Prevalence of Cumulative Trauma Disorders among Computer Work Station Users in Kakamega County, Kenya

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ABSTRACT---- ***The incidence rate of cumulative trauma disorders particularly injuries of the wrists, arms, shoulders and lower back, along with the financial and non-financial costs resulting from these disorders is receiving an increasing amount of attention. The purpose of this study was to investigate the prevalence of cumulative trauma injuries among computer user employees in Kakamega County.194 respondents were identified and One-way ANOVA was used to determine the interrelationship between the variables and presented in ANOVA tables. 38.5% secretaries and 34.5% officers suffered from low back strain attributed to lack of adherence to OSHA guidelines in office set up. 43% of them worked with their forearms, wrists and hands elevated, 65% did not support their lumber area on the backrests, 27% had their screens above their sitting eye level and the monitors were not placed right in front of them. Due to non-adherence to OSHA computer workstation guidelines, the employees suffered from various Cumulative Trauma Disorders. 20% of the employees suffered from wrist ganglion, 18% radial tunnel syndrome, 18% lateral epicondylitis, 23% rotator cuff tendinitis, 26% thoracic outlet syndrome, 22% neck tension syndrome, 36% low back strain, 29% nerve entrapments and 32% eye strain.***

Keywords--- OSHA; Occupation Safety and Health Association, CTDs; Cumulative Trauma Disorders

1. INTRODUCTION

According to Kohler (1994) there was an unprecedented eightfold increase in cumulative trauma disorders up from 21% cases of all injuries reported in 1982 to 56% in 1990. Bernard (1999) also indicated that work-related musculoskeletal injuries comprised 18% of occupational hazards in 1980 and rose to 65% by the late 1990s. This increase can be attributed to computerization of office work which has been adopted world over as a means of improving efficiency and productivity (Andersen *et al.*, 2006). Unfortunately computer operations are characterized by sitting for long periods of time, highly repetitive tasks and a culture of low physical activity (Graves, 1999; Kerin and Kerin, 2004; Khan and Siddiqui, 2005). The near-static postures common among computer users intensify the harmful effects of repetitive tasks (Kohler, 1994; National Institute of Occupational Safety and Health, 1997; Graves 1999).

Several occupational factors contribute to cumulative trauma disorders and may be classified into three major categories: (1) Work-related risk factors that include; awkward postures, wrist deviations, forceful extensions, cold, vibration, high grip forces, direct mechanical impact, wrist accelerations, repetitive motions and static postures (NIOSH, 2007, Johnson L. et al 1996). Other work-related risk factors include high workload, high work pressure, diminished job control, inadequate employee training in the use of new technology, poor supervisory relations, and fear for job security, technology breakdowns, technology slowdowns, and electronic performance monitoring (Johnson L. et al 1996). (2) Individual characteristics; these relate to individual basic skills and abilities, amount of training and experience, anatomy and physiology, age, gender and temperaments. (3) Medical factors which include; trauma, arthritis, diabetes, gout, pregnancy, the use of oral contraceptives, use of spectacles, and menopause (Liao and Drury 2000).

Cumulative trauma disorders affect the connective tissues of the body such as muscles, nerves, tendons, joints, cartilage, or spinal discs (Ann E. Barr et al, 2004. They may occur when muscles or tendons are stretched or over-used beyond their capabilities. The symptoms of the disorders include pain, swelling, numbness and tingling. The most frequent work-related disorders include rotator cuff tendinitis, thoracic outlet syndrome, carpal tunnel syndrome, eye strain, and lower back pain (Johnson L. et al., 1996). In addition these cumulative trauma disorders cost the economy a large amount of money. The costs that are most generally addressed are the direct expenses of high worker's

compensation insurance and the potential for OSHA fines, absenteeism and high turn-over rates, as well as reductions in productivity and product quality (U.S. Bureau of Labor Statistics, 1992).

Research has shown that several methods may be used to reduce or eliminate the ergonomic risk factors and even reverse the effects of CTDs. They include; Ergonomic adjustments that involve redesigning a workstation or a process to reduce the ergonomic risk factors such as static and poor posture, force, repetition, duration, recovery time, heat, cold, lighting, noise, vibration, stress, workload, shifts, overtime, slips and falls, fire, and exposure hazards such as electrical, chemical, biological and radiation (NIOSH, 2007). Administrative controls which involve rotating workers through a particular workstation to effectively reduce the exposure to a risk factor and training (NIOSH, 2007). Stretching and flexibility exercise programs (NIOSH, 2007) whose benefits include increased flexibility, improved range of motion within joints, improved circulation improved posture, and stress management.

