

## **Work Related Neck Pain and Its Associated Factors among Registered Female Nurses Who Are Computer Users in Universiti Kebangsaan Malaysia Medical Centre**

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**Abstract:** Work related neck pain is common problem in nurses, especially among those who are intensive computer users. It is generally agreed that the its etiology is multidimensional which is associated with, and influenced by a complex array of socio-demographic, work related, lifestyle, ergonomic and psychosocial factors. Across sectional study was conducted to in August-October 2012 in University Kebangsaan Malaysia Medical Centre, Malaysia to estimate the 1 month and 12 months prevalence rates of neck pain among registered female nurses and to determine which socio-demographic, work related, lifestyle, ergonomic and psychosocial factors are associated with 12 months prevalence rate. A total of 250 respondents have been selected by using stratified sampling method. Data was collected via self-reporting modified Dutch musculoskeletal questionnaire. The response rate was (96.8%) and data was analyzed by using SPSS version 19. Age of respondents was around 18 to 52 years old with the mean age of 32.31±9.27 years. The point and 12 month period prevalence rates of neck pain in registered female nurses were (36%) and (45.5%) respectively. Majority of respondents were Malay (97.9%), married (72.3%), not doing physical exercise (69%), having highest education, Diploma in Nursing (88.8%) and working in night shifts (76.9%). Generally, the respondents were reported that their neck pain was associated with working hours on computer for more than 4 hours (56.7%); neck bending (56.4%) and Personnel shortage (53.2%). In bivariate; Chi square analysis, the result of present study indicated that there were seven factors significantly associated with neck pain i.e. age, BMI, physical exercises, night shifts, neck bending, prolonged working hours on computer and personnel shortage. Further analysis, by using multiple logistic regression showed that age groups 30-39 ( $p= 0.011$ , 95% CI 1.233-5.5044) and 40-49 ( $p= 0.040$ , 95% CI 1.041- 5.311), physical exercises ( $p= 0.025$ , 95% CI 1.106- 4.384), working time on computer ( $p= 0.029$ , 95% CI 1.075-3.725), night shifts ( $p= 0.001$ , 95% CI 0.938-3.144), personnel shortage ( $p= 0.005$ , 95% CI 1.334-4.908) and neck bending ( $p= 0.013$ , 95% CI 1.192-4.299) were significant predictors to work related neck pain. The results of present study indicated that socio-demographic, lifestyle, ergonomic factors and some of psychosocial variables were associated with neck pain. These association patterns suggest also opportunities for intervention strategies in order to stimulate an ergonomic work place setting to improve physical exercises awareness and to increase a positive psychosocial work environment.

**Keywords:** Ergonomic, Neck pain, Nurses, Psychosocial, Socio-demographic.

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### **I. Introduction.**

The non communicable diseases have been dramatically increased all over the world especially musculoskeletal diseases which considered one of the major causes of morbidity throughout the world, that even could be the second only to respiratory disorders as a cause of short and long medical leave from work in many countries. Their direct and indirect cost is considerable and their management utilizes a significant part of the gross national product of many countries<sup>1</sup>.

Work related neck pain is one of the important components of work related musculoskeletal disorders; WMSDs and occupational health issues. It is a leading cause for disability and activity limitations and absenteeism of the workers that in turn could affect gross national production and could form a big economic burden for any country even though with small prevalence rates, for instance prevalence rates of work related neck pain were 27.1% in Norway and 47.8% in Canada while annual activity limitations of workers' costs were 11% and 14.1% respectively<sup>2</sup>.

Work related neck pain is one of the common musculoskeletal disorders that affects millions of workers throughout the world across variant works or sectors of services like nurses and office workers especially among those who are intensive computer users and keeping their neck in awkward postures or moving their neck repetitively when use the computer<sup>3+4</sup>.

The aim of this research is to study the point and 12 month period prevalence rates of work related neck pain among registered female nurses in Universiti Kebangsaan Malaysia Medical Centre and to determine which

socio-demographic, work related, lifestyle, ergonomic and psychosocial factors are associated with 12 months prevalence rate.

## **II. Methodology.**

This was a cross sectional study which conducted at Universiti Kebangsaan Malaysia Medical Centre from August until October 2012. Sample size was calculated based on the calculation from Ijmker S<sup>5</sup>, with confident interval 95%, the prevalence rate of the neck pain from the previous study was 42% among women and 24% among men; the minimum sample size would be 250 nurses. We managed to recruit 250 registered female nurses by using stratified sampling method to calculate the number of nurses from each department as participants then simple random sampling was applied. Data was collected by self-adminstrated questionnaire. The questionnaire contained of 37 items which related to socio-demographic, work related, lifestyle, ergonomic and psychosocial risk factors of neck pain. Likert Scale was used to score the psychosocial factors questions with four response categories (usually, all the time, sometimes and never); who answered (usually or all the time) was considered "yes" and who answered (sometimes or never) was considered "no". Other variables categorization into two groups by using "median" in SPSS analysis as a cut-off point between them. Data was analyzed using Statistical Package for Social Science (SPSS) programme version 19. Normality tests were done and all of the quantitative data were found to be normally distributed. Therefore, statistical analysis which used in this study was parametric test such as Pearson Correlation and Chi square test. For further analysis, multiple logistic regression was done to predict the factors that influence neck pain.

## **III. Results.**

The response rate in this study was 96.8% (242 out of 250). From the analysis to determine the work related neck pain prevalence rate; 36% of respondents had point prevalence rate of neck pain and 45.5% had period prevalence rate of neck pain.

### **1. Neck pain severity.**

Table 1 shows the self-rated neck pain severity in the last 1 month of present study from 15 of September to 15 of October 2012 generally was mild 39.1%, moderate 51.7% and severe 9.2%. And according to working departments, the highest mild pain was in surgical departments 76.2, the highest moderate pain was in medical and anesthesiology & ICU departments 42.9%, and the highest severe pain was in emergency unit 20%.

