ORIGINAL ARTICLE

THE PREVALENCE OF CARPAL TUNNEL SYNDROME AMONG COUNTER WORKERS IN TELECOMMUNICATION COMPANY

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ABSTRACT

The objectives of this study are to determine the prevalence of carpal tunnel syndrome (CTS) among the frontline counter workers and the associated risks. A cross sectional study was conducted among 100 frontline counter staffs whose working at the telecommunication company in Klang Valley area. A stratified random sampling was used to select the respondents. Respondents were interviewed by using structured questionnaire and Cornell Musculoskeletal Discomfort Questionnaire (CMDQ). The structured questionnaire is used to determine demographic data, meanwhile CMDQ is to measure the discomfort of both right and left hands. A Rapid Office Strain Assessment (ROSA) is designed instrument to quantify exposure to office work environment. ROSA is a picture based posture checklist to obtain the risk level of workstation. The finding revealed that the prevalence of CTS among counter workers of the telecommunication company was 63%. Chi Square test indicated that there was no association between sociodemographic factors for age, gender, BMI, and race except marital status and education level with p>0.05. On the right hand, nearly 53% of the respondents had discomfort on the index and middle finger (x^2=8.45, p=0.07), 31% on the ring finger and pinkie (x^2=6.97, p=0.13), 42% on the distal thumb (x^2=1.93, p=0.75), 38% on the hand and metacarpal area (x^2=7.36, p=0.12), 53% on the thumb base (x^2=3.95, p=0.41), and 40% reported discomfort on the heel of hand (x^2=4.50, p=0.34). There was no significant association between office work design and CTS. This study found that the counter workers in telecommunication company reported high case of CTS. The prevalence of CTS was high however showed no association with the workstation assessment among counter workers area.

***Keywords**: Carpal Tunnel Syndrome (CTS), Cornell Musculoskeletal Discomfort Questionnaire (CMDQ), Rapid Office Strain Assessment (ROSA), counter workers,*

INTRODUCTION

Cumulative Trauma Disorder (CTD) has caused both personal and socio-economic impact worldwide. In various parts of the globe, CTD could also be referred to as Work Related Upper Limb Disorder, Occupational Overuse Syndrome, or Repetitive Strain Injury[1]. Carpal Tunnel Syndrome (CTS) is one of the common work-related upper limb musculoskeletal disorders (WRULDs). The main cause of the CTS is due to the compression of the median nerve by the carpal flexor retinaculum that forms the palmar aspects of the carpal tunnel when too much pressure is stressed out on the nerve that runs through the wrist. On the basis of clinical examinations and nerve conduction studies, it has been approximated that one in every five subjects who complain of symptoms such as pain, numbness and a tingling sensation in the hands could have CTS[2].

The usage of computers becomes a main focus in many previous studies associating the relationship of different jobs and the factors influencing the occurrence of MSD[3]. Based on the occupational injuries or illnesses and fatal injuries profile, the incidence rates involving days away from work by service-type of occupation in telecommunication indicated 171 cases in 2014[4]. Meanwhile the incidence rates of MSD in the very same year was 33.8 cases in addition to the most affected part of body noted as the upper extremities with 32.0 incidence rate.

Thus, it is crucially important to determine the relationship between computer users and the ergonomics health effect among Malaysian telecommunication workers. In context of preventing further deteriorating health effect among the subjects, a baseline study should be conducted to ascertain the existing incidence rate of CTS as well as to emphasize the risk related to the health effects in order to formulate a suitable control measures in averting the problem. Therefore, the objective of this study was to determine the prevalence and its association with risk factors of CTS among counter workers in the telecommunication company.

Frontline counter workers are engaged with the service schemes involving almost hundred customers per day. In the job scope of customer service, the use of computer or visual display units (VDU) are required in most of the work process. The usage of these VDU can give an adverse health effect to the wrist and arms. Prolong exposure to the computer usage can lead to development of Carpal Tunnel Syndrome (CTS) and health effect such as musculoskeletal disorders in the upper limb. The requirement of VDU use may provide advantages such as efficiency and productivity, however this poses a higher risk for workers to be affected by

development or reported of carpal tunnel syndrome (CTS).

