Original Article

Prevalence of complaints of arm, neck, and shoulders among computer professionals in Bangalore: A cross-sectional study

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Abstract

Introduction: Complaints of arm, neck, and shoulders (CANS) is a common problem among patients whose work involves computer use, but often ignored most importantly by the physicians partly due to not being able to appreciate the importance of taking a careful detailed occupational history of exposure to a repetitive activity involving upper arms. Upper extremity musculoskeletal disorders constitute a major portion of occupation-related illness with annual costs related to treatment and absenteeism from work ranging between $45 and 54 billion in the United States. **Materials and Methods:** A cross-sectional study was done to assess the factors contributing to CANS among computer professionals in Bangalore. We screened 206 professionals and 181 were administered Maastricht Upper Extremity Questionnaire (MUEQ). Chi-square and logistic regression were used. **Results:** Prevalence of CANS in the study group was 58.6%. Neck complaints topped the list followed by shoulder, wrist, hand, elbow, upper arm, and lower arm complaints in the descending order. Women had overall higher prevalence and significantly higher prevalence of upper limb complaints than men. Inadequate space, maintaining good posture, and repetition of same tasks have emerged as an independent factors associated with CANS. **Conclusion:** CANS is highly prevalent among computer professionals working in small and medium-sized companies. Provision of adequate workspace and ergonomic designs of workstations are the modifiable risk factors which can be addressed by the employers to reduce the morbidity associated with CANS. Employees could correct postures and improve work habits.

Keywords: Complaints of arm, neck, and shoulders, computer professionals, ergonomics, occupational health

Introduction

Upper extremity musculoskeletal disorders constitute a major portion of occupation-related illness with annual costs related to treatment and absenteeism from work ranging between $45 and 54 billion in the United States.[1] Other synonyms for the disorder are cumulative trauma disorder, repetitive strain injury, work-related upper limb disorder, overuse injuries, complaints of arm, neck, and shoulders (CANS).[2] In the United States, the Bureau of Labour Statistics estimated that in 1996, 64% of all new work-related disability cases were related to CANS.[3] There was no universal way of labeling or defining upper extremity musculoskeletal disorders until a multidisciplinary committee arrived at a consensus of naming it as CANS.[2] Pain, paraesthesia, and subjective weaknesses are important features of this disorder.[4] CANS causes considerable work problems, including decreased work productivity, sickness absence absenteeism, and ultimately job loss.[5]

The prevalence of CANS among those with occupational use of computers has been reported to be in the range of 54%–64% in European studies.[6,7] A study done in Asia also revealed a similar prevalence of 64%.[8] There are three research studies done on IT/computer professionals in Delhi, India.[9-11]

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They have found the prevalence of musculoskeletal problems, which not only include complaints in arm, neck, and shoulders but also the lower back, to be around 77% approximately. In a study done by Varun Singh *et al.* in 2012, using Maastricht Upper Extremity Questionnaire (MUEQ), in 202 healthcare professionals/students with occupational use of computers, the prevalence of upper limb disorders was 45%.[12]

A Malaysian study on 110 participants published in 2015 showed neck complaints topped the list (54%) followed by shoulder complaints.[13] Risk factors for the development of CANS not only include physical factors; repetitive movements, poor workstation, and awkward posture but also psychosocial demands, low social support, less break time, and high job demands at the workplace.[1,14-16] CANS is a common musculoskeletal problem encountered by primary care physicians/family physicians in their practice. CANS results from repeated stress to the body's soft tissue structures including muscles, tendons, and nerves, sustained either in their jobs as in computer professionals or in extracurricular activities. Common complaints include tendon-related disorders, such as rotator cuff tendonitis, and peripheral nerve entrapment disorders, such as carpal tunnel syndrome.[17] This study aimed to determine prevalence and assess the factors contributing to CANS among computer professionals in Bangalore city.

