PREVALENCE OF WORK RELATED UPPER LIMBS SYMPTOMS (WRULS) AMONG OFFICE WORKERS

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ABSTRACT

Background: Work related upper limbs symptoms (WRULS) is an upper limbs musculoskeletal symptoms which is attributable to work. Office workers are potentially at risk for this problem due to their work setting which include computer and furniture.

Study objectives: The objectives of this study were to determine the prevalence of WRULS and the contributing factors.

Methodology: A cross-sectional study was carried out involving 463 office workers who were randomly selected among the study population. Information on socio demographic, hobby, medical history, job, and computer usage were collected using self-administered questionnaire. Univariate analysis and logistic regression modeling were used in the analyses to determine the prevalence of WRULS and also the factors associated with WRULS.

Results: A total of 463 (87.7%) participated in the study. The mean age (range) of the respondents was 34.1 (18-55) years old. Majority (91.6%) were Malays and female (72.8%). Nearly 90 percents attained at least upper secondary of education. The prevalence of WRULS was 33.0% (95% C.I.: 28.8%, 37.3%). The odds of WRULS among computer users was 2.0 (95% C.I.: 1.1, 3.4%) compared to non user. Computer usage of 5 hours and more per day was associated with an increase in odds by 7.5 (95% C.I.: 2.3, 24.2).

Conclusion: About one in three workers had WRULS. These symptoms were associated with computer usage.
CHAPTER 1

BACKGROUND OF STUDY

1.1 Introduction to the subject

1.1.1 Work-Related Upper Limbs Symptoms: General concept

Work-Related Upper Limbs Symptoms (WRULS) is by definition a work related phenomenon. It is not a new phenomenon as almost more than 300 years ago, Bernardino Ramazzini had reported work related health problems among the secretaries and the stenographer and he postulated that motor load lead to fatigue of muscles and tendons of the arm and hands.\(^1\)\(^2\) He reported that certain jobs and certain work related factors are associated with the manifold risk contracting a WRULS compared with other population groups or groups not exposed to these factors.\(^1\) His observations were as follows:

"Various and manifold is the harvested of diseases reaped by certain workers from the craft and trades they pursue. All the profit that they get is fatal injury to their health, mostly from two causes. The first and most potent is the harmful character of the materials they handle. The second I ascribe to certain violent and irregular motions and unnatural postures of the body, by reason of which, the natural structure of the vital machine is so impaired that serious disease gradually develops therefrom."\(^3\)

WRULS or disorder is not a medical diagnosis per se, but a label for pain perception. This WRULS term is used as an "umbrella" to include not only muscle pain but also known other constitutional conditions such as carpal tunnel syndrome, tennis

- 1 -
elbow and tenosynovitis. The cause is multifactorial and work activity may contribute to but are not the sole cause for the development and exacerbation. Individual, social, and cultural factors play similarly important roles in the development of WRULS. Therefore, improving a single workplace factor would not result in substantial reduction of the prevalence of these disorders.

In contrast to “occupational diseases” where there is a direct cause and effect relationship between hazards and disease, the World Health Organization (WHO) expert committee described “work related” disease as:

“they may be partially caused by adverse working conditions; they may be aggravated, accelerated or exacerbated by work place exposures; and they may impair working capacity. It is important to remember that personal characteristics, other environmental and socio-cultural factors usually play a role as risk factors for these diseases”

In May 1996 the World Health Assembly approved a Resolution on Global Strategy for Occupational Health for All. One of the objectives of the strategy required the establishment of registration and data systems in occupational health. In 1997, WHO in co-operation with National Institute of Occupational Safety and Health (NIOSH), United State of America, prepared a draft document on the use of ICD-10 in occupational health. A group of experts reviewed the draft in July 1998 in Geneva and proposed some improvements. The main purpose of this document is to serve as a guideline for the use of ICD-10 in notification of occupational diseases in countries which do not have a well-established notification system. Many musculoskeletal diseases can be related to work.
Due to the multifactorial origin of these diseases, the etiologic fraction due to work is often difficult to assess. Upper extremity pain and other symptoms are prevalent also in other types of tasks which involve repetitive, but usually not highly strenuous movements, such as modern keyboard work and typing. Disease of the musculoskeletal system and connective tissue was coded from M00-M99 in the ICD-10 documents.\textsuperscript{11}

In United States of America, the Department of Labor has issued guideline that provides official interpretations for recording and reporting occupational injury and illness. According to that guideline, “work related upper limbs disorder” must be recorded on the OSHA 200 form as an occupational illness under the “disorders associated with repeated trauma”. To be recorded the symptoms must be diagnosed as disorder and proven work related.\textsuperscript{12}

In Malaysia, under Factory and Machinery Act (FMA) 1967\textsuperscript{13} and Occupational Safety and Health Act (OSHA) 1994\textsuperscript{14} requires employer to notify to the nearest Department of Occupational Safety and Health (DOSH) of any diseases as listed in Third Schedule of FMA 1967. In this schedule “subcutaneous or acute bursitis of hand or wrist resulting from manual labour causing severe or prolonged friction or pressure” must be notified.

In 1994, Department of Bureau of Labor Statistics (BLS), United State of America indicated that there were approximately 705,800 cases of work related musculoskeletal injuries resulted from overexertion or repetitive motion. Of these injuries, 92,576 were due to repetitive motion (including typing or key entry)\textsuperscript{15}
1.1.2 WRULS: Terminology and synonyms

WRULS has been described differently in different countries under various terminology and synonyms. Words “cumulative trauma” and “repetitive strain” were frequently used by various countries. WHO documents used words “cumulative trauma disorders” and “repetitive strain injury” interchangeably.\(^\text{16}\)

In Japan, the term “Occupational Cervicobrachial Disorder (OCD)” was first established by the Japan Association of Industrial Health in 1972. It was not a pathologic or clinical diagnosis, but a symptom based diagnosis. The same terminology is used in Germany, Switzerland, Sweeden and Scandinavian countries.\(^\text{6}\)

