RISK FACTORS FOR UPPER BODY MUSCULOSKELETAL DISCOMFORTS AMONG COMPUTER USERS IN KENYA

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Abstract

The use of computers has been associated with incidences of musculoskeletal discomforts among frequent users. The objectives of this study were to assess the prevalence of musculoskeletal upper body discomforts among frequent computer users and to determine the associated risk factors. Data was collected by administering a modified Nordic questionnaire to 108 respondents of professional work groups from selected workplaces in Kenya. Personal characteristics, job and workstation factors were tested to predict the occurrence of neck, shoulder, upper back, hands/wrists and elbow discomforts. Binary logistic regression was used to identify the associations between risk factors and outcome variables. Prevalence rates of the discomforts were: neck (55.6%), shoulder (49.5%), upper back (45.8%), hands/wrists (27.1%) and elbows (16.8%). Neck discomfort (35.0%) and shoulder discomfort (38.8%) were most prevalent among the administration group, whereas wrists/hands discomfort (33.3%) and upper back discomfort (31.95) were prevalent among bankers. The study revealed significant associations between the upper body musculoskeletal discomforts and some of the potential risk factors. These risk factors were: computer work time, sitting time, chair cushioned with padded front edge, posture of shoulders whilst keyboarding, gender and unsupported hands/wrists. These findings suggest a widespread burden of upper body musculoskeletal discomforts among various professionals principally attributed to recurring exposure to the ergonomic risk factors. The study recommends that an integrated approach should be adopted by senior management in all workplaces in the design and implementation of workplace ergonomics programmes aimed at reducing exposure of employees to the risk factors associated with computer work.

Key words: Cross-sectional survey, occupational risk factors, workstation characteristics, odds ratio, biomechanical stress

1.0   Introduction

With the rapid embrace of computers across all occupations have emerged health disorders that are believed to affect the musculoskeletal structure of the human body. These musculoskeletal discomforts are injuries that affect the bones, joints, muscles, tendons, nerves and supporting structures caused by or aggravated by repeated movements and prolonged awkward or forced body postures (Rosenstock, 2000). Studies around the world have reported comparatively higher prevalence rates of discomforts in different body parts among office workers. For instance, Das *et al.* (2010) reported that male office workers in West Bengal, India had suffered discomforts of the neck (66%), shoulders (42%) and lower back (88%).

Even with these progressive research findings, Kenya lags behind without meaningful published research data in the area of office safety and ergonomics. This gap in research is also evident in the lack of data profiling either prevalence or incidences of musculoskeletal injury or ill-health related to computer-based office work. The situation is compounded by the obvious lack of ergonomics standards at national level that would provide the basis for an implementation framework at enterprise level.

Despite the recognised fact about the place of computers in workplaces, it is unfortunate that the degree of set up and suitability of computer workstations apparently remain incongruent with office ergonomics guidelines established in other parts of the developed world. In Kenya, for instance, office interiors are seemingly constructed, not with sound ergonomic principles in mind, but rather to achieve aesthetics and visual impact. This study was carried out to determine the prevalence of musculoskeletal discomforts among selected professionals in Kenya and, to identify the potential risk factors associated with prolonged computer work.

Research Objectives
The objectives of this research were to determine prevalence of upper body musculoskeletal discomforts among different professional work groups engaged in computer use and identify the risk factors for upper body musculoskeletal discomforts among computer users.

2.0   Materials and Methods
2.1   Research Design
This cross-sectional survey was conducted over a twelve month period in July 2011- June 2012 among computer users in thirty-nine (39) different office premises – private and public sector organisations.

2.2   Population and Sample Profile
The study targeted professionals in banking, accountancy, computer programming, engineering, and administration. This latter group included managers, assistant managers, data entry clerks, front office assistants and other subject matter specialists. Participants were randomly selected from each of these professional work groups.

2.3   Data Collection
Data was collected by means of a structured questionnaire which comprised 82 questions seeking demographic information, job factors and workstation characteristics and, experience and severity of the upper body musculoskeletal discomforts. Observations of work postures and workstation configuration were made by the researcher at individual workstations which served as a basis for validating responses provided in the questionnaires.