Materials and Methods

A cross-sectional study was done in Bangalore in two medium-sized software companies. Computer professionals with occupational use of computers for at least 2 h per day with 1 year or more work experience were included in the study. Those with preexisting disease conditions such as diabetes, rheumatic diseases, muscle diseases, neuropathy leading to symptoms similar to CANS, congenital, or acquired upper extremity damage, and acute trauma to upper extremity were excluded from the study. Considering the prevalence of CANS to be 54% from the existing evidence, using the formula $4PQ/d^2$ and an absolute precision of 7.5, sample size was calculated as 176.[6] Convenient sampling technique was followed. Screening Questionnaire and MUEQ for CANS were used. Screening Questionnaire was designed to elicit information on inclusion and exclusion criteria. Those who qualified in the screening were administered MUEQ.

The MUEQ is a tool used to evaluate the nature and occurrence of CANS in computer-office workers and the impact of psychosocial and ergonomic aspects on work conditions (MUEQ). The translated versions of MUEQ-Brazilian-Portuguese, Arabic, and Sinhalese were studied and found to have satisfactory reliability and internal consistency.[8,18-20] The MUEQ consists of 95 questions and needs approximately 20 min for completion. The questionnaire includes the sociodemographic characteristics (age, gender, and employment status), as well as six main domains assessing potential risk factors: that is, (1) workstation, (2) posture during work, (3) quality of break time, (4) job demands, (5) job control, and (6) social support.

Statistical analysis

Data were coded and entered into Microsoft Excel 2003 and analyzed using the statistical software Statistical Package for Social Sciences (SPSS for Windows, Version 16.0; SPSS Inc., Chicago, IL, USA). Descriptive and inferential statistical analysis was carried out. The prevalence of pain in different parts of the body and CANS was calculated in percentages. Univariate analysis was carried out to assess the association between CANS and contributing factors in various domains such as workstation and job demand. Chi-square test was used to test the significance of risk factors. Multiple logistic regression was used to characterize the relationship between CANS and independent variables (working hours, social support, posture, etc.) and to adjust for confounders. R^2 was used to check the goodness of fit. Independent variables were checked for multicollinearity using Cohen's kappa statistics and few variables were removed from the model. $P < 0.05$ was considered statistically significant.

Results

In all, 206 professionals were screened for inclusion criteria and 181 participated in the study. The study group comprised 91 men (50.27%) and 90 women (49.72%) with mean ages of 30.12 ± 5.23 years and 30.69 ± 6.67 years, respectively. More than half (61.3%) of them had more than 5 years of work experience and almost two-third (62.8%) of the study population worked more than 5 days in a week. One-fourth (26.5%) of them worked more than 8 h in a day [Table 1].

The study found the prevalence of CANS in the study group to be 58.6%. Region-wise neck complaints topped the list followed

Table 1: Sociodemographic characters

Characters	Frequency (N-181)	Percentage
Gender		
Men	91	50.2
Women	90	49.7
Age in years		
20-29	89	49.2
30-39	71	39.2
≥40	21	11.6
Work experience		
1-3	60	33.1
3-5	51	28.2
5-8	44	24.3
>8	26	14.4
No. of working days/week		
5 days	67	37.0
>5 days	114	62.8
No. of working hours/day		
6-8	133	73.4
9-10	48	26.5
No. of working hours with computer/day		
2-4	18	9.9
5-7	110	60.7
8-10	53	29.45

by shoulder, wrist, hand, elbow, upper arm, and lower arm complaints as shown in Table 2. Women had higher prevalence of musculoskeletal complaints and statistically significant prevalence in upper and lower arm, wrist, and hand ($P < 0.05$).

Chairs that did not support the lower back and not having enough space to work at the desk were found to be significant contributory factors for CANS in workstation domain. It was also found that in body posture domain, those who were not maintaining a good work posture (52.8% vs 72.2%), performing repetitive tasks at work (66.7% vs 47.4%), keeping head and twisted (71.1% vs 54.4%) or in bent position (71.7% vs 52.1%), maintaining an awkward posture (73% vs 54.9%), and physically exhausted (76.5% vs 51.5%) suffered from CANS more than those who maintained ergonomically good posture and had less physical exhaustion. Those who had to do extra hours to complete a task had 2.4 [confidence interval (CI): 1.2–4.8] times higher odds of developing CANS than those who did not have to work extra hours. Similar observation was noted among those who work more than 8 h [Table 3].