### **2. Socio-demographic characteristics.**

Respondents socio-demographic characteristics which have been studied were weight and height to calculate BMI, also age, race and marital status. Their age ranged from 18-52 years old and the mean age was 32.31±9.27 years. Most of them were married 72.3% when compared to 27.7% were single (unmarried, divorce and widows). In terms of age, it have been divided into 4 ethnic groups; Malay, Chinese, Indian and others; and the response rate were 97.9%, 0.4%, 1.2% and 0.4% respectively. And In terms of age, it have been divided into 4 categories; (18-29), (30-39), (40-49) and (50-59) years age-groups<sup>3</sup>; and the response rate were 44.2%, 31.4%, 20.7% and 3.7% respectively. And in terms of BMI, also it have been divided into 4 categories according to Asian BMI cut-off points into normal, underweight, overweight and obese; and the response rate were 29.3%, 3.7%, 31% and 36% respectively. Tables 2 and 3 show the demographic characteristics of respondents.

### **3. Lifestyle characteristics.**

Respondents lifestyle characteristics which have been studied were smoking and physical exercises. In terms of smoking, only 3 were smokers 1.2%. In terms of physical exercises, most of respondents were not doing physical exercises 69% and those who were doing 31%, only 24% (18 out of 75) of them were doing physical exercises regularly more than 3 times per week<sup>6+7</sup>. Table 3 shows the lifestyle characteristics of respondents.

### **4. Work related characteristics.**

Respondents work related characteristics which have been studied were working departments, night shifts, educational level, daily working time, employment duration and medical leave due to neck pain in preceding 12 months. In terms of working departments, in present study, total 17 department in UKMMC have been categorized into 5 departments; medical department (internal medicine, pediatric, family medicine, psychiatry, infectious controlling unit, radiotherapy & oncology, continuous medical education and clinic Warga), surgical department (general surgery, obstetric & gynecology, orthopedic & traumatology, ophthalmology, maxillofacial and ENT), emergency department, anesthesiology & ICU department and nursing management department, and the response rate were 25.2%, 29.8%, 19.8%, 21.1% and 4.1% respectively. In terms of night shifts, 76.9% of respondents were doing night shifts. In terms of educational level, 88.8% of

respondents had Diploma in Nursing. In terms of daily working time and according to median cut-off point, 75.6% of respondents were working less than 9 hours. In terms of employment duration and according to median cut-off point, 75.6% of respondents were working less than 4 years 54.5%. In terms of medical leave due to neck pain, it range from 1 to 3 day among respondents who reported neck pain in preceding 12 months 10.7%. Tables 2 and 4 show the work related characteristics of respondents.

#### **5. Ergonomic characteristics.**

Respondents ergonomic characteristics which have been studied were top of computer display's at eye level, distance of computer's display at arm's length, position of computer's display, arm resting during working on computer, support such as copy holder using during working on computer, working hours on computer per day, neck twisting, frequency of neck twisting, neck bending and frequency of neck bending. In terms of top of computer display's, 52.7% was not at respondents eye level. In terms of distance of computer's display, 63.6% was not in range of respondents own arm's length. In terms of position of computer's display, 51.7% was not placed in front of respondents. In terms of arm resting, 55.7% of respondents were rested their arms. In terms of copy holder using, 82.6% was not used by respondents. In terms of working hours on computer and according to median cut-off point, 57% of respondents were working less than 4 hours on computer. In terms of neck twisting and frequency of neck twisting, 41.2% and 35.4% (34 out of 96 who twisted neck) of respondents twisted the neck and not frequently respectively. In terms of neck bending and frequency of neck bending, 42.4% and 40.6% (41 out of 101 who bent neck) of respondents bent the neck and not frequently respectively. Table 5 shows the ergonomic characteristics of respondents.

#### **6. Psychological characteristics.**

Respondents psychological characteristics which have been studied were work satisfaction, personnel shortage, mental tiredness at the end of the workday, break-time sufficiency, perceived co-workers support, perceived supervisors support, perceived co-workers friendly dealing and perceived supervisors friendly dealing. In terms of work satisfaction, 58.6% of respondents were satisfied. In terms of personnel shortage, 64.7% of respondents reported there was a shortage in personnel that caused a work overload. In terms of mental tiredness, 85.2% of respondents reported they did not have it at the end of the workday. In terms of break-time, 72.1% of respondents reported that it was not sufficient. In terms of co-workers support, 58.9% of respondents perceived that it was not enough. In terms of supervisors support, 76.8% of respondents perceived that it was enough. In terms of co-workers and supervisors dealing, 75.3% and 72.1% respectively of respondents perceived that it was friendly. Table 6 shows the psychological characteristics of respondents.

#### **7. Association between neck pain and socio-demographic & lifestyle factors.**

Table 7 showed Chi square test for sociodemographic and lifestyle characteristic of nurses and neck pain. The results revealed that there were a significant associations between age, BMI and physical exercises, and neck pain ( $p$  value  $<0.05$ ). In terms of physical exercises, the nurses who did not do physical exercises 52.1% of them had more neck pain when compared to those who did, 30.7%.

#### **8. Association between neck pain and work related factors.**

Table 8 showed Chi square test for work related characteristic of nurses and neck pain. The results revealed that there was a significant associations between night shifts and neck pain ( $p$  value  $<0.05$ ). The nurses who did night shifts 51.1% of them had more neck pain when compared to those who did not, 26.8%.

#### **9. Association between neck pain and ergonomic factors.**

Table 9 showed Chi square test for ergonomic characteristic of nurses and neck pain. The results revealed that there were a significant associations between working hours on computer and neck bending, and neck pain ( $p$  value  $<0.05$ ). In terms of working hours on computer, the nurses who used computer for prolonged hours; more than 4 hours according to cut-off point in this study, 56.7% of them had more neck pain when compared to those who worked for less than 4 hours, 30.7%. In terms of neck bending, the nurses who bent their necks 56.4% of them had more neck pain when compared to those who did not bend, 36.5%.

#### **10. Association between neck pain and psychosocial factors.**

Table 10 showed Chi square test for psychosocial characteristic of nurses and neck pain. The results revealed that there was a significant association between personnel shortage and neck pain ( $p$  value  $<0.05$ ). The nurses who were exhausted due to work overload because of personnel shortage, 53.2% had more neck pain when compared to those who were not, 31%.