In Australia, words “Repetitive Strain Injury (RSI)” which was extensively used in 1980s and later “Occupational Overused Syndrome (OOS)”.\(^\text{4}\) In the United State of America, it is known as “Upper Extremity Cumulative Trauma Disorder”, “Work-related Musculoskeletal Disorders (WMSD) “Work-related Upper Extremity Disorders”.\(^\text{6, 8, 17-19}\) Similar terms has been used in study done in India.\(^\text{20}\) Researcher in New Zealand commonly used words “upper extremity musculoskeletal strain”.\(^\text{21}\) In Great Britain, this syndrome was known by numerous terms. Previously it was known as “Tenesynovitis” or “Teno”. However in 1985 the term “Upper Limb Strain Injury” has been used.\(^\text{6}\)

1.1.3 Work-Related Upper Limb Symptoms (WRULS): Clinical perspective

Over the years, different work related symptoms such as recurring or persistent pain, numbness, aching, burning or stiffness of the shoulder, elbow, wrist, hand and neck
have been group under the heading of one umbrella term. It also constitutional conditions such as tenosynovitis, tennis elbow etc. More over, many different terms are used for this group of disorders. 4,22,23

The definition used for WRULS (diagnostic criteria or case definitions) are not consistent and require, in each individual case and in each population study, careful identification of the symptoms and signs.5

WRULS are set of conditions characterized by pain, aching, stiffness, fatigue, discomfort, tingling and/or numbness generally in the upper limbs. The symptoms is caused or made worst by the work environment. These symptoms can exist with or without loss of function. It can be caused by disorder in tendon, nerve, muscle, joint, vascular and bursa. The disorders are as below: 5,10,23

a) Tendon disorder: Tendon is part of muscle that attached the muscle to the bone or fascia, transferring force from the muscle to the bone or fascia to produce a joint motion. The tendon consists of collagen fibers arranged in a parallel fashion. Fibrous tissue surrounding the tendon forms a tendon sheath that protects the tendon against mechanical friction when passing over bony structure. Tendon sheath consist of synovial membrane that reduces the friction against the bone. Tendinitis and tenosynovitis/tendovaginitis are inflammations of the tendon and the synovial membrane of the tendon sheath respectively. Among the disorders related to tendons are:

1 Shoulder tendonitis: localized shoulder pain with tenderness
over the humeral head.

2 Lateral epicondylitis: also known as tennis elbow, which cause lateral elbow pain and tenderness over the lateral epicondyle.

3 De Quervain’s tendinitis: inflammation of tendons to the long abductor and short extensor muscle of the thumbs.

4 Hand-wrist tendinitis: inflammation of the tendon crossing the radiocarpal joint.

b) Peripheral nerves disorder: Peripheral nerves carry signals to and from the central nervous systems are nerve trunk consisting of nerve fibers and connective tissue. The nerve fibers consist of a nerve cell body with one long extension: the axon. Disturbance of the axonal transport system is probably one of the mechanisms for entrapment neuropathies. The term “nerve entrapment” refers to a pathological condition caused by an incompatibility between the volume of a peripheral nerve structure and the anatomical space available to the nerve structure. Among the nerve disorders are:

1. Carpal tunnel syndrome: compression of the median nerve at the wrist. It is characterized by symptoms of pain, numbness and tingling in the median nerve distribution of the hand, often worst at night.

2. Thoracic outlet syndrome: neurovascular impingement syndrome at different anatomical levels where the brachial plexus and the subclavian vessels may be entrapped as they pass through, en route from the cervical spine to the arm.
c) *Muscle disorder:* muscle is an organ with the ability to contract. It consists of muscle fibers, nerve elements, connective tissue and vascular element that keep the muscle fiber together. Regional muscle pain syndromes often fall under the term myofascial syndrome.

These are the muscle-related syndromes that could be associated with work exposure:

Tension neck syndrome: is a term used for myofascial syndrome localized in the shoulder and neck region. Patient usually suffers from pain in the shoulder or neck.


d) *Vascular disorder:* The disorder is hypothenar hammer syndrome which consists of symptoms and signs of digital ischemia caused by thrombosis and/or aneurysm of the ulnar artery and/or the superficial palmar arch. The most frequently reported symptoms are cold sensivity in the affected hand, numbness, paresthesia or color changes without cold exposure.

### 1.1.4 Hypothesis for muscle symptoms

Insufficient recovery after local muscular fatigue is believed to be essential in the genesis of muscular pain in static work. According to the Cinderella hypothesis, prolonged or chronic activity of single muscle fiber may cause degenerative changes of the muscle.\textsuperscript{1,24}
The hypothesis requires that there are an exist motor units that are active (1) for
time long enough to actually damage the fibers, and (2) in different posture and
throughout the movements.

Frosman et al in their study that investigate the behavior of motor unit in forearm
and wrist during computer work had found that during the wrist motion or even holding a
mouse, motor unit were found active in all phases of the movement. In their study, the
firing behavior of motor units in the extensor digitorum communis (EDC) was registered
in eight subjects during a 25 minutes static low-level contraction and during full range of
motion wrist movements.24

Localized cumulative muscle fatigue in certain parts of the body contributes to the
development of pain and discomfort. Fatigue refers to the state which arises in body
muscle system as a result of excessive use (overuse or overexertion). When fatigue starts
to appear in particular muscle, it is very important that the muscle has recovery time to
gain its strength, otherwise excessive stress is placed on the musculoskeletal components
that may leads to inflammation. Therefore, the longer recovery period is needed, or else
the pain and discomfort will persist beyond working hours and at night.25

1.1.5 Global usage of computer

In 1964, WRULS problems became so widespread in Japan that the Japanese
Ministry of Labor set ergonomic guideline for keyboard operators, limiting their work-
day to five hours and ordering 10-minutes rest breaks each hour. However this guideline
failed to reduce the number of new cases reported.