Professionals who take sufficient breaks from work suffered from CANS less than who do not take breaks (46.9% vs 71.8%). Good physical environment such as fresh air inside the office and unwanted air were significantly associated with CANS. Professionals with friendly colleagues (54.3%) and supervisors (53.1%) reported less prevalence of CANS compared with those who did not have supportive colleagues (80%) and supervisors (78.9%).

A logistic regression was performed to ascertain the risk factors for CANS. The odds of developing CANS was 3.2 times higher (CI: 1.1–9.2) among those who did not have adequate workspace. Similarly those who maintain bad posture tend to develop CANS 2.3 (CI: 1.0–5.3) times more than those who maintain good posture. Not rotating job tasks also emerged as an independent risk factor for CANS [Table 4].

Discussion

In our study, the prevalence of CANS among professionals with occupational use of computers in Bangalore is 58.6%. It is closer to findings from a Dutch study by Eltayeb *et al.* which showed 55% prevalence rate.[6] However, this prevalence is lower comparatively to other studies done in Sudan (70%), Sri Lanka (63.6%), and Greece (64%).[8,18-20] The probable reason could be we had a stricter and exhaustive exclusion criteria, to satisfy the definition of CANS, for enrolling into the study, as well as in the final results we excluded those who said that their complaints were due to a previous accident.

The results of this study showed higher prevalence of neck and shoulder complaints in the study population compared with other complaints. The neck and shoulder complaints are followed by wrist and hand complaints. These findings are consistent with the earlier findings in various international studies as well as studies conducted in India using the same study tool.[6-12]

Furthermore, women had higher prevalence rates of upper extremity musculoskeletal complaints – region-wise as well as overall, than men in our study which is similar to the study done by Bekiari *et al.*[7] As per this study, possible explanations for this gender related difference could be that women tend to perform more repetitive work on average compared with men. Women are more exposed to additional stress from unpaid work such as housekeeping and child care. Women apparently do not always perform tasks with the same physical requirements or work organization as men.

Among the Indian studies, only one study done by Varun *et al.* in 2012 used the same study tool, that is, MUEQ to measure prevalence of CANS in healthcare professionals/students with computer usage.[12] Overall prevalence in that study was 45% which was comparatively lower when compared with this study among computer professionals which was 58.6%. It is probably related to the differences in the intensity of occupational use of computers between the two study populations. Region-wise prevalence was similar with neck and shoulder complaints topping the list followed by wrist and hand complaints. Contributory factors identified in this study are consistent with other earlier international studies.[1,21]

Earlier studies have shown that holding the head in a bent posture and working in the same posture for prolonged periods of time were both significantly associated with neck pain.[21,22] In this study too, holding head in a bent posture was found to have

Table 2: Prevalence rates of upper extremity musculoskeletal complaints during the previous year

Localization of complaints	Male		Female		Total, *n* (100%)	Chi square *P*
	n	%	*n*	%		
Neck complaints	46	50.5%	49	54.4%	95	0.60
Shoulder complaints	34	37.4%	44	48.9%	78	0.11
Upper arm complaints	9	9.9%	30	33.3%	39	0.00*
Elbow complaints	18	19.8%	33	36.7%	51	0.12
Lower arm complaints	8	8.8%	18	20%	26	0.03*
Wrist complaints	28	30.8%	39	43.3%	67	0.80
Hand complaints	19	20.9%	36	40%	55	0.005*
Any upper extremity complaint (not due to previous accident)	51	56%	55	61.1%	106	0.48