**11. Multivariate Analysis**

In order to determine which of the study variables best explained the variation in neck pain, multiple logistic regressions (backward LR technique) was done. All seven variables which associated significantly with neck pain in bivariate analysis by using Chi square test entered in the logistic regression. The significant predictors of neck pain in this model after control of confounders were (30-39) and (40-49) years age groups (p= 0.011) and (p= 0.040) respectively, physical exercises (p= 0.025), working time on computer (p= 0.029), night shifts (p= 0.001), personnel shortage (p= 0.005) and neck bending (p= 0.013), table 11. And the total model was significant (p< 0.000) and accounted for 33.1% of the variance in neck pain (Nagelkerke R Square=0.331). The Hosmer and Lemeshow Test indicated a good fit (p= 0.425).

Registered female nurses in age group (30-39) when compared to those who were in age group (18-29), shows 2.49 (95% CI 1.233- 5.5044) times more likely to have neck pain, also who were in age group (40-49) when compared to those who were in age group (18-29) 2.35 (95% CI 1.041- 5.311) times more likely to have neck pain, while who were in age group (50-59) fifth times less likely have neck pain.

Registered female nurses were not doing physical exercises 2.20 (95% CI 1.106- 4.384) times more likely to have neck pain when compared to those who were doing. Registered female nurses were working on computer more than 4 hours 2.00 (95% CI 1.075-3.725) times more likely to have neck pain when compared to who were not.

Registered female nurses who were working at night shifts 2.39 (95% CI 0.938-3.144) times more likely to have neck pain when compared to who were not. Registered female nurses who reported personnel shortage 2.56 (95% CI 1.334-4.908) times more likely to have neck pain when compared to who did not. Finally registered female nurses were bending their necks 2.27 (95% CI 1.192-4.299) times more likely to have neck pain when compared to who were not.

**IV. Tables.**

**Table 1 Neck pain severity in the last 1 month in departments of UKMMC.**

Departments	n	Neck Pain Severity		
		Mild n(%)	Moderate n(%)	Severe n(%)
Medical departments	21	10(47.6%)	9(42.9%)	2(9.5%)
Surgical departments	21	16(76.2%)	4(19%)	1(4.8%)
Anesthesiology & ICU	21	11(52.4%)	9(42.9%)	1(4.8%)
Nursing Management	19	10(52.6%)	8(42.1%)	1(5.3%)
Emergency Unit	5	3(60%)	1(20%)	1(20%)

**Table 2. Descriptive statistics of registered female nurses in UKMMC (n=242).**

Variables	Minimum	Maximum	Mean	S.D
Age (year)	18	52	32.31	9.27
Height (cm)	142	182	158.01	8.07
Weight (kg)	40	116	65.01	15.14
Body mass index (kg/m <sup>2</sup> )	17.26	42.46	25.88	5.11
Daily Working time (hours/day)	7	14	8.82	1.35
Working time on computer (hours/day)	3	6	4.39	0.96
Employment duration (years)	1	17	4.78	2.92
Night shifts no. (shifts/week)*	1	3	1.7	0.73

\*Among who did night shifts, n= 186.

**Table 3 Socio-demographic and lifestyle factors of registered female nurses in UKMMC (n=242).**

Factors	n	%
<b>Race</b>		
Malay	237	97.9
Chinese	1	0.4
Indian	3	1.2
Others	1	0.4
<b>Marital Status</b>		
Married	175	72.3
Unmarried	67	27.7
<b>Age</b>		
18-29 years	107	44.2
30-39 years	76	31.4
40-49 years	50	20.7
50-59 years	9	3.7

<b>BMI</b>		
Normal	71	29.3
Underweight	9	3.7
Overweight	75	31
Obese	87	36
<b>Smoking</b>		
Yes	3	1.2
No	239	98.8
<b>Physical Exercises</b>		
Yes	75	31
No	167	69
<b>Physical Exercises/week*</b>		
More than 3 times a week	18	24
Less than 3 times a week	57	76

\*This is only among who did physical exercises, n= 75.

**Table 4 Work related characteristics of registered female nurses in UKMMC (n=242).**

<b>Factors</b>	<b>n</b>	<b>%</b>
<b>Working Departments</b>		
Medical departments	61	25.2
Surgical departments	72	29.8
Anesthesiology & ICU	48	19.8
Nursing management	51	21.1
Emergency unit	10	4.1
<b>Night Shifts</b>		
Yes	186	76.9
No	56	23.1
<b>Educational Level</b>		
Diploma in nursing	215	88.8
Degree in nursing	27	11.2
<b>Daily Working Time</b>		
> 9 hours	59	24.4
≤ 9 hours	183	75.6
<b>Employment Duration</b>		
> 4 years	110	45.5
≤ 4 years	132	54.5
<b>Medical Leave Due to Neck Pain</b>		
Yes	26	10.7
No	216	89.3
<b>Job Change Due to Neck Pain</b>		
Yes	11	4.5
No	231	95.5
<b>Temporary Contract</b>		
Yes	14	5.8
No	228	94.2
<b>Working in Private Sector</b>		
Yes	50	20.7
No	192	79.3
<b>Neck Pain Start during Present Work</b>		
Yes	140	57.9
No	102	42.1
<b>Neck Pain Associated with Work</b>		
Yes	166	71.5
No	69	28.5
<b>Neck Pain Hindered Activities of Work</b>		
Yes	40	16.5
No	202	83.5

**Table 5 Ergonomic factors of registered female nurses in UKMMC.**

<b>Factors</b>	<b>n</b>	<b>%</b>
<b>Top of Computer's Display at Eye Level (n=239)</b>		
Yes	126	52.7
No	113	47.3
<b>Distance of Computer's Display at Arm's Length (n=231)</b>		
Yes	84	36.4
No	147	63.6
<b>Position of Computer's Display in Front of User (n=238)</b>		
Yes	123	51.7
No	115	48.3
<b>Arm Resting during Working on Computer (n=237)</b>		
Yes	132	55.7
No	105	44.3
<b>Support Using during Working on Computer (n=235)</b>		
Yes	41	17.4
No	194	82.6
<b>Working Hours on Computer/day (n=242)</b>		
> 4 hours	104	43.0
≤ 4 hours	138	57.0
<b>Neck Twisting (n=233)</b>		
Yes	96	41.2
No	137	58.8
<b>Frequent Neck Twisting (n=96)*</b>		
Yes	34	35.4
No	62	64.6
<b>Neck Bending (n=238)</b>		
Yes	101	42.4
No	137	57.6
<b>Frequent Neck Bending (n=101)**</b>		
Yes	41	40.6
No	60	59.4

\* Among nurses who twisted their necks. \*\* Among nurses who bent their necks.