Health effect due to the usage of computer or any VDUs ought to be avoided since the main purpose of using them is to assist the workers doing their task easier and convenience for the customers. However the effect of CTS will cause the employees having high risk of non-fatal occupational injuries due to loss of hand and wrist sensation or strength. For example, slower keying data process could happen if the workers lose the sensation at fingertips or hands hence causing the pain or discomfort in which consequently can disturb the work task and this problem will probably interfere the workers' quality of life as well.

METHODS

Subjects

This cross-sectional study aimed to determine the prevalence of CTS and its association with both occupational and non-occupational risk factors among counter workers in a telecommunication company. The subjects were randomly selected through stratified sampling to represent a number of service centres where the service counters were located. A total of 100 workers were being recruited to participate in this study. In order to determine the study respondents, selection criteria's was adopted;
Workers that served customers at the frontline counters with at least 6 months job tenure. In addition, any experience of wrist fractures, dislocation or surgery, diabetic, pregnant, menopause, hypothyroidism, and arthritic were excluded. There was no dropped out respondents (100% response rate) in this study as all respondents had been chosen first by the selected criteria.

Questionnaire

In collecting data, a number of methods and instrument were involved. A structured questionnaire was used and divided into three sections; Part A-socio-demographics, Part B-work practices, and Part C-previous working history. In Part A, it consisted of question about the background of respondent such as gender, age, marital status, educational level and race. Meanwhile Part B asking about the work practices of respondents pertaining type of computer used, dominant hand, major hand typing, hand stretching routine, and the usage of tablet or smartphone. On the other hand, Part C consisted of the working background such as the previous employment experience, and the current part time job, if any. Additional information related to height, weight, body mass index (BMI) was obtained in the questionnaire as well. The first stage of data collection was the distribution of preliminary questionnaire in order to include only those respondents poses the selection criteria. The second stage involved those eligible respondents to answer the structured questionnaire and Cornell discomfort questionnaire (CMDQ) as well as the workstation assessment.

Phalen's test

The screening of CTS's diagnosis was based on Phalen's test[5]. Respondents were requested to set a pressure on the wrist by pushing the surface of hand's dorsal using both hands for 60 seconds. Afterward, the respondents would inform if any clinical symptoms felt such as numbness, pain or tingling on any part of the hand and wrist. These inputs were used to determine the prevalence of CTS. The sensitivity and specificity of Phalen's test are 75% and 71% respectively[6].

Cornell Musculoskeletal Discomfort Questionnaire (CMDQ)

In order to determine the prevalence of MSD, Cornell musculoskeletal discomfort questionnaire was used. For both right and left hand, the respondents were asked on the frequency, intensity and work disturbance of hand discomfort. There were six areas of hand involved in this questionnaire which are the index and middle finger, ring finger and pinkie, distal thumb, hand and metacarpal area, thumb base, and the heel of hand. The scores outcomes from the questionnaire were analyzed by simply counting the number of symptoms per person.

Rapid Office Strain Assessment (ROSA)

The assessment of the design of work environment was carried out by using ROSA method[7]. ROSA is a picture based posture checklist designed to quantify exposure to risk factors in an office work environment. The working posture was recorded using video camera for 15 minutes. The final grand score was ascertained according to the calculation of each section; chair, telephone and monitor, and keyboard and mouse. The ROSA final score was broken into two areas: further assessment not immediately required, and further assessment required as soon as possible.

Statistical analysis

Data had been collected and analyzed using Statistical Package for Social Science programme (SPSS) version 22. Types of statistical analysis test used were univariate analysis and bivariate analysis. Univariate analysis was used to obtain the descriptive values such as mean, standard deviation, and percentage, showing the basic statistical data of information such as age, gender, educational level, race, marital status, dominant hand, type of computer used, major hand typing, hand stretching routine, usage of tablet or smartphone, and working background. Meanwhile, bivariate analysis used Chi-square

test to determine the association of CTS symptoms and the risk factors namely socio-demography, work practices, working background, hand discomfort, as well as office assessment among the respondents.

