edge.

With the individual factors, female sex was more prone to getting the symptoms and this is concurrent with other studies [14] maybe because of their unique anthropometry, but that needs further exploration. As mentioned in other studies [15], the morbidities increased with age, maybe due to the gradual disappearance of the healing processes of the body. But that also needs further exploration. The persons working for more years also had more problems, with those working for 6 years or more having 4 times the risk than those working for < 3 years. This may be also because of the same reason as above.

Repetition of work was found to increase WRMSDS, which corresponds with another study [16]. As for Hill's criteria for causation, strength of association, dose dependency, coherence, biological plausibilities were obtained for most of these factors, but temporal association could not be ascertained without cohort studies.

There were some limitations in this study. Firstly, this study was essentially a cross-sectional study, and has got all the pitfalls of such a design, like temoporal relation cannot be ascertained. Secondly, the measurement of exposure is a potent source of bias in the study as the ergonomic postures or factors measured were filled by the employees themselves. Median splits were done to make the misclassification a non-differential one. Thirdly, by not taking any pathological proof, or radiological evidence for the diseases, i.e., by not doing any diagnostic tests, the outcomes under study were not fully valid, but subjective and symptomatic only. Fourthly, lack of knowledge about induction time of the diseases may also have missed some important findings.

CONCLUSION

Thus this study is like a looking glass into the complex world of office ergonomics. Researches have to be targeted for this, customized

for the country, as this will help generate better human resources, lesser attrition, good value system of the companies, and help in the growth of the country. More evidence, preferably longitudinal, and multicentric, are required to gather enough information. Besides, almost nothing has been done to device appropriate intervention strategies to prevent this kind of office-related disorders. Also, studies should be done with proper laboratory, expert, and imaging support to pinpoint diagnosis. Ergonomic factors, instead of collecting by self-administered questionnaire, should ideally be done by standard "work cycle" methods. All of this will go a long way to increase the strength of evidence of these problems, and will help in policy making. Thus, before another volcano erupts, it is better to take the guard. Let this study be a harbinger to a comprehensive policy with appropriate recommendations that will increase productivity, decrease collateral damage and capture the true potential of this IT revolution without exposing its menaces.

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PARTICULARS OF CONTRIBUTORS:

1. Assistant Professor, Department of Community Medicine, R G Kar Medical College, Kolkata, West Bengal, India.
2. Professor and Head, Department of Community Medicine, All India Institute of Hygiene and Public Health, Kolkata, India.
3. Assistant Professor, Department of Physiology, Agartala Government College, Tripura, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Rivu Basu,
All India Institute of Hygiene and Public Health, Kolkata-700002, India.
Phone: 9830844035, E-mail: rivubasu83@gmail.com

FINANCIAL OR OTHER COMPETING INTERESTS: None.

Date of Submission: **Mar 31, 2014**
Date of Peer Review: **Aug 07, 2014**
Date of Acceptance: **Sep 17, 2014**
Date of Publishing: **Dec 05, 2014**