**Table 6 Psychosocial characteristics of registered female nurses in UKMMC.**

<b>Factors</b>	<b>N</b>	<b>%</b>
<b>Work Satisfaction (n=237)</b>		
Yes	139	58.6
No	99	41.4
<b>Personnel Shortage (n=238)</b>		
Yes	154	64.7
No	84	35.3
<b>Mental Tiredness at the End of the Workday (n=237)</b>		
Yes	35	14.8
No	202	85.2
<b>Break-time Sufficiency (n=240)</b>		
Yes	67	27.9
No	173	72.1
<b>Perceived Co-workers Support (n=236)</b>		
Yes	139	58.9
No	97	41.1
<b>Perceived Supervisors Support (n=237)</b>		
Yes	182	76.8
No	55	23.2
<b>Perceived Co-workers Friendly Dealing (n=235)</b>		
Yes	177	75.3
No	58	24.7
<b>Perceived Supervisors Friendly Dealing (n=233)</b>		
Yes	168	72.1
No	65	27.9



**Table 7 Association between neck pain and socio-demographic & lifestyle factors.**

Factors	n	Neck Pain		X <sup>2</sup>	p value	df	POR	CI 95 %
		Yes n(%)	No n(%)					
<b>Age</b>				19.79	0.000	3		
18-29 years	107	32(29.9%)	75(70.1%)					
30-39 years	76	41(53.9%)	35(46.1%)					
40-49 years	50	31(62.0%)	19(38%)					
50-59 years	9	6(66.7%)	3(33.3%)					
<b>Race</b>				5.69	0.128	3		
Malay	237	106(44.7%)	131(55.3%)					
Chinese	1	1(100%)	0 (0%)					
Indian	3	3(100%)	0 (0%)					
Others	1	0 (0%)	1 (100%)					
<b>BMI</b>				11.83	0.008	3		
Normal	71	22(31%)	49(69.0%)					
Underweight	9	2(22.2%)	7(77.8%)					
Overweight	75	39(52%)	36(48%)					
Obese	87	47(54%)	40(46%)					
<b>Physical Exercises</b>				9.59	0.002	1	0.41	0.23-0.73
Yes	75	23(30.7%)	52(69.3%)					
No	167	87(52.1%)	80(47.9%)					
<b>Smoking</b>				0.18	1.000	1	0.59*	0.06-6.67
Yes	3	1(33.3%)	2(66.7%)					
No	239	109(45.6%)	130(54.4%)					

p value based on Chi square test, <0.05 considered as significant association. \*Fisher Exact test.

**Table 8 Association between neck pain and work related factors.**

Factors	n	Neck Pain		X <sup>2</sup>	p value	df	POR	CI 95 %
		Yes n(%)	No n(%)					
<b>Working departments</b>				7.79	0.100	4		
Medical	61	24(39.3%)	37(60.7%)					
Surgical	72	41(56.9%)	31(43.1%)					
A. & ICU	48	21(43.8%)	27(56.2%)					
Nursing	51	18(35.3%)	33(64.7%)					
Emergency	10	6(60%)	4(40%)					
<b>Employment duration/year</b>				3.29	0.092	1	1.61	0.97-2.67
> 4 years	110	57(51.8%)	53(48.2%)					
≤ 4 years	132	53(40.2%)	79(59.8%)					
<b>Night shifts/week</b>				10.24	0.001	1	2.86	1.48-5.51
Yes	186	95(51.1%)	91(48.9%)					
No	56	15(26.8%)	41(73.2%)					

p value based on Chi square test, <0.05 considered as significant association.

**Table 9 Association between neck pain and ergonomic factors.**

Factors	n	Neck Pain		X <sup>2</sup>	p value	df	POR	CI 95 %
		Yes n(%)	No n(%)					
<b>Display's Height</b>				0.08	0.796	1	0.93	0.56-1.55
At eye level	113	50(44.2%)	63(55.8%)					
Not at eye level	126	58(46%)	68(54%)					
<b>Display's Distance</b>				0.16	0.783	1	1.12	0.65-1.92
At arm's length	84	36(42.9%)	48(57.1%)					
Not arm's length	187	67(45.6%)	80(54.4%)					
<b>Display's Position</b>				0.95	0.362	1	1.29	0.78-2.16
In front	123	51(41.5%)	72(58.5%)					
Not In front	115	55(47.8%)	60(52.2%)					
<b>Arm Resting</b>				0.20	0.695	1	0.89	0.53-1.49
Yes	132	59(44.7%)	73(55.3%)					
No	105	50(47.6%)	55(52.4%)					

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<b>Support Using</b>				0.34	0.606	1	1.22	0.62-2.39
Yes	41	20(48.8%)	21(51.2%)					
No	192	85(43.8%)	109(56.2%)					
<b>Working hours on computer/day</b>				9.36	0.003	1	2.24	1.33-3.76
> 4 hours	104	59(56.7%)	45(43.3%)					
≤ 4 hours	138	51(37.0%)	87(63.0%)					
<b>Neck Twisting</b>				0.87	0.423	1	0.78	0.46-0.13
Yes	96	41(42.7%)	55(57.3%)					
No	137	67(48.9%)	70(51.1%)					
<b>Twisting Frequency*</b>				0.05	1.000	1	0.92	0.39-2.13
Yes	62	26(41.9%)	36(58.1%)					
No	34	15(44.1%)	19(55.9%)					
<b>Neck Bending</b>				9.34	0.003	1	2.26	1.34-3.81
Yes	101	57(56.4%)	44(43.6%)					
No	137	50(36.5%)	87(63.5%)					
<b>Bending Frequency**</b>				0.22	0.686	1	1.21	0.55-2.69
Yes	41	22(53.7%)	19(46.3%)					
No								

p value based on Chi square test, <0.05 considered as significant association. \* Among nurses who twisted their necks. \*\* Among nurses who bent their necks.