In the European community, more than half of the working population, males and females alike, use computer in their daily work. Computer users tend to spend an increasing amount of time in front of the computers. In Denmark, it was reported that 23% of employees use computer as part of their work in 1990 and the figures has increased to 60% in 1999 and the numbers of work related musculoskeletal cases are expected to increase further in coming years. At the same time, health statistics indicate an increased incidence of work-related muscular disorder among computer users. The problems focus in particular on aches and pain in the upper extremities.
1.2 Literature review

1.2.1 Prevalence of WRULS

Cherry et al reported incidence of musculoskeletal disease in United Kingdom for year 1997-2000. Upper limbs cases accounted for 66% of the total musculoskeletal cases.\textsuperscript{27} In another study, this author also reported that musculoskeletal symptoms accounted 49.1% of all cases reported to Occupational Physician’s Reporting Activity (OPRA) which upper limbs symptoms cases were about 54% from all musculoskeletal cases.\textsuperscript{28}

Palmer et al reported 30% prevalence of upper limbs pain among non-manual workers that involved in their national survey in Britain.\textsuperscript{29} In Malaysia, National Institute of Occupational Safety and Health (NIOSH), reported in their study that prevalence of WRULS between 40% to 56%.\textsuperscript{30}

1.2.2 Prevalence of WRULS in an office environment

Blatter and Bongers conducted a cross-sectional study involving 5,400 office workers. The authors found that the prevalence of WRULS were 31% in secretaries and typist and 23% in other administrative occupation.\textsuperscript{31}

Cherry et al reported incidence of musculoskeletal disease in United Kingdom under Musculoskeletal Occupational Surveillance Scheme (MOSS) for year 1997-2000.
A total of 8,070 work related musculoskeletal cases were obtained under that scheme. From that, upper limbs cases were 66% and frequently reported occupational group were office worker which are clerical and secretarial workers.  

Cherry et al reported from occupational Physician’s Reporting Activity (OPRA) that half of the musculoskeletal cases were from upper limbs region. Occupation wise, of 21,480 cases, secretarial personnel were 480 cases, clerks 384 cases and computer operators were 252 cases.  

1.2.3 Gender difference  

Coury et al in their cross sectional study had found that WRULS was influenced by gender. However when compared within the same age group and age tenure, there was no significant difference in gender.  

Fuerstein et al found that women tended to be diagnosed with carpal tunnel syndrome to a greater degree than men. Apart from that, women also had higher percentages of receiving a non specific diagnosis of upper limbs problems than men.  

Fredriksson et al reported a population based case-control study in Sweden in 1993-1997. Their study involved cases who sought medical care treatment for neck and shoulder pain. The authors found the risk pattern to get neck and shoulder pain was differed between gender. The risk higher about 1.5 for women compared than men. Among women, an increased amount of video display terminal (VDT) work was
associated with neck or shoulder pain. Meanwhile, among men, it was associated with an increase amount of seated work.33

Demure et al in their cohort study had found significant association between women and wrist/hand discomfort.34 Jensen et al also found in their study that women reported musculoskeletal symptoms twice as frequently as men for all upper limbs body region.26

Fuerstein et al conducted study that involving federal workers with work related upper extremity disorder (WRUED) who filed for compensation claim. In that study they found that gender was a significant predictor of upper extremity functional limitation whereby female had greater limitation compared to male.35

Brogmus et al in their analysis of worker’s compensation claim for cumulative trauma disorders of upper limbs had found that women are over-represented to upper limbs musculoskeletal disorders. Growing population of women in the workforce had contributed to this feature. Even though women only accounted for only 30% of all claims but their claims for upper limbs musculoskeletal disorders were 65% of that percentage.18

Friedman conducted consecutive case series study involving 106 patients with WRUED at two occupational rehabilitation clinics in New Zealand between January 1994 and May 1996. Differed from other study, this author had found no gender relationship between cases and WRUED.21
1.2.4 WRULS and computer usage

A study on symptoms of upper extremity cumulative trauma disorder (CTD) among workers associated with strenuous hand intensive job was carried out by Gangopadhyay et al. This study involved workers from unorganized sector at West Bengal, India whereby among the groups were computer operators. The authors found that many computer users developed chronic neck, shoulder, arm, wrist and hand pain problems, due to long hours of extensive keyboard and mouse operation. Painful musculoskeletal disorder was common among computer user and became major cause of lost of productivity, work related disability and escalating employee health costs. They concluded that repetitive work, prolonged work activity and remaining in static activity for a long period may be regarded as the causative factors in the occurrence of CTD. 20

Punnet and Berqvist systematically analyzed 56 epidemiological studies published on work with computers before 1997. Most of these studies were cross-sectional, but a trend was seen between work on a computer and musculoskeletal problems. For disorders of the hand and wrist, it was found that computer usage was a direct causative agent, mediated primarily through repetitive finger motion and sustained muscle loading across the forearm and wrist. The odds for such disorders among computer users with at least four hours of keyboard work per day appear to be about twice that of those with little or no keyboard work. 36

Palmer et al conducted national survey to assess the symptoms in the neck and arm among keyboard user (inclusion criteria was using keyboard for 4 hours and more
per day). They had found the prevalence of neck or upper limbs symptoms within one week period was 30%. ²⁹

In contrast, Bergqvist et al in their survey of 353 office workers from 1981 to 1987 had found that musculoskeletal problems were not directly associated with computer work in general. However, they found that limited unscheduled rest breaks when combined with data entry work can increase the risk of musculoskeletal disorders over the neck and shoulder region. Arm and hand discomfort was increased when the keyboard position was too low. ³⁷

Computer task require workers to sit while doing their work. Ariëns et al conducted prospective cohort study for three years to establish the relationship of neck pain to work related neck flexion, neck rotation and sitting. They found significant increase risk (RR=2.0) of neck pain for workers who were sitting for more than 95% of the working time (RR=2.01). ³⁸

In Malaysia, National Institute of Occupational Safety and Health (NIOSH) together with Japan International Cooperation Agency (JICA) conducted a study to look at health effect among computer users in Malaysia. This study involved 469 workers that used computer for their daily work task (mainly from industries). Results showed that during the last 12 months, among male subjects, 51% of them complaint of neck pain and 40.7% of shoulder pain. Among female subjects, neck and shoulder pain was 54.0% and 55.6% respectively. ³⁰
1.2.5 Duration of computer usage

Duration of computer usage had been recognized as potential risk factors for WRULS. A person who is in the process of learning new skill or those interested in their task may exert more energy and effort while completing the task. They tend to focus their concentration on outcome rather than method. This may result in not noticing musculoskeletal pain or symptoms in the early stages, and continuing to complete their activities despite physical discomfort.