2.4   Statistical Analysis
Binary logistic regression analysis was used to investigate the associations between risk factors and the outcome variables. The analysis was done separately for the neck, shoulder, upper back, wrists/hands and elbow discomforts. Associations were considered statistically significant at $p \leq 0.05$. All the multivariate logistic regression models had good fit based on the Hosmer and Lemeshow goodness-of-fit test while the "explained variance" in each model was calculated by means of Nagelkerke's R^2.

3.0   Results
3.1   Response Rate and Duration of Working
The response rate was 71% (n=108). All the study population were employed on full time basis, working at least 5 days per week. Aproximately 42% of the respondents were involved in computer work for at least 6 hours per day. More than 60% 60.2% of the participants were male (Table 1).

Table 1: Descriptive characteristics of the study population

Duration of working	Females (n=43) %	Males (n=65) %
Number of working years in current position		
1 - 3 years	17.5	29.2
4 - 7 years	50.0	41.5
>7 years	40.0	29.2
Number of working hours with computer/day		
1 - 5 hours	35.0	38.5
6 - 8 hours	32.5	27.7
>8 hours	40.0	29.2
Number of hours sitting/day		
1 - 5 hours	22.5	40.0
6 - 8 hours	37.5	26.2
>8 hours	47.5	33.8

3.2 Prevalence of Upper Body Musculoskeletal Discomforts

The prevalence rates of upper body musculoskeletal discomforts among various professional groups are indicated in Table 2. Administration personnel commonly reported discomforts of neck (35.1%), elbow (38.9%) and shoulder (38.8%), while Bankers commonly reported discomforts of wrists/hands (33.3%) and elbow (38.9%).

Table 2: Prevalence of upper body musculoskeletal discomforts by professional groups

Body part	Professional group				
	Accountants (n=14) %	Administration (n=36) %	Bankers (n=20) %	Computer Programmers (n=8) %	Engineers (n=24) %
Neck	15.8	35.1	26.3	5.3	17.5
Shoulders	10.2	38.8	24.5	8.2	18.4
Elbow	5.6	38.9	38.9	5.6	11.1
Wrists/Hands	14.8	33.3	33.3	7.4	11.1
Upper back	12.8	31.9	25.5	6.4	23.4

Discomforts of neck and elbows and upper back were prevalent among males than females (Table 3). On the other hand, most females than male commonly reported discomforts of the shoulder and hands/wrists than males.

Table 3: Distribution of upper body musculoskeletal discomforts by gender

Upper body discomforts	Females (n=43) %	Males (n=65) %	(N=108) %
Neck	45.0	55.0	55.6
Shoulders	50.9	49.1	49.5
Elbows	44.4	55.6	16.8
Hands/Wrists	51.7	48.3	27.1
Upper back	42.9	57.1	45.8

3.3 Potential Risk Factors

3.3.1 Neck Discomforts

Neck discomfort was not significantly associated with any of the independent variables. The Nagelkerke's R^2 was 0.09 and the Hosmer-Lemeshow goodness-of-fit test was not significant (χ^2 = 2.796, p = .947).

3.3.2 Shoulder Discomfort

There were significant associations between shoulder discomfort and computer work time [OR: 1.455 (1.086-1.949), p = 0.012], sitting time [OR: 0.845 (0.722 -0.989), p = 0.036] and chair cushioned with rounded/padded front edge [OR: .287 (0.083 − 0.998), p = 0.05]. The Nagelkerke's R^2 was 0.264 and the Hosmer-Lemeshow goodness-of-fit test was not significant (χ^2 = 10.124, p = .256) Table 4.