**Table 10 Association between neck pain and psychosocial factors.**

Factors	n	Neck Pain		X <sup>2</sup>	p value	df	POR	CI 95 %
		Yes n(%)	No n(%)					
<b>Work Satisfaction</b>				0.09	0.792	1	0.92	0.55-1.56
Yes	98	61(43.9%)	78(56.1%)					
No	139	45(45.9%)	53(54.1%)					
<b>Personnel shortage</b>				11.89	0.001	1	2.54	1.45-4.45
Yes	154	82(53.2%)	72(46.8%)					
No	84	26(31%)	58(69%)					
<b>Mental distress at end of the workday</b>				0.52	0.582	1	0.77	0.37-1.59
Yes	35	14(40%)	21(60%)					
No	202	94(46.5%)	108(53.5%)					
<b>Sufficient rest-time</b>				0.17	0.773	1	0.89	0.51-1.57
Yes	067	29(43.3%)	38(56.7%)					
No	173	80(46.2%)	93(53.8%)					
<b>Co-workers support</b>				0.65	0.429	1	0.81	0.48-1.36
Yes	139	60(43.2%)	79(56.8%)					
No	97	47(48.5%)	50(51.5%)					
<b>Supervisors support</b>				0.04	0.878	1	1.06	0.58-1.95
Yes	182	82(45.1%)	100(54.9%)					
No	55	24(43.6%)	31(56.4%)					
<b>Co-workers friendly dealing</b>				0.17	0.761	1	0.89	0.49-1.61
Yes	177	77(43.5%)	100(56.5%)					
No	058	27(46.6%)	31(53.4%)					
<b>Supervisors friendly dealing</b>				3.56	0.078	1	0.58	0.33-1.03
Yes	168	70(41.7%)	98(58.3%)					
No	65	36(55.4%)	29(44.6%)					

p value based on Chi square test, <0.05 considered as significant association.



**Table 11 Logistic regression of neck pain of registered female nurses in UKMMC.**

Variables	B	S.E.	Wald	df	Sig.	Exp(B)	95% CI for EXP(B)	
							Lower	Upper
<b>Age</b>								
50-59 years	1.144	0.923	1.536	1	0.215	3.138	0.514	9.153
40-49 years	0.855	0.416	4.228	1	0.040	2.351	1.041	5.311
30-39 years	0.914	0.359	6.469	1	0.011	2.494	1.233	5.044
18-29 years	<b>Reference Group</b>							
<b>BMI</b>								
Obese	0.601	0.396	2.307	1	0.129	1.825	0.840	3.964
Overweight	0.692	0.395	3.063	1	0.080	1.998	0.920	4.337
Underweight	-1.291	0.995	1.683	1	0.194	0.275	0.039	1.934
Normal	<b>Reference Group</b>							
<b>Physical Exercises</b>								
No	0.789	0.351	5.047	1	0.025	2.202	1.106	4.384
Yes	<b>Reference Group</b>							
<b>Working Hours on Computer/day</b>								
> 4 hours	0.694	0.317	4.790	1	0.029	2.001	1.075	3.725
≤ 4 hours	<b>Reference Group</b>							
<b>Night Shifts/week</b>								
Yes	1.380	0.410	11.313	1	0.001	3.975	1.779	8.882
No	<b>Reference Group</b>							
<b>Personnel Shortage</b>								
Yes	0.940	0.332	7.996	1	0.005	2.559	1.334	4.908
No	<b>Reference Group</b>							
<b>Neck Bending</b>								
Yes	0.817	0.327	6.232	1	0.013	2.264	1.192	4.299
No	<b>Reference Group</b>							
<b>Constant</b>	<b>-4.038</b>	<b>0.645</b>	<b>39.188</b>	<b>1</b>	<b>0.000</b>	<b>0.018</b>		

B=Regression estimates; Exp (B) = odds ratio; 95% CI=95% confidence interval.

## V. Discussion.

### 1. The prevalence rate of neck pain among registered female nurses.

In this cross sectional study, the point and period prevalence rates of the work related neck pain were 36% and 45.5% respectively of the respondents reported prevalent neck pain. In terms of point prevalence rate of neck pain during the past 1 month in this study is in agreement with other studies<sup>8+9</sup>. Other studies have reported both higher<sup>10+11</sup> and lower<sup>12+13</sup> point prevalence rates of neck pain. In terms of 12 months period prevalence rate of neck pain in this study is in agreement with other studies<sup>3+14+15+16+17+18+19+20</sup>. Also other studies have reported both higher<sup>21+22</sup> and lower<sup>23+24</sup> 12 months period prevalence rates of neck pain.

However, the prevalence rates of WMSDs noted to vary across occupational groups and over national boundaries that could be due to variations and differences in subjectivity of terms, instruments or questionnaires, organizational work settings, cultural perception, sample sizes, response rate, cut-off points of some variables such as BMI and age groups, literature reviews and reporting of pain and healthy worker effect, all these were adduced for the variation in the prevalence rates of neck complaints in the different studies<sup>3+21</sup>.