RESULTS

There were a total of 100 respondents participated in this research. Most of the respondents were in the category of more than 31 years old (50%) and the mean of age were 31.8±6.64 years old. Majority of the respondents were female (76%) and majority of them are Malay (97%) while a few of them are Indian (3%). Nearly 45% of the respondents are overweight and 22% are obese. However, there are 8% of respondents who are underweight apart from 25% who have normal BMI. A large number of respondents were married (73%) and only 25% are single and the rest are divorcee (2%). On the educational level, majority of the respondents are STPM/Diploma (53%) holder, 27% respondents at SPM level and 20% are at degree level. Most of the respondents use the desktop (53%) type-of-computer and about 7% use laptop, meanwhile 10% of them use both desktop and laptop. Most of the respondents had been employed (69%) previously before working at the current telecommunication company. There were 55 respondents who had previous employment involving the use of computer (55%). About 11% of respondents have current part time job apart from working at the telecommunication company while majority of them do not have any part time job currently. The overall prevalence of Carpal Tunnel Syndrome (CTS) based on Phalen's test was 63% (Table 1). Majority of the respondents reported the pain sense (41%), followed by the numbness sense (35%) as well as the tingling sense (26%).

Table 1 – Prevalence of CTS

Variable		CTS Symptom (n=100)	
		Yes n (%)	No n (%)
Experience CTS symptoms	Numbness	35 (35%)	65(65%)
	Tingling	26 (26%)	74(74%)
	Pain	41(41%)	59(59%)
	Total	63(63%)	37(37%)

DISCUSSION

Prevalence of HAVS

The study revealed that for the prevalence of CTS, a total of 63% of the respondents reported the symptoms as based on the result of Phalen's test. The CTS symptoms were pain and numbness on their wrist, thumb, index fingers and middle fingers. Table 1 showed that among the three symptoms reported on CTS, pain (41%) was the highest complaint of symptoms among the respondents, followed by numbness (35%) and tingling (26%). The prevalence was slightly higher than other study because this study used questionnaire and physical examination to determine the prevalence and the respondents might had given the wrong data or information. Factor that might contribute to the high prevalence of this study was the over-estimation of the respondents pertaining the experienced symptom/s. Therefore, the accuracy of the reported data relied on the honesty and perception of respondents in answering and identifying the CTS symptoms without the diagnosis of any physician. A study done by Spielholz *et al*. founded that the subjects often are inaccurate when reporting specific health effects[8].

Study was done among 1250 government servants gave the prevalence of CTS of 18%[9]. Another study is conducted among 9480 members of a trade union of the Danish Association of Professional Technicians showed the self-reported prevalence of 10.9% reporting tingling/numbness in the right hand at the baseline[10]. The prevalence of CTS obtained from this study was relatively higher compared to other studies and it could be due to several other factors linked to working condition among counter works such as long working hour more than 8 hours per day, relatively high working exposure with computer usage and the intermittency of shift break.

The only physical examination done in this study was the Phalen's test. The physical exam helps to confirm that symptoms are related to a nerve problem, and then localize the nerve problem to the wrist. As according to Rempel *et al.*, the respondents in which had experienced numbness and tingling symptoms on their thumb, index finger and middle finger during Phalen's sign test for 60 seconds will be categorized as experienced CTS symptoms.

Association of CTS and socio-demography factors

From the results, there were 97% of the respondents are Malay workers and only a small number of Indian respondents. Besides, most of the workers are female (76%) and the respondents are predominantly aged more than 31 years old (50%). The study showed that there was no statistical significance between CTS and socio demographic factors such as age, gender, BMI, race, type of computer used, dominant hand, typing hand, and the use of tablet or smart-phone. However, result tabulated in Table 2 showed that there was significant association between CTS and marital status, educational level, and hand exercise.

There was a significant association to the CTS symptoms in relation to the marital status in this study. A large population-based study done in central/northern Italy has illustrated that the marital status showed higher incidence peaks of in-hospital cases of CTS[11]. Results showed that the CTS symptoms were positively associated with the level of education among the respondents. Based on the result, most of the respondents have STPM/Diploma level of education.