Table 4: Risk factors for shoulder discomfort among study participants

Risk Factors	B- Coefficient	S.E.	P-Value	Odds Ratio (95.0% C.I.)
Gender	.550	.536	.305	1.734 (.606 - 4.958)
Age	.309	.507	.543	1.361 (.504 - 3.679)
Computer work time	**.375**	**.149**	**.012****	**1.455 (1.086 - 1.949)**
Sitting time	**-.169**	**.080**	**.036****	**.845 (.722 - .989)**
Ergonomics programmes	.629	.693	.364	1.877 (.482 -7.302)
Adjustable seat height	.106	.696	.879	1.112 (.284 - 4.351)
Chair cushioned with rounded front edge	**-1.248**	**.636**	**.050****	**.287 (.083 - .998)**
Feet rest firmly on floor with back supported	.309	.614	.615	1.362 (.409 - 4.535)
Shoulders relaxed with hands on keyboards	-.045	.709	.949	.956 (.238 - 3.833)
Computer positioned directly in front of user	.227	.811	.780	1.255 (.256 - 6.155)
Hands/wrists free from desk edges	1.028	.625	.100	2.795 (.821 - 9.514)
Constant	-3.469	1.987	.081	.031

$p < 0.05$**, $p < 0.01$*, $p < 0.001$***

3.3.3   Elbow Discomfort

Elbow discomfort was significantly associated with computer work time [OR: 2.143 (1.360 -3.376), p = 0.001] and sitting time [OR: .747 (.612 - .910), p = 0.004], Table 4. The Nagelkerke's R^2 was 0.355 and the Hosmer-Lemeshow goodness-of-fit test was not significant (χ^2 = 5.013, p = .756) Table 5.

Table 5: Risk factors for elbow discomfort among study participants

Risk factors	B-Coefficient	S.E.	P-Value	Odds Ratio (95.0% C.I.)
Gender	.619	.753	.411	1.857 (.425 - 8.116)
Age	.375	.749	.616	1.456 (.336 - 6.313)
Computer work time	**.762**	**.232**	**.001*****	**2.143 (1.360 -3.376)**
Sitting time	**-.292**	**.101**	**.004****	**.747 (.612 - .910)**
Ergonomics programmes	.971	.978	.321	2.641 (.388 - 17.965)
Adjustable seat height	-.261	1.098	.812	.770 (.090 - 6.621)
Chair cushioned with rounded front edge	-.055	.958	.954	.946 (.145 - 6.191)
Feet rest firmly on floor with back supported	.379	1.025	.712	1.460 (.196 - 10.879)
Shoulders relaxed with hands on keyboards	-.769	1.075	.474	.463 (.056 - 3.808)
Computer positioned directly in front of user	-.014	1.043	.989	.986 (.128 - 7.608)
Hands/wrists free from desk edges	-.696	.944	.461	.499 (.078 - 3.173)
Constant	-5.413	2.825	.055	.004

$p < 0.05$**, $p < 0.01$*, $p < 0.001$***

3.3.4   Wrists/Hands Discomfort

Occurrence of wrists/hands discomfort was significantly associated with gender [OR: 3.580 (1.137 - 11.277), p = 0.029] and marginally with computer work time [OR: 1.297 (.988 - 1.703), p = 0.061]. The Nagelkerke's R^2 was 0.220 and the Hosmer-Lemeshow goodness-of-fit test was not significant (χ^2 = 1.706, p = .989).

3.3.5 Upper Back Discomfort

Upper back discomfort was significantly associated with computer work time [OR: 1.369 (1.037 - 1.806), p = 0.027], sitting time [OR: .838 (.704 - .997), p = 0.046] and hands free from desk edges [OR: 3.352 (1.025 - 10.954), p = 0.045]. The Nagelkerke's R^2 was 0.217 and the Hosmer-Lemeshow goodness-of-fit test was not significant (χ^2 = 4.818, *p* = .777).

Table 6: Risk factors for upper back discomfort among study participants

Risk Factors	B-Coefficient	S.E.	P-Value	Odds Ratio (95.0% C.I.)
Gender	.013	.524	.980	1.013 (.362 - 2.832)
Age	-.174	.485	.719	.840 (.324 - 2.174)
Computer work time	**.314**	**.142**	**.027****	**1.369 (1.037 - 1.806)**
Sitting time	**-.177**	**.089**	**.046****	**.838 (.704 - .997)**
Ergonomics programmes	.563	.690	.415	1.756 (.454 - 6.794)
Adjustable seat height	-.350	.677	.605	.705 (.187 - 2.655)
Chair cushioned with rounded front edge	-.261	.594	.660	.770 (.241 - 2.467)
Feet rest firmly on floor with back supported	-.249	.604	.680	.779 (.239 - 2.544)
Shoulders relaxed with hands on keyboards	-.462	.715	.518	.630 (.155 - 2.558)
Computer positioned directly in front of user	-1.070	.838	.201	.343 (.066 - 1.771)
Hands/wrists free from desk edges	**1.209**	**.604**	**.045****	**3.352 (1.025 - 10.954)**
Constant	-.106	1.817	.954	.900