2. RELATED STUDIES

Shahab A. Alazawi (2012) assessed the prevalence of Musculoskeletal Symptoms among Visual Display Terminal Users. The result of this study was that the neck, shoulder and lower back pain were the main problems among VDT workers. Both male and female VDT workers suffered pain in neck, shoulder, low back, forearm, wrist, elbow and the different parts of the upper extremities. This study also revealed that the female VDT workers suffer more discomfort feeling than male VDT workers. Prolonged period of work in an awkward posture mainly leads to discomfort among the VDT workers. The 12 month prevalence of musculoskeletal complaints in various body parts were: neck (30.0%), back (28.3%), shoulder (18.3%), wrist (8.3%), forearm (6.6%) elbow (5.8%) and (2.5%) fingers. It was found that there was a gradual increase in musculoskeletal complaints as the number of hours spent for working on computers daily increased.

A study by Connie Y.Y. et al., (2003) on Physical and Psychosocial Factors in Display Screen Equipment Assessment. Hong Kong Journal of Occupational Therapy 13: revealed that Mouse–elbow height match was a significant predictor for discomfort of the lower back, whilst keyboard–elbow height match was a significant predictor for discomfort of the shoulders and upper back. Psychosocial status and accumulative DSE usage of employees were also significant factors for discomfort. Workstation–worker match attributed most significantly to workers' discomfort.

Catherine Cooket al., (2000) conducted a study on the prevalence of neck and upper extremity musculoskeletal symptoms in computer mouse users. The results showed that no relationship was found between hours of mouse use per day and reported symptoms. A relationship was found between the variable of arm abduction which is specific to mouse use and symptoms in the neck. Relationships were found between non-mouse specific risk factors such as stress, screen height and shoulder elevation. The findings of the study supported the hypothesis that mouse use may contribute to musculoskeletal injury of the neck and upper extremity. Mouse users are exposed to the same recognized risk factors associated with keyboard use as well as the additional risk factor of arm abduction during mouse use as well.

Nur Turhanet al., Celil (2008) studied Ergonomic Risk Factors for Cumulative Trauma Disorders in VDU Operators. A visual posture analysis of the workers and an ergonomic analysis of workstations and workload were used to reveal risk factors. Neck and shoulder pain, extensor tendonitis of the wrists and De Quervain's disease were common in the study population. An assessment of risk factors showed that leaning wrists on the keyboard, hard keystrokes, extreme wrist joint and thumb positions and working in poor ergonomic design were correlated to pain and development of CTDs.

Srilatha et al., (2011) Prevalence of Work-Related Wrist and Hand Musculoskeletal Disorders (WMSD) among Computer Users in Karnataka State, India. Overall, 57.7% of 723 employees reported work-related WMSD of the wrist and hand during the study. Prevalence of work-related WMSD was significantly higher in women than men (68.9% vs. 52.6%). With regard to sites of symptoms, the right side (42%) was affected the most followed by involvement of both sides (34%).

Shari M. and Rafer L. (2003) conducted a study about Computer Use, Workstation Design Training and Cumulative Trauma Disorders among College Students. From the findings the most frequently reported disorders related to health were eyestrain affecting nearly 85% and, upper back and neck pain affecting 70% of computer users. Only 26.6% of the sample indicated receiving training on workstation design. The study recommended that Identifying college students at risk for CTDs and other musculoskeletal discomforts early enough for intervention.

Johnson et al., (1996) conducted a research to estimate prevalence of musculoskeletal pain/discomfort and visual strain symptoms for a UK Trade Union in response to increasing numbers of health complaints among intensive computer workers in a data processing environment. 86% of the data processors reported musculoskeletal pain/discomfort in the previous year, with the highest prevalence rate found for the neck (58%). The reported prevalence for visual strain symptoms was 47% and that of tired eyes was (41%).

Strazdins and Bammer (2004) investigated Public Service employees (73% women and 73% clerical workers) and found gender differences in risk factors. 34% of women compared to 21% of men sat in the same position for long periods of time, 81% of women compared to 73% of men worked longer than 5 hours per day on a computer, and 30% of

women compared to 16% of men reported that their job involved repetitive movements all of the time. Women were also more likely to work in poorly designed and uncomfortable environments. 15% of women compared to 10% of men described their work environments as either uncomfortable or very uncomfortable. In addition, women spent considerably less time than men exercising or relaxing during leisure-time. 20% of women did not exercise at all and 14% did not spend time relaxing over the previous month. This compares to 12% and 10%, respectively, for men.

