

# Persistent Neck and Shoulder Pains among Computer Office Workers: A Longitudinal Study

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## A-R-T-I-C-L-E I-N-F-O

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## A-B-S-T-R-A-C-T

**Background & Aims of the Study:** In developing countries, with increasing use of computer systems, millions of computer workers are at high risk of neck and shoulder pains. The aim of this study was to assess the relationships between work-related physical and psychosocial factors and persistent neck and shoulder pains among computer office workers.

**Materials & Methods:** This longitudinal study with 1-year follow-up was conducted among all eligible computer office workers (n=182) of Shahroud universities (northeastern Iran) in 2009-2010. "Cultural and Psychosocial Influences on Disability (CUPID)" questionnaire was used to collect data on demographic characteristics, physical, organizational and psychosocial factors at work, and neck and shoulder symptoms. Chi square and logistic regression analysis was used to analyze the data through SPSS version 16.

**Results:** Computer office workers with the mean±SD age of 32.1±6.7 years and the mean±SD weekly work hours of 47.4±8.2 participated in this study. At the baseline 39.6% of workers reported neck and shoulder pains. At one year follow-up, 59.7% of them reported neck pain and 51.3% reported shoulder pain. Significant relationships were found between persistence of neck and shoulder pains and age, gender, and decision latitude at work.

**Conclusions:** Although neck and shoulder pains were equally prevalent among the study group, after one year follow up, persistent neck pain was more than shoulder pain. Age, gender, and decision latitude at work were identified as risk factors for both pains.

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## Background

Work-related Musculoskeletal Disorders (MSDs) are a wide group of harmful inflammatory diseases that can cause pain and disability in the functions of neck, shoulders, elbows, arms, wrists, and hands. In these disorders, tendons, nerves, muscles, blood vessels, and joints are damaged (1). Many

studies have shown that these disorders have extensive financial effects on individuals, organizations, and societies (2). Therefore, prevention of MSDs among workforces is a national priority in many countries (3).

Neck (4) and shoulder pains (5) are among the most prevalent diseases which can lead to disability, sickness absence, and large expenses for individuals and societies. These disorders are more prevalent in some occupations than

others. Millions of computer operators are among those who are at the risk of neck/shoulder pains (6). Many studies have indicated associations between working with computer and neck/shoulder and upper extremities pain (7-11).

A study conducted among computer office workers in Sri Lanka showed that neck and shoulder pains with frequencies of respectively 36.1% and 34.2% were the most prevalent among all MSDs (6). Eltayeb and colleagues, in a study among computer office workers in Sudan found that neck and shoulder pains with respectively 62% and 56% of frequencies were the most prevalent MSDs (12). Also, results of a research among computer office workers in New Zealand indicated that neck pain as the most prevalent MSDs was reported by 74 people (51%) and shoulder pain by 56 people (28%) over past 12 months (13).

The prevalence and risk factors of MSDs in developing countries are under study (6) but they have not been fully recognized yet (14). Studies have shown that possible risk factors can include intensity of previous pain (15), presence of other MSDs (14), and physical and psychosocial work-related risk factors (6,8,10,14,15). In Iran, very few studies have been conducted on neck/shoulder pains and their persistence among computer office workers.

**Aims of the study:** The aim of the present study was to determine the prevalence, incidence and persistence of neck/shoulder pains, and the risk factors associated with this persistence among computer office workers of universities in Shahroud, northeastern Iran.

## Materials & Methods

The present research is a longitudinal study with 1-year follow-up. This study was conducted among all eligible computer office workers (n=182) employed in four universities in Shahroud (located in the northeastern Iran) including “Shahroud University of Medical

Sciences” and its subsidiary units and hospitals, “Shahroud University of Technology”, “Shahroud University of Quranic Sciences”, and “Shahroud Azad University” and its subsidiary hospital, first at baseline from July 2009 to March 2010, and a year later at follow-up from July 2010 to March 2011. The inclusion criterion of the study was one year or more working with computer for at least four hours a day. Exclusion criteria were Neck/shoulder pains due to trauma and accidents.