*Significant *P*

Table 3: Significant factors associated with CANS

Factors	Category	Total			*P*	OR 95% CI
		Present	Absent	Total		
Work Hours	<8	84 (63.2%)	49 (36.8%)	133	0.03	1.1 (0.6-2.0)
	>8	22 (45.8%)	26 (54.2%)	28		
Workstation						
Chair supports lower back	Yes	64 (52%)	59 (47.9%)	123	0.009	0.4 (0.21-0.81)
	No	42 (72.4%)	16 (27.5%)	58		
Enough space to work	Yes	73 (52.1%)	67 (47.8%)	140	0.001	0.26 (0.12-0.61)
	No	33 (80%)	8 (19.5%)	41		
Body posture						
Good posture	Yes	67 (52.8%)	60 (47.2%)	127	0.01	0.42 (0.21-0.85)
	No	39 (72.2%)	15 (27.8%)	54		
Awkward posture	Yes	27 (73%)	10 (27%)	37	0.04	2.2 (1-4.9)*
	No	79 (54.9%)	65 (45.1)	144		
Repetitive tasks	Yes	70 (66.7%)	35 (33.3%)	105	0.009	2.2 (1.2-4.0)*
	No	36 (47.4%)	40 (52.6%)	76		
Physical exhaustion	Yes	39 (76.5%)	12 (23.5%)	51	0.02	3.05 (1.4-6.3)*
	No	67 (51.5%)	63 (48.5%)	130		
Head bent	Yes	43 (71.7%)	17 (28.3%)	60	0.01	2.3 (1.1-4.5)*
	No	63 (52.1%)	58 (47.9%)	121		
Head twisted	Yes	32 (71.1%)	13 (28.9%)	45	0.04	2 (0.9-4.2)
	No	74 (54.4%)	62 (45.6%)	136		
Job demand						
Extra hours to complete tasks	Yes	40 (72.7%)	15 (27.3%)	55	0.01	2.4 (1.2-4.8)*
	No	66 (52.4%)	60 (47.6%)	126		
Break time						
Alternate/change body posture	Yes	53 (51%)	51 (49%)	104	0.01	0.4 (0.2-0.8)
	No	53 (68.8%)	24 (31.2%)			
Rotate job tasks	Yes	33 (44.6)	41 (55.4%)	74	0.002	0.3 (0.2-0.6)
	No	73 (68.2%)	34 (31.8%)	107		
Sufficient break time	Yes	45 (46.9%)	51 (53.1%)	96	0.001	0.3 (0.18-0.64)
	No	61 (71.8%)	24 (28.2%)	85		
Work environment						
Unwanted air	Yes	24 (82.8%)	5 (17.2%)	29	0.04	4 (1.4-11.3)*
	No	82 (53.9%)	70 (46.1%)	152		
Fresh air	Yes	44 (51.2%)	42 (48.8%)	86	0.05	0.5 (0.3-1.0)
	No	62 (65.3%)	33 (34.7%)	95		
Social support						
Can ask and enquire in one's work	Yes	78 (53.8%)	67 (46.2%)	145	0.009	0.3 (0.14-0.71)
	No	28 (77.8%)	8 (22.2%)	36		
Friendly colleagues	Yes	82 (54.3%)	69 (45.7%)	151	0.009	0.2 (0.1-0.7)
	No	24 (80%)	6 (20%)	30		
Friendly supervisors	Yes	76 (53.1%)	67 (46.9%)	143	0.004	0.3 (0.1-0.7)
	No	30 (78.9%)	8 (21.1%)	38		

OR: Odds ratio; CI: Confidence interval. *Significant OR

significant association with CANS and neck complaints topped the list in region-wise complaints.

In our study, there was no statistically significant association of CANS with age group, work pattern, work experience, number of work days/week, and number of working hours/day. We also found that working extra hours is associated with CANS in univariate analysis. These results were not corroborating with a prospective Dutch cohort study by Eltayeb *et al.* among 264 computer office workers with a follow-up period of 2 years.[21] The differences in results could be due to inherent behavior/cultural differences of the study population, greater sample size of the Dutch study, and it being a prospective/longitudinal cohort study with a follow-up period of 2 years.