Waiganjo e*t al*., (2012) investigated the prevalence of musculoskeletal injuries and health-related problems among computer-user employees in the banking institutions in Nairobi. The findings of the study showed that most of the bank employees (63.86%) suffered from various musculoskeletal injuries. Significant differences existed in terms of work positions with a calculated X^2 of 672 (df=8, p< 0.05), where the tellers (78.70%) were the most affected by musculoskeletal injuries. It was concluded that computer-user bank employees in Nairobi Kenya suffer from work-related musculoskeletal injuries and health-related conditions

3. RESEARCH METHODOLOGY

This study targeted computer users in Kakamega County. The purpose of the study was to evaluate adherence to OSHA guidelines and determine gender differences on the prevalence of CTDs. Inclusion criteria identified workers who spent more than 20% of their workday at computer workstations. 194 employees were selected to participate in the study. G*power was used determine a sample size that would result to a medium effect size and high power and therefore determine the critical F value that would rule the tests significant or otherwise. Sample size was set at 94, effect size at 0.25 and power at 0.8. Employees' awareness of ergonomic setup was examined by use of the OSHA computer workstation evaluation checklist. Information on CTDs was collected by use of cumulative trauma disorders checklist. The data collected was analyzed using the Statistical Package for Social Scientists (SPSS).

4. RESULTS AND DISCUSSIONS

194 participants (n=194) volunteered to participate in the study of which 41.5% of the employees were men while 58.5% were women. 37.2% were between 30 and 35years of age while 4.3% were above 50 years old. 41.5% were secretaries while 58.5% were office administrators. 29.8% the employees had worked in the same station between 11 and 15 years.

4.1 Prevalence of CTD at the Computer Workplace

Due to non-adherence to OSHA computer workstation guidelines the employees observed to suffer from various Cumulative Trauma Syndromes. The prevalence was as follows: Wrist ganglion (20%), cubital tunnel syndrome (15%), radial tunnel syndrome (18%), lateral epicondylitis (18%), rotator cuff tendinitis (23%), thoracic outlet syndrome (26%), neck tension syndrome (22%), low back strain (36%), nerve entrapments (29%) and eye strain (32%).

Gender differences in the prevalence of CTDs were determined. It was observed that more women suffered from CTDs than their male counterparts. Women (36%) suffered from neck tension syndrome compared to Men (18%), rotator cuff tendinitis (29% Women: 15% Men), lateral epicondylitis and radial tunnel syndrome (22% Women: 13% Men), low back strain (40% Women: 31% Men) while vision strain syndrome (42% Women: 18% Men) suffered from. These results are supported the study finding by Strazdins and Bammer (2004) which found out that gender differences in risk factors associated with CTDs.

More women (42%) than men (18%) suffered from vision strain syndrome. Gender difference was significant (.014). This could be attributed to the fact that more women compared to men had worked in the same position for long time routinely. Similar results were also found by Srilatha, Maiya Arun G, Vinod Bhat, Nalini Sathiakumar (2011). This is summarized in table 1 below.

Table 1: Gender comparison in prevalence of cumulative trauma disorders

Descriptive				ANOVA summary					
Male		Female			SS	df	MS	F	Sig.
Yes	No	Yes	No	Between Groups	1.30	1	1.300	6.254	.014
18%	82%	42%	58%	Within Groups	19.12	92	.208		
				Total	20.426	93			

Gender difference was observed to be significant (.053) in the occurrence of neck tension syndrome among the employees with more women (36%) than men (18%) reporting neck tension syndrome. This was associated with poor working posture at the work. Majority of the victims were women who were observed to overreach their monitor screens placed far away from them. Another r contributing factor was that the monitor screens were not directly in front of the users and therefore had to twist their heads and necks while working on the computers. Nur Turhan, Celil Akat Müfit Akyüz and Aytül Çakc (2008) had similar results. See the summary in table 2 below.

Table 2: Prevalence of neck tension syndrome

Descriptive				ANOVA summary					
Male		Female			SS	df	MS	F	Sig.
Yes	No	Yes	No	Between Groups	.774	1	.774	3.854	.053
18%	82%	36%	64%	Within Groups	18.471	92	.201		
				Total	19.245	93			

Rotator cuff tendinitis is a common shoulder tendon disorder which occurs when the arm tendons pushing arm tendons against the bony structure in the shoulder causing inflammation of the tendons. Occurrence of Rotator cuff tendinitis showed gender difference (.125) with 29% of women compared to 15% of the men exhibiting the condition. This was attributed to the fact that 45% of the employees were women who used chairs that had high armrests hence elevation of the arms at the shoulder. Nur Turhan, Celil Akat Müfit Akyüz and Aytül Çakc (2008) had such results associated with shoulder pains. See table 3 below.