### 2. Association between neck pain and socio-demographic factors.

In terms of age, in this study the majority of the respondents' age was fallen into age group 18-29 years 44.2%. There were significant associations between age groups (30-39) and (40-49) years and neck pain. While while age group (50-59) years have showed no significant association. This reverse U-shaped association between age groups and neck pain was in agreement with other studies<sup>3+25+26+27</sup>. And could be explained as the risk of neck pain increased until the age of 50 and decreased slightly thereafter, and the increase with age could be understood by increasing degeneration of the cervical spine with age, and the decrease of neck pain in the oldest age group could be that chronic diseases and other ailments may gain the upper hand<sup>3</sup>. Or could be explained as WMSDs increase with age and duration of employment. It was observed that after age 50 years and

at greater than 20 years of clinical practice, the prevalence of WMSDs declined. The lower rate of WMSDs among the very senior nurses in terms of age and years of clinical practice may be attributed to less manual handling but more administrative duties that often come with rise in job cadre, while older nurses have increased level of knowledge about injury prevention, avoid harmful physical load, and have developed better coping strategies for musculoskeletal problems than the less experienced and younger nurses. And also healthy worker effect was also implicated for the inverse trend observed between lower prevalence of WMSDs and each of older age and higher clinical experience. Which could be described in cross sectional studies as a continuing selection process such that those who remain in an employment tend to be healthier over time that in turn would lead to attenuating an adverse effect of exposure and decreasing the observed associations between WMSDs and physically demanding jobs<sup>28+29+30</sup>.

In terms of BMI, the majority of the respondents' BMI fell into the obese category 36%. Although there was a significant associations between BMI and the neck pain by using Chi square test, but logistic regression test, revealed that there was no significant. And the possible explanations could be due to work tasks and the homogeneous sample group as the respondents were females or could be due to the influence of other risk factors in logistic regression analysis, and the and this was in agreement with<sup>3+31+32+33</sup>.

Obesity is a disease which prevalent all over world that could be resulted from infrequent physical exercises, sedentary jobs such as prolonged office working hours, pregnancy, drugs intake side effects such as oral contraceptives and steroids or any other causes, and this will lead to accumulation of excess fat in any body part such as neck region; a narrow area that result in soft tissues and nerves compression that in turn lead to pain in neck region, and the obese women and men have an approximately 20% more chance of having chronic musculoskeletal pain<sup>34+35</sup>.

In terms of race, majority of the the respondents were Malay 44.7%. And there was a no significant association between race and the neck pain by using Chi square test and logistic regression test. And almost all studies revealed no significant relationship between race and the neck pain, and the variance of the prevalence rates of neck pain among populations were due to physical inactivity, BMI, eating habit, alcoholism or smoking<sup>36+37</sup>.

### **3. Association between neck pain and work related factors.**

In terms of categorised into 5 working departments as abovementioned, by using Chi square test there was no significant relationship between the neck pain and the working departments in present study. However, the 12 months prevalence rates of neck pain among according to working departments of UMKCC in medical departments, surgical departments, anesthesia and intensive care department, nursing management and emergency department were 39.3%, 56.9%, 43.8%, 35.3% and 60% respectively. This insignificant relationship could be explained that present study focused on computer using related risk factors of the neck pain rather than other risk factors of the neck pain itself such as excessive force use in lifting patients in bed and transferring patients out of bed because excessive force use could cause neck pain indirectly due to trapezius muscle stretching affect that in turn could cause shoulder and neck pain. In present study was focusing on neck pain risk factors in terms of computer using, however, high prevalence rates of neck pain were high surgical, anesthesia and intensive care and emergency departments where the excessive force use is common which is in agreement with other studies This was in agreement with other study<sup>10+38+39</sup>.

In terms of working duration, there was no significant relationship between the neck pain and the working duration in present study by using Chi square test. And this insignificant relationship could be explained be due to short employment duration of the majority of newly recruited registered female nurses according to nursing management department of UKMMC data base which was in agreement with other study<sup>40</sup>.

However, the association between the neck pain and the employment duration could be explained according to NIOSH 1997) one of the risk components of cumulative WMSDs is the length of exposure duration or could be explained the ageing process and muscular strain due to computer uses<sup>26+30+40+41</sup>.

In terms of night shifts, there was significant relationship between neck pain and night shifts in this study by using Chi square test and logistic regression test. And this significant association could be explained either according to NIOSH 2012 and other studies<sup>15+18</sup> as the working at night shifts could lead to muscle weakness which in turn lead to lack of support to the all joints of the body and as a consequence the risk of initial fatigue and overexertion injury will be increased or the day shifts were far more demanding the number of activities related to patients' care than afternoon and night shifts which in turn could make the number of nurses in charge during night shifts to be substantially lower than during day shifts and impose an overload and affect the health of the nurses<sup>42+43</sup>.

### **4. Association between neck pain and lifestyle factors.**

In this study, the prevalence rate of the neck pain among registered female nurses who were smokers was 33.3%; 3 out of 242 respondents have reported that they were smokers, and Chi square test showed a

statistically insignificant association between the neck pain and the smoking, which was in agreement with other studies<sup>3+11+33</sup>. And the possible explanation of this insignificant association could be due to the majority of registered female nurses in UKMMC were not smoking.

The objectives of studying the smoking in present study were to corroborate efficiency and effectiveness of anti-smoking educating messages on smoking harmful health effects that have provided by the nurses, doctors and teaching staff<sup>44</sup> and to highlight awareness and perception of Malaysians about health risks of smoking. Malaysia like other Islamic countries, the smoking among females 1.6% could be considered as social stigma comparing with the males 46.4% according to WHO 2011 report on the global tobacco epidemic; therefore there was an insignificant association between neck pain and smoking as it was already expected. However, other studies showed that there is association between WMSDs and smoking<sup>45</sup>.

In terms of physical exercises, there was significant association between the neck pain and regular doing physical exercises at least 3 times per week<sup>6+7</sup> by using Chi square test and logistic regression test. The prevalence rate of the neck pain among the respondents was more than half, 52.1% of them did not do physical exercises regularly. And the possible explanation could be that the lack of physical exercises lead to muscle weakness which in turn lead to lack of support to the all joints of the body and as a consequence the risk of initial fatigue and overexertion injury will be increased<sup>45+46+47</sup>. And this significant association was in agreement with other studies<sup>41+48+49</sup>.

Generally there is no public widespread knowledge about physical exercises recommendations, as a survey done in USA by Centers for Disease Control and Prevention and American College of Sports Medicine among people knowledge about these recommendations showed that only third of them had accurate knowledge, therefore there was a need for more effective campaigns to promote physical activity among the people<sup>50</sup>.