Palmer et al had found that regular keyboard uses for more than 4 hours per day was significantly associated with pain and discomfort at the shoulders and wrist. 29

Blatter and Bongers in their cross-sectional study involving office workers had found that working with a computer for more than 6 hours per day was strongly associated with WRULDs in all body region (OR=1.95 and 95% CI: 1.61 to 2.36), neck or shoulder symptoms (OR=1.88 and 95% CI: 1.48 , 2.38) and elbow, arm or wrist/hand symptoms (OR=2.01 and 95% CI: 1.28 , 3.15). Computer work between 4 and 6 hours per day was moderately associated with these symptoms (OR around 1.5). When analyzed separately between genders, it was found that in men; moderately increase in odds ratio was observed for duration of computer use more than 6 hours per day. In women a moderately increase odds ratio was observed for duration of computer use of more than 4 hours per day. Also there was an increased in risk for duration of computer usage for more than 6 hours per day. 31
Fogleman and Lewis who conducted survey among computer users at office site also found significant increase risk of discomfort on each of the body regions as the number of hours of keyboard use increased.39

Punnet and Berqvist concluded that convincing evidence exists for a relationship between computer work and neck and shoulder problems. The risk was increase with the hours per day and the total number of years in which computer work is being performed. Also for disorders of the hand and wrist, evidences were found that the use of computer or keyboard was a direct causative agent whereby the risk increases by duration of exposure. The odd among computer user with 4 hours and more of keyboard work was twice that of those with little or no keyboard work.36

Jensen et al reported a survey using questionnaire involving 3,475 employees in 11 Danish companies and institutions. The logistic regression analyses showed that working almost the whole day with a computer was associated with neck symptoms (OR=1.92 and 95% CI:1.21, 3.02) and shoulder symptoms (OR=1.83 and 95% CI:1.13, 2.95) among women. Meanwhile, among men, working almost the whole day with a computer was associated with hand symptoms (OR=2.76 and 95% CI:1.51,5.06). Among respondents who worked almost all of their work time with computer and use mouse for half of their work time, after adjusted for gender and age, authors found the odds ratio to have hands/wrist symptoms was 1.68 (1.22, 2.31).26
Bergqvist et al reported that computer users who worked more than 20 hours per week were more prone to get neck and shoulder discomfort if their work involved repetitive movements. Prolonged use of computer was also associated with arm or hand region discomfort if the users had limited rest break during computer work and no lower arm support.  

1.2.6 Other factors

Hobby has been suggested as related to WRULS. As mentioned by Melhorn, hobbies such as tennis, racquetball and basketball (to name a few) may contribute to or worsen this problem. However, Fogleman and Lewis found no significant association between hobbies and occurrence of self reported musculoskeletal discomfort among video display terminal user.

There are studies suggested that WRULS was associated with psychosocial factors. Josephson et al in their cohort study over three years involving nursing personal had found that job strain is a risk factor for musculoskeletal symptoms. Conversely, Halford and Cohen found no association between psychosocial factors and musculoskeletal symptoms in general. Only certain psychosocial factors had an association such as workload, help from management and monitoring.

WRULS was not associated with age. The explanation in one of the study was because, the most exposed and symptomatic workers were usually the eldest. Thus, because of the symptoms, they leave the organization and leaved only the younger one.
Sitting for long period was mentioned as having an influence to WRULS. Regardless of how good your working posture is, working in the same posture or sitting still for prolonged periods is not healthy. Working posture should be changed frequently throughout the day by making small adjustments to chair or backrest, stretch fingers, hands, arms, and torso or stand up and walk around for a few minutes periodically. 42

1.3 Validity of literature reviewed

Most of the previous studies used different name for WRULS. Due to this factor, several terms for WRULS have been identified.

Another problems encountered in the literature review was that many studies did not give definition for cases that they categorized as symptomatic. Most of the time, authors’ defined cases as symptomatic if respondents reported as having symptoms in the questionnaire. Few cases used definition based on the definition given by NIOSH, USA. 17,31,40

The definition for computer usage was rarely given. Various cut off points were used in term of duration of computer usage to categorize respondents as computer user or not. 8,31,43

In term of study design, majority of previous studies used cross-sectional design or survey which may limit the interpretation for its temporal relationship. Only few
studies used case control, cohort and randomized control trial.\textsuperscript{38,43,44}

Most of the previous studies used self-administered questionnaire to elicit musculoskeletal symptoms. However few studies confirmed the symptoms by conducting physical examination.\textsuperscript{21,32}

In terms of occupation, only few studies were conducted on office workers while mainly involved general industry or computer user not from office setting. However, among the computer users, there were also office workers.

1.4 Problem statement

Work Related Upper Limbs symptoms (WRULS) is an upper limbs musculoskeletal symptoms caused or made worst by the work environment.\textsuperscript{1,2,31}

Nowadays, this symptom is relatively common and reported under various terms all over the world.\textsuperscript{5}

WRULS is associated with occupational use of the upper limbs. The symptoms usually associated with “repetitive motion” represent an increasing proportion of occupational illness, medical services and worker’s compensation. WRULS can cause severe and debilitating symptoms such as pain, numbness and tingling sensation. It can reduce work productivity, lost time from work, temporary or permanent disability and inability to perform job tasks.\textsuperscript{45}
What is not generally recognized, however, is that the direct costs of compensated cases are only a fraction of the total cost, which also includes replacement and retraining of personnel, disruption in production etc. It has been assumed that total cost may be two to three times direct compensation cost. There are hidden costs even when cases do not meet compensation criteria, for workers still experience significant musculoskeletal symptoms and discomfort and absenteeism. Poor quality, lower work performance and decreased motivation are hypothetically part of these hidden costs.\textsuperscript{5,17,45}