Table 2- Association of CTS and Socio-demography factors.

Variables	χ^2	p-value*
Age	2.334	>0.05
Gender	0.831	>0.05
Body Mass Index (BMI)	1.285	>0.05
Race	0.018	>0.05
Marital Status	5.991	<0.05*
Educational Level	12.047	<0.05*

Association of CTS and Working background

In Table 3 it was revealed that those who had previous employment before working as the counter workers at this telecommunication company showed no significant association towards CTS. This might be due because of the differences between employed job fields among the respondents. On the other hand, this study also indicated a significant association between those who had previous employment involving computer use and the reporting of CTS symptoms. Although this result was contradict with another study done by Liu et al., in 2003 which found no significant correlation between CTS development and duration of employment involving the usage of computer (r=0.220,p=0.146). The different result with respect to other report may depend on case inclusion criteria and the occupational activities

of the subjects or respondents. In fact, the respondents involved in this study were ensured to be working as of computer operators and working experience must be at least of six months. In addition, these counter workers are subjected to duration of training first beforehand to ensure high efficiency in catering the customer services scheme. Table 3 also indicated that there was no association between CTS and current part time jobs. It is probable that not many of the respondents have part time jobs while being full employee at the current telecommunication company.

Table 3 – Association of CTS and working background.

Variables	χ^2	p-value*
Had previous employment	2.499	>0.05
Previous employment involving computer use	4.961	<0.05*
Current part time jobs	0.502	>0.05

Association of CTS and work practices

Table 4 summarizes the association between CTS and the work practices factor. The association of CTS symptoms and hand exercise showed a significant p-value in this study. The respondents were being asked on whether they did the hand exercise such as light stretching on basis of before, after or during their working task. A few studies have shown a positive relationship between low CTS risk and hand exercise routine. A number of exercises have been recommended for the prevention of musculoskeletal discomfort among VDT (Visual Display Unit)/office workers[12]. This study suggested a need for greater attention to the practical aspect of exercise which is readily performed at the workstation to be promoted for VDT users. Apart from that, the type of computer used had no relationship as contributing to CTS due to the same functionality offered by either laptop or desktop computer which is likewise. In the context of dominant hand, the study revealed no association between CTS occurrence.

This was contradicting with a study done by Reinstein which found that CTS occur significantly more frequently in the dominant hand of both right-and left-handed persons[13]. The clinical implications of these findings were discussed, particularly as they are related to the role of repetitive hand activities in the etiology of CTS. This study also concluded that the increased daily activity of the dominant hand is a contributing factor in the development of CTS. Table 4 also reported no association between CTS and hand typing among the respondents and this result is in agreement with the report by De Krom et al. that there was no association between CTS and typing could be demonstrated[14]. In spite of no association between CTS and both dominant hand and typing hand, this can be explained by the physical activities or hobbies done by the respondents apart from working job. The intensive and repetitive use of hand and wrist might be due to such activities apart from the usage of computer itself. Even though the use of tablet or smartphone showed no relationship towards contributing to CTS, other study has resulted otherwise. A study conducted on the effect of CTS on smartphone users had concluded that the use of smartphones for too long can be considered to adversely affect the wrist, as well as continued use can be considered to induce muscle fatigue[15].

Association of CTS and Rapid Office Strain Assessment (ROSA)

Based on the ROSA assessment, there are three distinct sections namely chair, mouse and keyboard as well as telephone and monitor sections, that need to be assessed beforehand as to obtain the final score, deemed as high risk or low risk. The ROSA final scores ranged in magnitude from 1 to 10, with each successive score representing an increase presence of risk factors. Research has shown a correlation between discomfort levels and increasing ROSA scores[7]. However, in this study it was founded that there was no association between ROSA and CTS symptoms among the respondents. Therefore, the work station design of the respondents exhibited a low risk of CTS, proving that the working posture is of good state. On the other side, some finding show that ergonomic analysis of the work postures has identified that it was highly likely to generate work-related musculoskeletal disorders among dental hygienists[16]