##### **5. Association between neck pain and ergonomic factors.**

The studying of awkward neck postures in this study was done in terms of awkward bent and twisted neck postures. The 12 months prevalence rate of neck pain among the respondents who bent their necks was 56.4%. And statistically there was a significant association between neck bending and the neck pain by using Chi square test and logistic regression test. In this study according to OSHA guidelines 2008, the distance of computer's display, using copyholder and arm resting on table which could cause or be related with neck bending. The majority of the respondents 82.6% did not use copyholder, 63.6% reported that the distance of computer's display was not at their own arm's length from their eye level, which could make them to extend forward or flex forward necks, and this which was in agreement with other studies<sup>3+51+52+53</sup>.

The explanation of this significant association; first, could be due to the muscles and ligaments around cervical joints were stretched or compressed during neck extension or flexion forward<sup>51</sup>, second, could be explained due to these increased neck flexion angles were associated with increased upper trapezius muscle activity and with neck and shoulder discomfort in office workers, and the neck pain was twice as likely for those sitting in poor posture with the head in a flexed forward position<sup>3+52</sup>, or third, could be explained due to the lower display heights the more head and neck flexion with more spinal asymmetry when working on computer.<sup>53+54</sup>

The 12 months prevalence rate of neck pain among the respondents who twisted their necks was 42.7%. And statistically there was no significant association between neck twisting and the neck pain by using Chi square test. The studying of awkward twisted neck posture was done in this study to determine the association between neck twisting and the neck pain, to corroborate the association of the computer's display position to the users and the neck pain. And the explanation of this insignificant association between the neck twisting and the neck pain; first, could be explained due to monitor placement with respect to the eyes of the users as most of the nurses 51.7% have reported that computer's display position was in front of them<sup>55</sup> or second, could be explained due to small sample size of study, most of the respondents, 44.2% were in young (18-29) age group or the short observation periods that made the results less meaningful than they could be in a more elaborate study<sup>56</sup>.

Furthermore, according to Norwegian National Institute of Occupational Health examination evidence report on the systematic review of association between the computer work and WMSDs of the neck and upper extremity disorders stated that the results of 22 studies (26 articles) have showed limited evidence for a causal relationship between computer work per se, computer mouse and keyboard time related to a diagnosis of tension neck syndrome, forearm disorders and wrist, and insufficient evidence was found for an association between other WMSDs diagnoses of the neck and upper extremities, and have concluded that there was a limited epidemiological evidence for an association between aspects of computer work and some of the studied clinical diagnoses, and none of the evidence was considered as moderate or strong so there is a need for more and better documentation<sup>57</sup>.

In terms of repetitive movements of neck, there was no significant association between the neck pain and the repetitive bending and twisting movements of neck by using Chi square test. which was in agreement

with some studies<sup>58</sup>. In this study, associations of repetitive neck movements and awkward neck postures with neck pain was studied, and the repetitive neck movements studying was limited to the respondents who kept their necks in awkward bent or twisted postures which in turn minimized the number of respondents in this study. And this done due to according to other studies<sup>59+60</sup> prolonged neck bending and repetitive movement were associated more with shoulder pain or neck & shoulder pains together so to proof this tripartite association, repetitive movements was limited to those who kept their neck in awkward postures.

The muscles in the neck and shoulder regions usually act as stabilizers and static contraction of the trapezius and other shoulder muscles are needed to keep the arms at right angles. This contraction is accentuated when there is also rotation or bending of the neck when the computer screen is placed to the side of the worker, not in front which is the recommended position, and the neck pain was twice as likely for those sitting in poor posture with the head in a flexed forward position<sup>3</sup>.

In terms of working hours on computer, there was significant relationship between the neck pain and the prolonged working hours; more than 4 hours on computer by using Chi square test and logistic regression test. And 12 months prevalence rate of the neck pain among respondents who spent more than four hours on computer was 56.7%. And this significant association could be explained as remaining seated for long periods, usually accompanied by curvature of the spine, increases pressure on cervical vertebra discs, ligaments, and muscles of the neck and upper limbs<sup>61</sup>. And Many studies have showed that the duration of computer use, frequency of breaks, method of keyboard operation, position of computer monitors, type and use of input devices were associated with neck pain at work, and taking mini breaks of 30 seconds once every 20 to 40 minutes is an effective means to reduce neck pain at work and these short breaks with no adverse effect on productivity<sup>45+62+63</sup>.

#### **6. Association between neck pain and psychosocial factors.**

Among many psychosocial risk factors of WMSDs complaints, work satisfaction, personnel shortage, mental tiredness at the end of workday, sufficient break-time, co-workers support, supervisors support, co-workers' friendly dealing and supervisors' friendly dealing factors were done<sup>3+31</sup> which which showed 43.9%, 53.2%, 40%, 43.3%, 43.2%, 45.1%, 43.5 and 41.7% respectively 12 months prevalence rates of neck pain among respondents. However, only personnel shortage showed significant association with the neck pain by using Chi square test and logistic regression test.

This significant association could be explained as that the personnel shortage might was an indirect reflection of work overload which was in agreement with consistent evidences in previous cross sectional and longitudinal studies<sup>3+26+64</sup>.

According to other psychosocial risk factors, even though they were not significant statistically but showed marked 12 months prevalence rate of the neck pain, which could be explained as when the physical demands an included in a model of WMSDs complaints, the significance of psychological demands will be disappeared<sup>65</sup>, or could be explained according to (Rahmah et al 2008) as the psychosocial risk factors could affect the risk of injury, severity and healing process. And by taking mini breaks of 30 seconds once every 20 to 40 minutes will allow a reduction in computer exposure and permit muscle relaxation without adverse effect on worker productivity<sup>61+62</sup>. However, in a cross sectional survey it is difficult to determine whether the pain proceeds or follows the psychological symptoms.