Data were collected through the standardized “Cultural and Psychosocial Influences on Disability (CUPID)” questionnaire (16). The questionnaire was translated from English into Persian and then independently back-translated to English with amendment of the Persian version where problems were identified. This questionnaire includes demographic characteristics (age, gender, level of education, height, smoking status, work hours, work experience, etc.) physical factors of work (repeated movements of the wrist or fingers, repeated bending and straightening of elbows, lifting weights of 25 kg or more by hand, kneeling and squatting, working with hands above shoulder height for longer than one hour, working under time pressure, temporary employment or receiving salary based on the quantity of work, second job, etc.), and psychosocial factors at work (bonus, decision making, colleagues’ or supervisor support, job satisfaction, job security, etc.). Some items were also adapted from the Nordic questionnaire (17). At baseline, participants were asked about pains in the neck and shoulders lasting for at least a day over the past 12 months. At follow up, they were asked about neck and shoulder pains lasting for at least a day over the past month. Figures of neck and shoulders were included in the questionnaires.

Those who had reported no pain at baseline but reported pain at follow-up were studied to estimate the incidence of pain, and those who had reported pain at baseline over the past 12

months and also at follow-up reported pain over the past month were studied to estimate the persistence of pain.

**Data analysis:** Associations between variables were tested through Chi square and logistic regression tests, with statistical significance set at a level of  $p < 0.05$ , and were summarized as odds ratios (ORs) with associated 95% confidence intervals. SPSS software version 16.0 was used to analyze the collected data.

## Results

At the baseline, 182 computer office workers participated in the study. Table 1 summarizes the individual and psychosocial characteristics of the study participants. The mean age of the participants was 32.1 years ( $SD=6.7$ ) and the mean weekly work hours was 47.4 hours ( $SD=8.2$ ). Fifty percent ( $n=81$ ) of the study population had worked for longer than 5 years in their current position. Most of the participants (64.8%) were females and 3.8% smoked cigarettes. 33.7% had a feeling of job security and 68.3% reported working under time pressure. From 182 participants at baseline of the study, 91.2% ( $n=166$ ) participated at follow-up one year later. The results of this study on neck and shoulder pains are separately discussed in what follows.

**Neck pain:** At the base-line of the study, 39.6% ( $n=72$ ) of computer operators reported neck pain over past 12 months. The prevalence of neck pain among women (50.8%) was much greater than that among men (18.7%). But from those who had not reported neck pain at the baseline, 19 people (19%) reported incidence of neck pain at follow up. The incidence rate of neck pain among men was greater than women (27.9% *vs.* 12.3%). 59.7% ( $n=43$ ) of the participants who had reported neck pain at baseline also reported pain one year later at follow-up. 38.1% ( $n=16$ ) of them had referred to physicians due to neck pain. Just like the incidence of neck pain, the persistence of neck

pain was greater among men than among women (81.8% *vs.* 61.8 %).

The persistence of pain had also caused disability in the study group, so that 4 people (33.3%) had problem getting dressed and 29 people (69%) had problems performing the chores around the house and for one participant (2.4%) getting dressed was even impossible.

Table 2 shows the prevalence, incidence and persistence of neck pain for different genders of the participants. In studying the related risk factors for persistent neck pain, the Chi square results showed significant relationships between persistent neck pain and age ( $p=0.01$ ), gender ( $p=0.031$ ), age of finishing education ( $p=0.030$ ), and decision making on how to perform work ( $p=0.003$ ). The association between cigarette smoking and persistent neck pain showed no significance ( $p=0.77$ ).

Logistic regression analysis was used to investigate the simultaneous relationships between these variables and the persistence of neck pain (so that effects of possible confounding factors could be controlled). Those variables in the univariate analysis, which showed a significant relationship with neck pain ( $p < 0.1$ ) entered the logistic regression analysis model. According to Table 3, associated risk factors of persistent neck pain were found to be gender ( $p=0.03$ ), age ( $p=0.003$ ), and decision latitude at work ( $p=0.05$ ).

**Shoulder pain:** At the baseline of the study, 39.6% ( $n=72$ ) of participants reported shoulder pain. These people reported more pain in the right shoulder than in the left one (39.8% *vs.* 13.9%) and other participants reported pain in both shoulders. It is worth mentioning that 94% of the participants were right-handed. Prevalence of shoulder pain was generally higher among women compared to men (44% *vs.* 33.3%). In this study, 30.9% of the participants who had not reported shoulder pain at the baseline, reported incidence of shoulder pain one year later at follow up. Incidence of shoulder pain among women was greater than

among men (34.5% vs. 25.6%). In this study, 53.6% (n=37) of the participants who had reported shoulder pain at baseline, reported persistence of shoulder pain at the follow-up. Just like the prevalence and incidence of shoulder pain, the persistence of shoulder pain was greater among women than among men (58.8% vs. 38.8%). 14 people (37.8%) with persistent shoulder pain had referred to physicians because of shoulder pain.