It is interesting to note that ergonomics of the workstation is the most common risk factor in all the domains. A study done in Brazil among computer office workers also demonstrated that those who reported more musculoskeletal disorders had worse ergonomic indexes. It also suggested that chair height, arm, and back rest are linked to improper upper limb postures leading to musculoskeletal disorders.[23] Occupational Safety and Health

Table 4: Multiple logistic regression associated with CANS

Factors	Category	*B*	Adjusted OR	95% CI		*P*
				Lower	Upper	
Chair with back support	Yes* No	−0.4	0.66	0.26	1.7	0.39
Enough work space	Yes* No	1.17	3.2	1.13	9.28	0.02**
Maintaining good posture	Yes No	0.87	2.3	1.0	5.3	0.03**
Performing repetitive tasks	Yes No*	0.4	1.4	0.7	3.0	0.28
Physical exhaustion	Yes* No	0.62	1.86	0.75	3.0	0.17
Working extra hours	Yes No*	0.6	1.82	0.75	4.3	0.17
Rotation of job tasks	Yes No*	0.89	2.45	1.16	5.15	0.01**
Sufficient breaks	Yes* No	0.61	1.85	0.91	3.7	0.08
Friendly colleagues	Yes* No	0.44	1.56	0.42	5.6	0.49
Friendly supervisor	Yes*	0.66	1.94	0.62	6.0	0.25

OR: Odds ratio; CI: Confidence interval. *Reference; **Significant *P*

Administration (OSHA) suggests making small adjustments to chair or back rest, stretching fingers, hands, arms, and torso, standing up and walking for few minutes periodically, and performing some tasks in standing position as healthy practices for computer professionals.[24]

We found that social support from colleagues and supervisors reduces the risk of CANS. According to Karasek's Demand Control Model, having a job with high demands with no or little control over the decisions (e.g. fixed schedules, having a subordinate position) leads to an increase in stress and subsequent illness.[25] It is proposed that these outcomes can be modified if the person receives social support within the employment context.[26] This model has also been incorporated into musculoskeletal research and formulation guidelines.[27] But a systematic review concludes that employment-related support has little to no effect on risk of occurrence but a more notable effect on prognosis for those with back pain.[28] Professionals with less job demand and good social support by the supervisor will be probably possible to have more rotation of job tasks and reduce the risk of CANS. Perhaps, a long-term cohort study would be able to answer the question of causal relationship between social support and musculoskeletal pain.

CANS is often ignored most importantly by the physicians partly due to not being able to appreciate the importance of taking a careful detailed occupational history of exposure to a repetitive activity involving upper arms. Employment screening questions, incorporated into patients' initial assessment, are an efficient means of identifying potential occupational causes of symptoms.[17,29] Initial management is conservative with medication, physiotherapy, or bracing which can be done by family physicians. Surgery is reserved for those refractory to conservative treatment.[17] Occupational health ought to be integrated into primary care systems as total separation of occupational and no occupational care is inefficient, counterproductive, and arbitrary.[30] Not only are primary care physicians or family physicians often the first to see patients with occupational diseases but also are more reliable compared with occupational physicians employed by industries, who can be biased toward the employer.[31,32] However, it has been reported that primary care physicians are poor in eliciting an occupational history and need additional education.[33,34] In India, physicians working in industrial settings are mostly primary care physicians, who have done a 3-month certificate course in occupational health as mandated by the Ministry of Labour, Government of India. Family physicians or primary care physicians as gatekeepers are in a unique position to provide not only with adequate curative or preventive care to these patients but also with rehabilitation, compensation, and insurance issues.[35] Hence, they can have a significant impact on the patient's quality of life if they are alert to occupational cause of the illness and do comprehensive evaluation to elicit relationship between symptoms and occupation.[30,36]

Convenience sampling which we used may have limited the external validity of the study. Our samples were taken from small- to medium-sized companies, hence the prevalence and risk factors for CANS may vary in large IT companies. Many companies did not give permission due to lengthy questionnaire. Some companies gave conditional permission (only if we reveal the medical findings of the individual person to the management), hence was excluded.

Our study with a cross-sectional study with self-reporting of symptoms and there was no objective assessment done to ascertain the morbidity. We were able to do only in two locations as it was difficult to get permission from large-scale IT companies. We had used a long questionnaire which took almost 20 min per person. So our sample size was relatively lesser than studies done across the globe. However, we used a validated tool and assured anonymity of the participants to reduce under-reporting of the problem.