It was reported in United State of America that in 1992, the mean cost per case (more than 5 million cases) of upper extremity cumulative trauma disorder was $8070 compared with only $824 for other workers compensation cost. In 1996, direct healthcare cost were more than $418 billion and lower range estimates for indirect costs were more than $837 billion.\textsuperscript{6}

Fuerstein et al reported that upper extremity cumulative trauma disorder represents 4.4\% of all claims in the federal workforce from 1\textsuperscript{st} October 1993 to 30\textsuperscript{th} September 1994. The work related upper limbs disorder diagnosis was coded according to the International Classification of Disease, Clinical Modification (ICD-9-CM). They concluded that even finding showed upper extremity disorder represents a relatively small percentage of all worker compensation cases, the health care and indemnity costs are considerable. Work related upper limbs disorder had significantly higher direct and indirect medical costs, because of the longer duration of treatment and greater work disability.\textsuperscript{19}
Cherry et al found that out of 49.1% of musculoskeletal symptoms reported to OPRA, half of the it were upper limbs cases. Office workers contributed to that claim with percentages of 5.2% (secretarial personnel, clerks and computer operators).\textsuperscript{28}

The rise in concern for WRULS parallels the proliferation of computers in office environment. It is well known that the use of computer has increase dramatically since the introduction of personal computers in as early as 1970s in Japan and 1980s in most of other countries in the world. It has been estimated that increase in worldwide personal computer (PC) shipment from 25 million PCs in 1990 to 57 million in 1995.\textsuperscript{18,46}

Blatter and Bongers also found that among office workers who used computer, prevalence of WRULS were 31% in secretaries and typist and 23% in other administrative occupation.\textsuperscript{31} Palmer et al reported 30% prevalence of upper limbs pain among non-manual workers and association of keyboard used with pain in the shoulder.\textsuperscript{29} Brogmsus et al found that job usually associated with computer work account for about 11% of the disorders. The authors concluded that even the claim is relatively small but there is a steady increase in cases and claims for less than 1% in 1986 to 4% in 1993.\textsuperscript{18}

Hales et al also reported 22% prevalence of upper extremity musculoskeletal disorders and they conclude that work related upper limbs disorders are common among workers who utilize computer. Their finding involved confirmation of cases by physical examination.\textsuperscript{7}
This scenario was also observed in Malaysia, whereby the use of computers by office workers have increased tremendously over the years. In recent years, computer industry has become one of the fastest growing industries in Malaysia. The biggest users are in financial sectors followed by business, services and government sector. The “1987 Asian Computer Directory” had listed Malaysia as the four biggest users of computers in Asia after Japan, Singapore and Hong Kong.  

1.5 Rationale for the study

Malaysia, as many other countries in the world is beginning to give its due attention to the work related problems including WRULS. Considering the scenario in Malaysia whereby modern technology has grown and the use of computers by the office workers had been increased tremendously over the years, it is important that necessary measures are taken to ensure health of the worker and safer working environment including working condition. Even though the usage of computer has been so common among our office workers nowadays, data on the health effect in particular WRULS is still lacking.

There are few studies that look into health problem in office setting particularly musculoskeletal problem in the local setting. It is hope that this study can provide insight to the extent of WRULS and its association with computer usage.
CHAPTER 2

OBJECTIVES

2.1 General objectives

The objectives are to establish the extent of WRULS among office workers and to explore the associated factors contribute to the development of the symptoms.

2.2 Specific objectives

The specific objectives are:

1) To describe sociodemographic profile of the study subjects
2) To determine the prevalence of WRULS
3) To establish the role of computer usage in the development of WRULS

2.3 Research hypothesis

The research hypotheses are:

1) The prevalence of WRULS is as high as found in other countries
2) Computer usage contribute to WRULS
CHAPTER 3

MATERIALS AND METHODS

3.1 Study design

This study was conducted using a cross-sectional study design.

3.2 Study area

This study was carried out at Ministry of Health Malaysia (MOH) Headquarters in Klang Valley. This ministry is one of the ministries in Malaysia under the Federal Government structure.\(^{48}\)

Administratively, MOH was headed by Health Minister of Malaysia and assisted by a Deputy Minister and Parliamentary Secretary. Heading the professional and technical component is the Director General of Health (DG Health). This component comprised three main programs namely public health program, medical program and research and technical support. Each component is headed by Deputy Director General of Health.\(^{49}\)

3.3 Study population

Study population was defined as all office workers (permanent staff) who work in the MOH Headquarters. Female workers who were pregnant at the time of study period were excluded from this study.
3.4 Sample size estimation and sampling procedure

The minimum sample size required for this study was estimated using Epi Info version 3.2.2. Calculation was based on population survey methods. Confidence interval was set at 95%. Sample size required was 323 samples. A random sampling method was used to get the sample subjects.

Subjects were explained about the study and to obtain their consent. If any of the subjects refused to be involved in this study, another subject will be selected using the same methods. Those names that refused to be involved were taken out from the list. The process continued until the required amount of sample subjects obtained. Those consented were selected as study subjects and given WRULS questionnaires to be filled up. Each study subject who refused to be involved in this study will be contacted three times before they were considered as “non respondent”.

3.5 Study variables

3.5 (a) Dependant variable

The dependent variable (outcome) for this study was Work Related Upper Limbs Symptoms (WRULS). The definition for WRULS was:\textsuperscript{17,31,40}

Study subjects were considered as having WRULS if they reported the following in the \textit{neck, shoulder, elbow, forearms, wrist and/or fingers}:
(i) Symptoms of pain, aching, stiffness, burning, tingling or numbness;
(ii) The symptoms occurring at least once a month within the past year;
(iii) The symptoms developed since in the current job; and
(iv) No previous injury or trauma to the symptomatic area

In this study, words “symptoms” was used instead of “disorders” because it was self-reported symptoms in the questionnaires and no medical examination was conducted to confirm it. The term “work related upper limbs symptoms” (WRULS) were used as a descriptor for self reported musculoskeletal symptoms and deals mainly with upper limbs.