Persistent shoulder pain had also caused disability in the study group, so that 32.4% (n=12) had problem with combing hair, 21.6% (n=8) with bathing, 37.8% (n=14) with getting dressed, and 62.2% (n=23) with performing the chores around the house. For one participant (2.7%), combing hair, bathing, getting dressed and performing the chores around the house were impossible.

Table 4 shows the prevalence, incidence, and persistence rates of shoulder pain among

participants on the basis of gender.

The evaluation of risk factors related to the persistence of shoulder pain through Chi square showed significant relationships between persistent shoulder pain and gender ( $p=0.025$ ), working under time pressure ( $p=0.041$ ), and deciding when to take a break ( $p=0.023$ ). Then, the logistic regression analysis was used to control confounding factors and to assess the simultaneous effects of the independent variables on the persistence of shoulder pain. Then, the variables in the univariate analysis, which had shown significant relationships with persistence of shoulder pain ( $p<0.1$ ) along with the background variable of age were entered into logistic regression analysis. Table 3 shows significant relationships between persistent shoulder pain and age ( $p=0.049$ ), gender ( $p=0.034$ ), and decision latitude at work ( $p=0.05$ ).

**Table 1) Characteristics of study population (computer office workers, N=182)**

Characteristics		Mean±SD	
Age		32.1±6.7	
Height		165.6±7.5	
Hours per week		47.4±8.2	
Categorized variables		Frequency	Percent
Gender	Female	118	64.8
	Male	64	35.2
Job history	>5 years	91	50
Right handed	yes	171	94
	High school	63	34.6
Education	Undergraduate	32	17.6
	Bachelors	87	47.8
Age finished education	<19	58	31.8
	>19	124	68.1
Smoking	yes	7	3.8
<b>Work-related physical and psychosocial factors</b>			
Repeated movements of the wrist or fingers for more than four hours	yes	163	89.6
Repeated bending and straightening of elbow for longer than one hour	yes	148	81.3
Working with hands above shoulder height 1+ hour	Yes	73	40.1
Lifting weights of 25 Kg or more by hand	Yes	13	7.1
Kneeling or squatting for longer than one hour	Yes	34	18.7
Piece work	Yes	25	13.7
Working under pressure to complete tasks by a fixed time	Yes	123	68.3
Deciding about how to do work (never, seldom)	Yes	48	26.3
Deciding about work time table and breaks (never, seldom)	Yes	104	57.1
Support from colleagues supervisor/manager (never seldom))	Yes	43	24.4
Satisfaction with job	Yes	134	73.6
Job security	Yes	61	33.7

**Table 2) Prevalence, incidence, and persistence of neck pain of study population (computer office workers, N=182)**

Gender	Prevalence of neck pain at baseline over previous 12 months (n=182)	incidence of neck pain over past one month at follow up (n=97, female=57, male=43)	persistence of neck pain over previous one month at follow up (n=66, female=55, male=11)
Male (n=64)	12 (%18.7)	12 (%27.9)	9 (%81.8)
Female (n=118)	60 (%50.8)	7 (%12.3)	34 (%61.8)
<b>Total</b>	<b>72 (%39.6)</b>	<b>19 (%19.5)</b>	<b>43 (%65.1)</b>

**Table 3) Odds ratio (OR) and 95% confidence intervals for persistence of neck and shoulder pain among study population (computer office workers, N=182)**

Risk factors	N	OR	95% CI for OR	p-value	
<b>Neck pain</b>					
age	-	1.09	1.03- 1.16	0.003	
Gender	male	9	1		
	female	34	3.06	1.09- 8.58	0.03
Age finished education	<19	20	1		
	>19	23	0.69	0.31- 1.5	0.374
Smoking	No	40	1		
	Yes	3	3.7	0.45 -31.2	0.221
Deciding about How do work	Yes	24	1		
	No	19	2.2	0.99- 5.15	0.053
<b>Shoulder pain</b>					
age		1.07	1.01- 1.1	0.034	
Gender	male	7	1		
	female	30	2.8	1.0 -7.9	0.049
Education	Bachelor	14	1		
	Undergraduate	2	0.46	0.091- 2.4	0.357
	High school	21	2.4	0.94 -6.3	0.068
Piece work	yes	2	1		
	No	35	2.8	0.57 -14.0	0.204
Working under pressure to complete tasks by a fixed time	No	6	1		
	yes	30	2.5	0.85- 7.1	0.097
Deciding about how do work	Yes	23	1		
	No	14	2.4	0.97- 6.2	0.057
Deciding about work time table and breaks	yes	10	1		
	No	27	1.7	0.67- 4.1	0.273