Conclusion

CANS is highly prevalent among computer professionals working in small- and medium-sized companies. The neck and shoulder complaints are reported more frequently than complaints in any of the other upper body regions. Furthermore, women had overall higher prevalence and significantly higher prevalence of upper limb complaints than men. Provision of adequate workspace and ergonomic designs of workstations are the modifiable risk factors which can be addressed by the employers to reduce the morbidity associated with CANS.

Employees could correct postures and improve work habits. These can be done by dissemination of knowledge among

employees and strict legislation and guidelines by the government. These measures could be used as preventive, curative, as well as rehabilitative among those with CANS.

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Conflicts of interest

There are no conflicts of interest.

References

1. Bongers PM, Ijmker S, van den Heuvel S, Blatter BM. Epidemiology of work related neck and upper limb problems: Psychosocial and personal risk factors (part I) and effective interventions from a bio behavioural perspective (part II). J Occup Rehabil 2006;16:279-302.
2. Gerr F, Marcus M, Monteilh C. Epidemiology of musculoskeletal disorders among computer users: Lesson learned from the role of posture and keyboard use. J Electromyogr Kinesiol 2004;14:25-31.
3. Huisstede BMA, Miedema HS, Verhagen AP, Koes BW, Verhaar JA. Multidisciplinary consensus on the terminology and classification of complaints of the arm, neck and/or shoulder. Occup Environ Med 2007;64:313-9.
4. Jepsen JR. Upper limb neuropathy in computer operators? A clinical case study of 21 patients. BMC Musculoskelet Disord 2004;5:26.
5. Hutting N, Staal JB, Heerkens YF, Engels JA, Sanden MW. A self-management program for employees with complaints of the arm, neck, or shoulder (CANS): Study protocol for a randomized controlled trial. Trials 2013;14:258.
6. Eltayeb S, Staal JB, Kennes J, Lamberts PH, de Bie RA. Prevalence of complaints of arm, neck and shoulder among computer office workers and psychometric evaluation of a risk factor questionnaire. BMC Musculoskelet Disord 2007;8:68.
7. Bekiari EI, Lyrakos GN, Damigos D, Mavreas V, Chanopoulos K, Dimoliatis ID. A validation study and psychometrical evaluation of the Maastricht Upper Extremity Questionnaire (MUEQ) for the Greek-speaking population. J Musculoskelet Neuronal Interact 2011;11:52-76.
8. Ranasinghe P, Perera YS, Lamabadusuriya DA, Kulatunga S, Jayawardana N, Rajapakse S, *et al.* Work-related complaints of arm, neck and shoulder among computer office workers in an Asian country: Prevalence and validation of a risk-factor questionnaire. BMC Musculoskelet Disord 2011;12:68.
9. Talwar R, Kapoor R, Puri K, Bansal K, Singh S. A Study of visual and musculoskeletal health disorders among computer professionals in NCR Delhi. Indian J Community Med 2009;34:326-8.
10. Sharma A, Khera S, Khandekar J. Computer related health problems among information technology professionals in Delhi. Indian J Community Med 2006;31:36.
11. Suparna K, Sharma AK, Khandekar J. Occupational health problems and role of ergonomics in information technology professionals in National Capital Region. Indian J Occup Environ Med 2005;9:4-7.
12. Singh V, Goyal N, Singh A, Bhatty SM, Deane A, Prakash JS. Upper limb musculoskeletal disorders associated with computer usage in health-care professionals. Int J Med Sci Public Heal [Internet] 2015;4:1615-9.
13. Faryza E, Murad MS, Anwar S. A study of work related complaints of arm, neck and shoulder (CANS) among office workers in Selangor and Kuala Lumpur. Malaysian J Public Health Med 2015;15:8-16.
14. Sen A, Richardson S. A study of computer-related upper limb discomfort and computer vision syndrome. J Human Ergol 2007;36:45-50.
15. Van Den Heuvel SG, Van Der Beek AJ, Blatter BM, Hoogendoorn WE, Bongers PM. Psychosocial work characteristics in relation to neck and upper limb symptoms. Pain 2005;114:47-53.
16. Bongers PM, Kremer AM, TerLask J. Are psychosocial factors, risk factors for symptoms and signs of the shoulder, elbow or hand/wrist? A review of the epidemiological literature. Am J Ind Med 2002;41:315-42.
17. O'Neil BA, Forsythe ME, Stanish WD. Chronic occupational repetitive strain injury. Can Fam Phys 2001;47:311-6.
18. Turci AM, Bevilaqua-Grossi D, Pinheiro CF, Bragatto MM, Chaves TC. The Brazilian Portuguese version of the revised Maastricht Upper Extremity Questionnaire (MUEQ-Br revised): Translation, cross-cultural adaptation, reliability, and structural validation. BMC Musculoskelet Disord 2015;16.
19. Eltayeb SM, Staal JB, Hassan AA, Awad SS, de Bie RA. Complaints of the arm, neck and shoulder among computer office workers in Sudan: A prevalence study with validation of an Arabic risk factors questionnaire. Environ Health 2008;7:33.
20. Eltayeb S, Staal JB, Kennes J, Lamberts PH, de Bie RA. Prevalence of complaints of arm, neck and shoulder among computer office workers and psychometric evaluation of a risk factor questionnaire. BMC Musculoskelet Disord 2007;8:68.
21. Eltayeb S, Staal JB, Hassan A, de Bie RA. Work related risk factors for neck, shoulder and arms complaints: A cohort study among Dutch computer office workers. J Occup Rehabil 2009;19:315-22.
22. Wahlstrom J. Ergonomics, musculoskeletal disorders and computer work. Occup Med (Lond) 2005;55:168-76.
23. Rodrigues MS, Leite RD, Lelis CM, Chaves TC. Differences in ergonomic and workstation factors between computer office workers with and without reported musculoskeletal pain. Work 2017;57:563-72.
24. Occupational Health and Safety Administration on Computer work station guidelines Internet. Available from: https://www.osha.gov/SLTC/etools/ computerworkstations/positions.html. [Last cited on 2018 Jun 30].
25. Karasek R, Brisson C, Kawakami N, Houtman I, Bongers P, Amick B. The Job Content Questionnaire (JCQ): An instrument for internationally comparative assessments of psychosocial job characteristics. J Occup Health Psychol 1998;3:322-55.
26. Johnson JV, Hall EM. Job strain, work place social support, and cardiovascular disease: A cross sectional study of a