#### **7. Neck Pain Severity.**

As abovementioned in table 1 the results of neck pain severity in terms of working departments in last month in this study between 15 September and 15 October 2012 is to some extent in agreement with a study was done in Turkey among the nurses, to determine the prevalence rates and the risk factors of WMSDs of low back, shoulder and neck complaints, and the results have showed that and the nurses who were working in the departments of general surgery and obstetrics & gynecology had more WMSDs complaints than the nurses in other departments<sup>10</sup>. Also neck pain disability have assessed through neck pain interfering with daily work activities according to study in Belgium<sup>3</sup>, and in this study the respondents have reported that neck pain interfered with their activities from minimum one day to maximum three weeks, on average one neck pain have interfered them about 7 days in doing their daily work activities during working hours, regardless the working departments.

#### **8. Economic Burden of Sick leave due to Neck Pain.**

Work related neck pain in present study population caused a rate of sick leave in the past 12 months of 42 days, which ranged from one to three days, and according to Malaysian salary schedule 2012 data base in nursing management department in UKMMC; the basic salary of nurses with diploma in nursing and degree in nursing start from 1780.34 RM and 2274 RM with annual bonus about 36 RM and 100 RM respectively.



According to present study, the most of respondents had diploma in nursing 88.8%, so the cost of each day of sick leave will be according to them, and the employment duration ranged from one to seventeen years, and as abovementioned nurses with diploma in nursing their basic salary was 1780.34 RM (about 60 RM per day) for those who have employment duration of one year and 2206.11 RM (about 74 RM per day) for those who have employment duration of seventeen years. And average of them will be 67 RM per day (60 RM plus 74 RM divided by 2), so cost of one day sick leave due to neck pain was 67 RM.

Generalizing this feature to the overall nurses' population in Malaysia would yield considerable lost working days during the preceding year. This estimation indicates that in this occupation "nursing", regardless of indirect costs and negative effects of work related neck pain on quality of services and productivity, work related neck pain have caused pronounced direct costs in the form of lost working days<sup>66</sup>.

## **VI. Conclusion.**

In this study registered female nurses; the respondents reported a 1 month point prevalence rate from 15 of September to 15 of October 2012, 36% and 12 month period prevalence rate, 45.5% of neck pain, which was compatible with many other studies, the variables that have been studied in terms of literature review of present study in Chi square test and that showed a significant relationship with neck pain were age, BMI, physical exercises, working time on computer, night shifts, personnel shortage and neck bending, while logistic regression showed the variables had significant relationship with neck pain of registered female nurses were; age groups 30-39 ( $p= 0.011$ ) and 40-49 ( $p= 0.040$ ), physical exercises ( $p= 0.025$ ), working time on computer ( $p= 0.029$ ), night shifts ( $p= 0.001$ ), personnel shortage ( $p= 0.005$ ) and neck bending ( $p= 0.013$ ).

Furthermore, (10.7%) of the respondents had medical leave from work due to neck pain and only (4.5%) of them have changed their work because of neck pain, and lastly (16.5%) of registered female nurses with neck pain had minimal hindrance or disability which have meant the daily life activities performance without any difficulties.

Although this study was unable to conclude significant result to several factors, other research has concluded association between those factors with neck pain such as BMI, repetitive neck movements, working department, most of psychosocial risk factors. The reasons could be due to small sample size of the study and it was also homogenous in term of gender.

## **VII. Recommendations.**

Based on the present study results suggest that effective intervention strategies aiming at reducing the occurrence of neck pain most likely have to take into account both ergonomic improvements, psychosocial work factors and cognitive behavioural aspects. Intervention should be applied to reduce computer exposure and also toward improving ergonomic conditions. Dynamic and sit/stand chairs will lead to more variation in posture and comfort. The use of document holders, a correct placement of the screen and adjustable chairs will reduce the neck load.

Ergonomic studies were done years ago have indicated that a correct placement of the screen, adjustable chairs and keyboard and document holders use were important factors in providing a comfortable work environment and preventing a broad range of computer use associated WMSDs such as eye, neck and back strain, fatigue, headaches, and wrist, hand, elbow and shoulder disorders, also have showed dramatically improvements through use of good ergonomic designs.

Ergonomic healthy education programs designing to raise knowledge about safe work practice through introducing a message to the studied registered female nurses who are computer users about the right manner of safe ergonomic practice accompanied with illustration of ergonomic posture for computer users which is advised to be such as top of monitor at or just below eye level, shoulder relaxed, and elbows close to body and arm supported and wrists in line with forearms and feet flat on the floor.

Arranging for task variation and job and worker rotation, rearrange workstation and providing work station with ergonomic chairs like Aeron and Exercise Ball chairs and workstation accessories such as document holder, footrest and wrist rest. The approach of ergonomic principles and bio-mechanics education and training programs of proper computer using in the work stations, that kind of knowledge for the frontline health care providers can improve the working environment and as a consequence preventing injury and promoting safe work place are also very important in work place.

Nurses can be advised to do regular exercises to strengthen their muscles at least three times per week for minimum twenty minutes, engaging computer users in physical activity as part of their work day would be an appropriate prevention strategy, and encouraging leisure activities may be beneficial in sedentary workers because physical activity facilitates both mechanical and metabolic processes that are healing for musculoskeletal tissues.

Taking mini breaks of 30 seconds once every 20 to 40 minutes is an effective means to reduce neck pain at work and these short breaks have no adverse effect on worker productivity, also nurses can be advised to do neck exercises during working hours<sup>62</sup>.

Employers should ensure ergonomic adjustment in work places to reduce the risk of neck symptoms or injury such as adapting "The Take-a-Stand" project and using Ergotron sit-stand workstations products to meet the physical needs of workers which creates a work environment that promotes wellness while improving productivity; Ergotron is a member of the human factors and ergonomics society, reflecting dedication to workplace wellness while contributing to the study of ergonomics<sup>67</sup>.

Employers may be able to reduce neck pain in the workplace by increasing the collective decision making of employees, and insuring that workers have support from superiors when making decisions.

The psychosocial risks faced by nurses require attention in order to prevent the progression of prolonged work related pain into work instability which could lead to work related disability<sup>68+69</sup>.

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