p < 0.05**, *p* < 0.01*, *p* < 0.001***

4.0 Discussion

The current study revealed that neck discomfort was the most prevalent form of upper body musculoskeletal discomfort at 55.6%, followed by shoulder discomfort (49.5%), upper back discomfort (45.8), wrists/hands discomfort (27.1%) and lastly, elbow discomfort (16.8%). These observed prevalence rates are similar to the prevalence reported from other countries (Akrouf *et al*., 2010, Eltayeb *et al*., 2009, Hedge *et al*., 2012).

Bankers and Accountants had particularly higher prevalence rates of upper body musculoskeletal discomforts of the elbows, neck, and upper back compared to others. These results were further underlined by the high odds of reporting these types of discomforts, implying that Bankers and Accountants were more at risk of experiencing upper body musculoskeletal discomforts compared to other professionals.

Shoulder, elbow, wrists/hands and upper back discomforts were significantly associated with computer work time. This findings is in line with recent reports that have investigated the interactive effects of both biomechanical/physical factors and occupational factors in the causation of musculoskeletal disorders, in which prolonged computer usage was a risk factor. Boogar R. *et al*. (2013) and Ranasinghe *et al.* (2011) both evaluated physical/psychosocial factors among computer users and found that daily computer usage was a highly significant independent predictor of neck, shoulder, arms/forearms and hand complaints. However, the present study did not find significant association between neck discomfort and any of the independent variables, a finding which is consistent with the results of Aydeniz *et al.* (2008) who investigated the association between cumulative computer use and upper extremity musculoskeletal disorders among bank workers in Turkey.

The current study found sitting time to be significantly but negatively associated with discomforts of the shoulders, elbows and upper back. This negative association implies that sitting period may not on its own result in upper body musculoskeletal discomforts except in situations where it is accompanied by improper posture such as a bent curvature of the spine, which increases biomechanical strain on ligaments, muscles and vertebral discs (Ortiz-Hernandez *et al*., 2003). However, this result differs with the finding in a research among computer operators at Zagazig University in which prolonged sitting was found to be a significant predictor of musculoskeletal discomfort (Ahmed-Refat, *et al.,* 2008).

The use of a chair with front edge that is rounded and padded was negatively but significantly associated with shoulder discomfort; thus, this chair characteristic, implying a proper ergonomic design quality and comfort, was serving as a protective factor against musculoskeletal discomforts. Ranasinghe *et al.* (2011) found that poorly designed workstations correlated with musculoskeletal complaints suggesting that modifications would serve a primary preventative strategy against musculoskeletal discomforts.

Gender was found to be significantly associated with wrist/hand discomfort with a high odds ratio and therefore was considered to be a significant risk factor. This result corresponds with the finding documented by Ranasinghe *et al*. (2011) in which female gender was significantly associated with forearm and hands discomfort.

5.0 Conclusions

According to the study, there were high prevalence rates of shoulder discomfort (38.8%) & elbow discomfort (38.9%) among Administration group (38.9%). Elbow discomfort (38.9%) and wrists/hands discomfort (33.3%) were most prevalent among Bankers. Computer work time was a significant risk factor for shoulder, elbow and upper back discomforts at $p \leq 0.05$ whereas gender was a significant risk factor for wrists/hands discomfort at $p \leq 0.05$. Therefore, these variables are considered to be important risk factors for the occurrence of upper body musculoskeletal discomforts.

The study recommends that senior management in workplaces should establish and implement robust integrated ergonomic interventions that address all these aspects such as modification of workstation facilities; provision of ergonomics training on preventative strategies and, carrying out periodic evaluation of ergonomic programmes to assess their effectiveness at reducing the risk of upper body musculoskeletal discomforts.

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