random sample of the Swedish working population. Am J Public Health 1988;78:1336-42.

27. Bongers PM, Ijmker S, van den Heuvel S, Blatter BM. Epidemiology of work related neck and upper limb problems: Psychosocial and personal risk factors (Part I) and effective interventions from a bio behavioural perspective (Part II) J Occup Rehab 2006;16:279-302.
28. Campbell P, Wynne-Jones G, Muller S, Dunn KM. The influence of employment social support for risk and prognosis in nonspecific back pain: A systematic review and critical synthesis. Int Arch Occup Environ Health 2013;86:119-137.
29. Taiwo OA, Mobo BH, Cantley L. Recognizing occupational illnesses and injuries. Am Fam Phys 2010;82:169-74.
30. Walker B Jr, Adenuga B, Mouton C. The relevance of occupational medicine to primary care *in th*e 21st century. J Natl Med Assoc 2011;103:306-12.
31. Cegolon L, Lange JH, Mastrangelo G. The primary care practitioner and the diagnosis of occupational diseases BMC Public Health 2010;10:405.
32. Lee J, Liem LP, Koh D. Occupational health in general practice in an industrial area of Singapore. Occup Med 2001;51:312-7.
33. Politi BJ, Arena VC, Schwerha J, Sussman N. Occupational medical history taking: How are today's physicians doing? A cross-sectional investigation of the frequency of occupational history taking by physicians in a major U.S. teaching center. J Occup Environ Med 2004;46:550-5.
34. Newman LS. Occupational illness. New Engl J Med 1995;333:1126-34.
35. Russell G, Brown JB, Stewart M. Managing injured workers: family practice experiences. Can Fam Phys 2005;51:78-9.
36. Mowe G, Gylseth B, Hartveit F, Skaug V: Occupational asbestos exposure, lung-fiber concentration and latency time in malignant mesothelioma. Scand J Work Environ Health 1984;10:293-8.