Table 3: Prevalence of rotator cuff tendonitis

Descriptive				ANOVA summary					
Male		Female			SS	df	MS	F	Sig.
Yes	No	Yes	No	Between Groups	.429	1	.429	2.402	.125
15%	85%	29%	71%	Within Groups	16.422	92	.179		
				Total	16.851	93			

A significant difference (.026) was noted between the secretaries and Office administrators in the occurrence of low back strain. More secretaries (38.5%) than office administrators (34.5%) officers suffered from the condition. The results were attributed to lack of adherence to OSHA guidelines on office set up. 23% of the secretaries and 38% of office administrators did not sit upright while working on the computer. In addition 72% of the secretaries and 58% of the officers did not support their lower back on the backrest as they worked while 62% of the secretaries and 64% of the officers used chairs without backrest. The findings are similar to those of Shahab A. Alazawi (2012) the summary is shown in table 4 below.

Table: 4 Prevalence of low back strain

Descriptive				**ANOVA summary**					
Secretary		Officers			SS	df	MS	F	Sig.
Yes	No	Yes	No	Between Groups	1.009	1	1.009	5.089	.026
38.5%	61.5%	34.5%	65.5%	Within Groups	18.236	92	.198		
				Total	19.245	93			

Significant difference (.113) was noted between the officers and the secretaries in terms of the occurrence of eyestrain, 41% of the secretaries and 25.5% of the officers suffered from the condition. This concurs with findings of

Johnson et al., (1996). This is attributable to non-adherence to OSHA guidelines on the placement of the monitor. There was glare from windows and overhead lamps reflected on the screen. See table 5 below.

Table: 5 Prevalence of eyestrain

Descriptive				**ANOVA summary**					
Secretary		Officers			SS	df	MS	F	Sig.
Yes	No	Yes	No	Between Groups	.553	1	.553	2.561	.113
41.0 %	59.0 %	25.5 %	74.5%	Within Groups	19.872	92	.216		
				Total	20.426	93			

A number of the respondents were not aware on the OSHA guidelines and therefore did not observe them. Most of the office equipment such as desks, chairs and accessories did not meet specific needs of the users. Due to non-adherence to OSHA computer workstation guidelines many of the employees suffered from various Cumulative Trauma Syndromes. This findings are supported by Shari McMahan and Rafer Lutz (2003)and A study by Connie Y.Y. Sung, Kenneth K.F. Ho, Ray M.W. Lam, Ada H.Y. Lee, and Chetwyn C.H. Chan (2003) . The summary of the findings are shown in table 6 below.

Table 6: Adherence to OSHA guidelines

Respondents Adherence to OSHA guidelines on Working Posture	Percentages		
	Yes	No	Total
Work Posture			
I always keep my torso upright	59%	41%	100%
I ensure that my head, neck and trunk always faces forward	65%	35%	100%
I ensure that my trunk is always perpendicular to the floor	69%	31%	100%
My shoulders and upper arms are always perpendicular to the floor	71%	29%	100%
I always keep my upper arms and elbows close to my body	62%	38%	100%
I ensure that my forearms, wrists and hands are at about 90 degrees to the upper arm	57%	43%	100%
My thighs are always parallel to the floor and lower legs nearly perpendicular to the floor	69%	31%	100%
My feet always rest flat on the floor or on a stable footrest	53%	47%	100%
My computer tasks are organized in a way that allows for micro-breaks during work	69%	31%	100%
Adherence to OSHA guidelines on use of Office chairs (Setup)	**Percentages**		
	Yes	No	Total
I usually support my lower back on the chair back rest?	35%	65%	100%
My chair has stable stands with operational wheels	37%	63%	100%
The seat-pan of my chair does not press against the back of my knees	73%	27%	100%
The arm rests of my chair supports both arms and keeps them close to the body	55%	45%	100%
Adherence to OSHA guidelines on Monitor positioning	**Percentages**		
	Yes	**No**	**Total**
The top of my computer screen is at or below my seated eye level	73%	27%	100%

I am able to read from the computer screen without leaning forward	78%	22%	100%
The screen of my computer is placed directly in front of me	73%	27%	100%
Glare from windows and lamps is not reflected on the computer screen	47%	53%	100%
Adherence to OSHA guidelines on use of Office Accessories	**Percentages**		
	Yes	No	Total
My document holder is placed at about the same height and distance as the computer screen	10%	90%	100%
The wrist/palm rest keeps my wrists and palms straight while typing	32%	68%	100%
I hold my head upright when answering calls	32%	68%	100%
My workstation and equipment have sufficient adjustability	60%	40%	100%

5. CONCLUSION

The results demonstrate lack of awareness on the OSHA guidelines among computer work station users. It also reveals the relationships between musculoskeletal overuse injuries and workstation set-up. This sheds light on the parameters that might be useful in risk assessment of computer use in the workplace. Observing OSHA guidelines will save the organizations from hefty fines resulting from litigation, insurance funds for medical treatment and time lost during treatment and recovery from injuries.

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