3.5 (b) Independent variables

The independent variables are listed below and the definitions are as shown in Appendix 1 or as noted:

i) Socio-demographic characteristics
   • Age
   • Gender
   • Ethnic groups
   • Education level

ii) Upper limbs symptoms
   • Body parts
   • Duration/frequency of symptoms
• Medical consultation

iii) Hand intensive hobby

iv) Medical problems related to WRULS

v) Job factors
   • Type of job
   • Duration of work

vi) Computer usage factor
   • Computer usage at work
   • Duration of computer usage at work

3.6 Methods of data collection

All necessary information for this study was collected by using self-administered questionnaires. The questionnaire used in this study was modified from the Dutch Musculoskeletal Questionnaires\(^{50}\) and Ergonomic Questionnaire used in one of a study by Lewis et al that was published in the International Journal of Ergonomics, 2001.\(^{8}\) Permission from the authors of these questionnaires was obtained via e-mail communication (Appendix 2).

Translation to Bahasa Melayu was done by having two different persons translating the questionnaires and comparing the result for similarity of language. There are 17 questions in this questionnaire (Appendix 3).
It was mentioned in previous study that self reported questionnaires were often used to obtain occupational health histories on employees for clinical and epidemiological investigations. The questionnaires should be relied on to detect changes in health status.

Pre-testing and test for reliability of the questionnaires were done before the actual study carried out. In the reliability test, similar type of questionnaire was given twice to the same study subject within one-week interval. Total of 39 questionnaires was distributed but only 35 study subjects completed the questionnaires in both sessions. The data gathered were analyzed using kappa statistic. Results of the analysis were ranging from 0.62 (for position of hand while handling mouse) to 1.0 (e.g. symptoms at body parts and duration/frequency of symptoms).

Questionnaire used in this study comprises of few aspects namely socio demographic profile, upper limbs musculoskeletal symptoms, medical problems, hand intensive hobby, job profile and computer usage.

All questionnaire collected were checked for its completeness. If any information was found to be incomplete, the respondents will be contacted to fill up the missing information.
3.7 Data processing and analysis

3.7 (a) Univariate analysis

Raw data obtained were labeled for systematic control of the data in terms of storing and processing purposes. All data were double checked for errors before entering into the computer program. Dependant and independent variables were created and data were then entered using the Statistical Package for Social Science (SPSS).

In order to process and analyze the data meaningfully, the raw data were sorted out in relation to the objectives of this study and variables selected. These data were coded appropriately according to the type of variables.

Quantitative data that were obtained, for example duration of computer work per day, were later coded as categorical data. When there is no respond for any variable, it will be treated as missing value.

Continuous data on age were grouped into “less than 30, 30-39, 40-49 and 50 years old and more”. For education level, SRP/MCE was recoded into “lower secondary”, SPM/STP into “upper secondary” and Diploma/Ijazah/PhD into “tertiary”.
Upper limbs symptoms was recoded into “yes” for reported symptoms at any listed body parts in the questionnaire and “no” for no answer at all or answer of “no”. For symptom started since working in current job, it was recoded into “yes” for respondents who answered yes and “no” for respondents who answered no. Similar process was used for injury to the symptomatic area.

In order to get respondents that can be categorized into “WRULS” or “no WRULS”, all four variables namely upper limbs symptoms, duration/frequency of symptoms, symptom started since in the current job and injury to affected area were used.

For medical diseases, it was recoded into “medical disease related to WRULS” for respondents that had medical diseases as mentioned by Franzblau et al which are thyroid dysfunction, diabetes mellitus, rheumatoid arthritis, gout, cervical spondylosis, osteoarthritis and frozen shoulder. Other medical disease and answer of “no medical disease” was recoded into “no medical disease related to WRULS”.

If respondents reported as having hobbies listed, they will be recoded into “Hand intensive hobby” and “no hand intensive hobby” for respondents who did not answer this part or mark the list for “not related”.
For job group, those answered “managerial” was recoded into “Managerial and Professional group”. “Supportive” group, were those doing clerical and secretarial work or typing. Continuous data on duration of work were recoded into “less than 10, 10-20 and more than 20” years.

Continuous data on duration of computer usage at work was used to group respondents into “computer user” for those who used computer more than 2 hours per day and “non-computer user” for those who used computer for 2 hours and less per day. For variable duration of computer usage per day, the same continuous data was recoded into “Less than 5 hours per day” and “5 hours and more per day”.

Data cleaning and editing were carried out before analysis was performed. Prior to subjecting the data to any statistical treatment, data were first checked by running frequency distribution for both qualitative and quantities data. Apart from that simple descriptive statistics (mean and range) for quantitative data were also run. Descriptive analyses were carried out for all categorical variables to obtain the initial description of the data. The distribution of continuous data was checked by plotting the histogram.

Analysis begins by comparing the demographic characteristics of the respondents. Analysis of risk factors was carried out by grouping similar characteristics under separate headings of major variable types. Each of the
independent variables thought to be a potential risk factor was described in terms of its frequency distribution.

Preliminary analysis was then carried out using chi-square for categorical data. If any $r \times c$ table analysis showed expected value of less than 5, the table will be collapsed. Of the resultant $2 \times 2$ table contain expected value less than 5, and then Fisher’s Exact test will be used instead. Significance level is preset at 0.05. Odds ratio and 95% confidence interval is reported in univariate and multivariate analyses.

3.7 (b) Multivariate analyses

The hypothesis of this study is to establish the role of computer usage in the development of WRULS. In order to answer this hypothesis and to eliminate for potential confounders, multivariate analyses were carried out by using binary logistic regression modeling because the dependent (outcome) variable is binary (WRULS: yes/ no).

For selection of independent variables to be included in the multivariate modeling, probability value of 0.25 was used as a cut off point. Socio demographic factors were automatically included in the modeling even though the $p$-value more than 0.25 because of biological effect. From the $r \times c$ tables analyses the following variables were selected:

- Socio demographic factors (age, gender and education level)
- Job type
- Hand intensive hobby
- Use of computer at work
- Duration of computer usage at work

Several factors can be potential effect modifiers. (E.g. the association between computer usage and WRULS can vary according to age level). Due to this, factors such as age, education, job type and computer usage were examined by including the following interaction terms in the modeling:

- Age * computer usage
- Gender * computer usage
- Education * computer usage
- Job type * computer usage

However, none of these interaction terms were statistically significant. Thus, the multivariate modelings were pursued without these terms.