Table 4 – Association of CTS and work practices

Variables	χ^2	**p-value***
Type of computer used	2.634	>0.05
Dominant hand	0.002	>0.05
Typing hand	1.246	>0.05
Hand exercise	3.748	<0.05*
Use of tablet/ smartphone	1.194	>0.05

N=100

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Table 4 – Association of CTS and office assessment (Rapid Office Strain Assessment)

Variables		χ^2	**p-value***
Office Assessment	Low Risk High Risk	1.969	>0.05

N=100

Association of CTS and Hand Musculoskeletal Discomfort

This study found that the self-reported prevalence of Musculoskeletal Discomfort (MSD) among frontline counter workers in a telecommunication company was 70.0% with 70 of 100 respondents reporting pain. Table 5 summarized the work disturbance factor due to hand discomfort towards the reported CTS symptoms.

There was a significant association between work disturbance on index, middle finger and heel of hand, and CTS symptoms on the right hand respectively. This might be due to the dominant hand used among the respondents which was mainly right handed. In addition, most of the typing fingers involved were the main index and middle finger, meanwhile heel of hand acted as the resting base for the hand while typing. A study done by Mircea in 2006 reported a high prevalence of discomfort/pain/ache on the right side of wrist level which was 95.5% as compared to the 86.5% of left side. Additionally, the area in the distal proximity of the wrists was the most affected site being indicated in 90% of cases for left side and 95% of cases for the right side. Based on Cornell Musculoskeletal Discomfort Questionnaire (CMDQ), there were six areas of each right and left hand that were evaluated. Discomfort was assessed on these six areas on hands.

Limitations of the study

There were several limitations in this study. For instance, the study focused on the frontline counter workers in the customer service scheme of telecommunication company. Therefore, the findings from this study can only be generalized to the population having the similar characteristic only as compared to the whole telecommunication industry.

The reported of CTS symptoms and some other information were based on questionnaires without diagnosis of physician or medical doctor. Therefore, the accuracy of research data relied on the honesty and perception of respondents in answering the questionnaires. Data from the Questionnaires could be subjected to respondent's recall bias because sometimes the respondents have the possibility to overestimate or under estimate the
symptoms.

It was difficult to determine the actual posture accurately when assessing the workstation area. The workers need to do their task as usual without interruption since they work as the frontline customer service and any interruption can cause delay and need to be avoided since there is no break unless shift changes.

The exposure estimated could not represent the actual exposure as cross sectional study design only consider of the exposure during that particular time of assessment In addition the number of respondents involved in this study was small as compared to other studies. Hence the results probably were not conclusive thoroughly to be generalized to a bigger population.

Data from the questionnaires as well as the Phalen's test conducted could be subjected to respondent's over- or under-estimation. The the perception of the respondents. For example, the findings could be less accurate and precise when using the Phalen's test as compared to the use of the gold standard method, namely the nerve conduction test. However due to the unavailability of this particular tools, only Phalen's test was the convenient option

CONCLUSION

As a conclusion, CTS was prevalent among counter workers in telecommunication company with the prevalence rate of 63%. Though this study shows a high prevalence of CTS among the respondents, the findings of this study have not been able to signify the association between both occupational and non occupational risk factors except for marital status, educational employment involving computer use, as well as work disturbance due to hand discomfort.

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COMPETING INTERESTS

There is no conflict of interest.

Table 5 – Association of CTS and work disturbance on hand musculoskeletal discomfort

Variables		χ^2	p-value*
Index, middle finger	Right	5.445	<0.05*
	Left	4.567	>0.05
Ring finger and pinkie	Right	3.150	>0.05
	Left	0.007	>0.05
Distal thumb	Right	4.407	>0.05
	Left	4.136	>0.05
Hand, metacarpal area	Right	4.303	>0.05
	Left	1.773	>0.05
Thumb base	Right	2.233	>0.05
	Left	1.252	>0.05
Heel of hand	Right	6.799	<0.05*
	Left	5.399	>0.05

N=100

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