**Table 4) Prevalence, incidence, and persistence of shoulder pain among study population (computer office workers, N=182)**

Gender	Prevalence of shoulder pain at baseline over previous 12 months (n=182)			Incidence of shoulder pain over previous one month at follow up (n=97, female=58, male=39)			persistence of shoulder pain over previous one month at follow up (n=697, female=51, male=18)		
	Right side	Left side	Both sides	Right side	Left side	Both sides	Right side	Left side	Both sides
Male (n=64)	11 (%17.2)	1 (%1.6)	8 (%12.5)	7 (%17.9)	1 (%2.6)	2 (%5.1)	4 (%22.2)	1 (%5.5)	2 (%11.10)
Female (n=118)	17 (%14.4)	9 (%7.6)	26 (%22)	9 (%15.5)	7 (%12.1)	4 (%6.9)	17 (%33.3)	5 (%90.8)	8 (%15.7)
<b>Total</b>	<b>28 (%15.4)</b>	<b>10 (%5.5)</b>	<b>34 (%18.7)</b>	<b>16 (%16.6)</b>	<b>8 (%8.2)</b>	<b>6 (%6.2)</b>	<b>21 (%30.4)</b>	<b>6 (%88.7)</b>	<b>10 (%14.5)</b>

## Discussion

In this study, prevalence of both neck and shoulder pains among computer operators was 39.6%, which is less than the results of similar studies in Sudan (12), Japan (18) and New Zealand (13) and more than the results of studies in Germany (14) and Sri Lanka (6).

In a cross-sectional study by Choobineh and colleagues on computer operators working in banks of Shiraz (located in the southwest of Iran), neck and shoulder pains with respectively 59.6% and 58.2% of frequency were the most prevalent, which are higher than the results of the present study (19). Similar studies reported greater prevalence of neck pain than shoulder pain among computer operators (6,12,13) and in some studies, shoulders pain were higher (14). Of course, at the follow-up of the present study, neck pain showed greater persistence than shoulder pain, which is consistent with the findings of most studies.

Moreover, considering individual, physical, and psychosocial risk factors, our results indicate that age, gender, and decision latitude at work have significant relationships with persistence of both neck and shoulder pains.

Similar studies have found significant relationships between the female gender and MSDs (20,21), which are consistent with the finding of this study. A study by Lassen and colleagues also showed a significant relationship between the persistence of arm and elbow pains and female gender, and no significant relationship was observed between the persistence of arm and elbow pain and age (15). However, some other researchers, in line with the findings of the present research, have also found significant relationships between age and work-related MSDs (22, 23).

Relationship between MSDs and decision latitude at work have also been found significant in other studies (24,25), which is in accordance with the findings of this study. Moreover, in a study on 150 computer

operators in San Francisco, more working hours with computer and low decision latitude showed significant relationships with MSDs (26).

The results of the present study also indicate that people with high school diploma are exposed to risk factors of shoulder pain 2.4 times more than those with bachelor's degrees. It seems that with the increase in the level of education, prevention principals of MSDs are followed more. Andersen and colleagues also reported that low education level increased the risk of neck and shoulders pain 1.8 times more (27).

Some other studies also indicated that prevalence of back pain was associated with low education level (28). Moreover, in a study on factors related to returning to work after MSDs, higher levels of education were found to be an important predictor (29). Some other research projects have shown mixed results on the relationships between risk factors and persistence of neck and shoulder pains (8,30).

In a systematic review study by De Costa and colleagues on work-related MSDs, main risk factors for neck pain included cigarette smoking, female gender, awkward position at work, presence of other MSDs, and for shoulder pain, they included heavy physical work and psychosocial factors (31).

**Conclusions:** Although prevalence of neck and shoulder pains among the study group was equal, after one year of follow-up, persistence of neck pain was greater than that of shoulder pain. Age, gender, and decision latitude at work were identified as significant risk factors for both pains. Therefore, effective interventions strategies, management measures, training workers on work variety, and providing workers with decision latitude at work are suggested as possible strategies for preventing symptoms of computer-related MSDs.

## Footnotes

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### Conflict of Interest:

The authors declare no conflict of interest.

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