The odds ratio and its 95% CI were estimated in the multivariate model using several methods namely block entry of variables and stepwise methods (forward likelihood ratio and backward likelihood ratio). All the three methods showed similar results. The investigator chose backward likelihood ratio modeling.

3.8 Limitations and Errors

This study had several imitations and error as described below. However, investigator had taken steps to minimize the errors.
i) Study design

There are two salient problems in using cross sectional design. First is the direction of causation. Secondly is that the association finding in this study can be confounded by other factors such as age, gender and hand intensive hobby.

ii) Questionnaire

Back translation was not carried out while doing the translation of questionnaire from the original questionnaire that is in English language to Bahasa Melayu due to time constrain.

iii) Self reporting information

Self reporting of information (e.g. in the ascertainment of WRULS) is very subjective which may misclassify the persons as having WRULS or not.

iv) Non-respondent

In many studies, the main problem is non-respondent. In order to minimize this problem, quantity of the questionnaires distributed was inflated by 65% because previous study had reported response rate of only 25% in self-administered questionnaire.31 Apart from that reminder memo were given to those failed to submit questionnaire within the given time frame. Despite of this, there were still about 13% non-respondents. The
main reasons for non respondents were those went for outstation, course and also unknown causes.

v) Recall bias

Study subjects that recently had symptoms may provide more information as they are more likely to remember information pertaining to their symptoms. Some information such as frequency of the symptoms is important to classify cases as having WRULS or not as they may not recall then duration.

3.9 Ethical consideration

Before carrying out any data collection, investigator would introduce herself to the study subjects and explain the nature and purpose of this study. Investigator then ensured the study subjects on the confidentiality of all information.

Study subjects that were selected from sampling list had the right to refuse or disagree to participate in this study. Those refused were not including as subjects and their name were removed from the list. A written consent was then obtained from subjects that agreed to participate in this study.
CHAPTER 4

RESULTS

A total of 530 questionnaires were distributed for this study of which 465 responded (response rate = 87.7%). Two (2) respondents were later excluded because both of them were pregnant. The following description analysis was done on 463 respondents.

4.1 Description of respondents

The frequency distribution of respondents was studied in relation to various variables. These variables groups include socio-demographic, hand intensive hobby, medical disease, job factors and computer usage.

4.1.1 Socio-Demography

Table 1 shows the distribution of respondents by age, gender, ethnic group and education status which reflects the socio-demographic characteristics of the respondents.

Age of the respondents was range from 18 to 55 years old, with mean (range) age of 34.1 (18-55) years. In term of proportion, majority of the respondents (44.5%) aged less than 30 years. Only 9.9% of the respondents were more than 50 years old.
In term of gender, majority (72.8%) of the respondents were female. Malay constituted majority of the respondents (91.6%). The rest were Chinese, Indian, Kadazan, Melanau and Kadazan Dusun. Nearly 90.0% of the respondents had at least upper secondary education.

Table 1. Frequency distribution of 463 respondents by socio-demographic characteristics

<table>
<thead>
<tr>
<th>Socio-demographic Variable</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age group (years)</strong></td>
<td></td>
</tr>
<tr>
<td>Less than 30</td>
<td>206 (44.5)</td>
</tr>
<tr>
<td>30-39</td>
<td>104 (22.5)</td>
</tr>
<tr>
<td>40-49</td>
<td>107 (23.1)</td>
</tr>
<tr>
<td>50 years and more</td>
<td>46 (9.9)</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>126 (27.2)</td>
</tr>
<tr>
<td>Female</td>
<td>337 (72.8)</td>
</tr>
<tr>
<td><strong>Race group</strong></td>
<td></td>
</tr>
<tr>
<td>Malay</td>
<td>424 (91.6)</td>
</tr>
<tr>
<td>Indian</td>
<td>25 (5.4)</td>
</tr>
<tr>
<td>Chinese</td>
<td>8 (1.7)</td>
</tr>
<tr>
<td>Others</td>
<td>6 (1.3)</td>
</tr>
<tr>
<td><strong>Education level</strong></td>
<td></td>
</tr>
<tr>
<td>Lower secondary</td>
<td>47 (10.2)</td>
</tr>
<tr>
<td>Upper secondary</td>
<td>210 (45.4)</td>
</tr>
<tr>
<td>Tertiary</td>
<td>206 (44.5)</td>
</tr>
</tbody>
</table>

Footnote:
1. Race group (others): - Kadazan, Melanau and Kadazan Dusun
2. Education level: - Lower secondary: up to Sijil Rendah Pelajaran
   - Upper secondary: up to Sijil Pelajaran Malaysia and Sijil Tinggi Pelajaran
   - Tertiary: Diploma/Bachelor degree/Master/PhD
4.1.2 Upper limbs symptoms

4.1.2 (a) Body parts

Upper limbs symptoms is any symptoms of aching, stiffness, burning, tingling or numbness in the neck, shoulder, elbow, forearms, wrists and/or fingers. Respondents can report symptoms at more than one body region. Table 2 shows the distribution of upper limbs symptoms among respondents.

Majority of the respondents (307 out of 463) which was 66.3% reported as having upper limbs symptoms. Of that 65.5% reported symptoms on multiple parts of the body. There were 8.1% of the respondents claimed that they had symptoms on all body regions. As far as single body part concerned, four areas which were neck, shoulder, wrist and fingers were mostly affected.

4.1.2 (b) Duration of symptoms

From those respondents with upper limbs symptoms, majority (72.6%) of them has symptoms at least once a month. This frequency is important because it is one of the criteria in the definition of WRULS. Duration of symptoms is as shown in Table 2.
4.1.2 (c) Medical consultation/treatment

As shown in Table 2, of 307 respondents with upper limbs symptoms, only 25.1% of them seek medical consultation and/or treatment. Of that, majority (54.5%) were not issued any medical certificate. Among those issued with medical certificate, majority (40.3%) of them were issued medical leave up to one week duration.

Table 2. Frequency distribution of respondents by upper limbs symptoms

<table>
<thead>
<tr>
<th>Variables</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Distribution of body parts</strong> (n=307)</td>
<td></td>
</tr>
<tr>
<td>Single body parts</td>
<td>81 (26.4)</td>
</tr>
<tr>
<td>Multiple body parts</td>
<td>201 (65.5)</td>
</tr>
<tr>
<td>All body regions</td>
<td>25 (8.1)</td>
</tr>
<tr>
<td><strong>Duration of symptom</strong> (n=307)</td>
<td></td>
</tr>
<tr>
<td>Continuous</td>
<td>1 (0.3)</td>
</tr>
<tr>
<td>Every day</td>
<td>43 (14.0)</td>
</tr>
<tr>
<td>Few times per week</td>
<td>82 (26.7)</td>
</tr>
<tr>
<td>At least once / month</td>
<td>97 (31.6)</td>
</tr>
<tr>
<td>Once in every 2-3 months</td>
<td>59 (19.2)</td>
</tr>
<tr>
<td>1-2 times / year</td>
<td>25 (8.1)</td>
</tr>
<tr>
<td><strong>Medical consultation/treatment</strong> (n=307)</td>
<td></td>
</tr>
<tr>
<td>Consult doctor</td>
<td>77 (25.1)</td>
</tr>
<tr>
<td>Did not consult any doctor</td>
<td>230 (74.9)</td>
</tr>
<tr>
<td><strong>Medical leave</strong> (n=77)</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>42 (54.5)</td>
</tr>
<tr>
<td>Up to one week</td>
<td>31 (40.3)</td>
</tr>
<tr>
<td>Up to two weeks</td>
<td>2 (2.6)</td>
</tr>
<tr>
<td>Up to one month</td>
<td>1 (1.3)</td>
</tr>
<tr>
<td>More than one month</td>
<td>1 (1.3)</td>
</tr>
</tbody>
</table>
4.1.3 Hand intensive hobby

Hand intensive hobby such as hobby of using musical instruments, sports that using racquet, handcraft, knitting, sewing and gardening. It was found that majority of the respondents (61.1%) had hand intensive hobby (Table 3).

Table 3. Frequency distribution of 463 respondents by hand intensive hobbies

<table>
<thead>
<tr>
<th>Hand intensive hobbies</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>283 (61.1)</td>
</tr>
<tr>
<td>No</td>
<td>180 (38.9)</td>
</tr>
</tbody>
</table>

4.1.4 Medical diseases

Respondents were asked to report any medical disease they had/previously suffered. Diseases were then regrouped into “medical disease related to WRULS” and “no medical disease” (no medical disease at all or medical diseases not related to WRULS). Medical diseases related to WRULS are thyroid dysfunction, diabetes mellitus, rheumatoid arthritis, gout, cervical spondylosis, osteoarthritis and frozen shoulder. Of 463 respondents, only 16.6% (n=77) reported as having medical diseases. When the medical diseases were regrouped, it was found that only 5.2% of the respondents had “medical diseases related to WRULS”.

40
4.1.5 Job factors

4.1.5 (a) Type of Job

As shown in Table 4, majority (58.1%) of the respondents were from supportive group which consisted of those doing secretarial, clerical or typing work.

4.1.5 (b) Duration of work

Further question on job factor was duration of their work (Table 4). Majority of the respondents (65.4%) worked less than 10 years. Only 16.2% of respondents had worked more than 20 years. Duration of work was ranged from one to 34 years, with mean age of 8.7 years.

Table 4. Frequency distribution of 463 respondents by job factors

<table>
<thead>
<tr>
<th>Variables</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of job</strong></td>
<td></td>
</tr>
<tr>
<td>Managerial and Professional</td>
<td>194 (41.9)</td>
</tr>
<tr>
<td>Supportive</td>
<td>269 (58.1)</td>
</tr>
</tbody>
</table>

| Duration of work (years) | n (%)       | Mean (range): 8.7 (1-34) |
|--------------------------|-------------|
| Less than 10             | 303 (65.4)  |
| 10-20                    | 85 (18.4)   |
| More than 20             | 75 (16.2)   |

Footnote:
1. Managerial and Professional: Executive staffs were categorized under Managerial and Professional group
Supportive group: Secretarial, Clerical, Typist
4.1.6 Computer usage

4.1.6 (a) Computer usage at work

As shown in Table 5, respondents who used computer at work for more than 2 hours per day were categorized as “computer user”. Of 463 respondents, majority of them (80.1%) use computer at work. In term of duration, among 371 of respondents who used computer, majority of them (70.4%) used computer for 5 hours and more per day. Duration of computer usage was ranged from three to ten hours per day with mean duration of 5.29 hours.

Table 5. Frequency distribution of respondents by computer usage at work

<table>
<thead>
<tr>
<th>Variable</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Status</strong></td>
<td></td>
</tr>
<tr>
<td>Computer user</td>
<td>371 (80.1)</td>
</tr>
<tr>
<td>Non user</td>
<td>92 (19.9)</td>
</tr>
<tr>
<td><strong>Duration (hours per day)</strong> n=371</td>
<td></td>
</tr>
<tr>
<td>Less than 5</td>
<td>110 (29.6)</td>
</tr>
<tr>
<td>5 hours and more</td>
<td>261 (70.4)</td>
</tr>
<tr>
<td>Mean (range): 5.3 (3-10)</td>
<td></td>
</tr>
</tbody>
</table>

4.1.6 (b) Computer usage at home

As shown in Table 6, only 5.4% out of 371 respondents used computer at home. Among those who used computer at home (n=20), majority of them (65.0%) used it for duration of less than 5 hours per day.
Duration of computer usage was ranged from one to ten hours per day with mean duration of 7.39 hours.

<table>
<thead>
<tr>
<th>Variables</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Status</strong> (n= 371)</td>
<td></td>
</tr>
<tr>
<td>Computer user</td>
<td>20 (5.4)</td>
</tr>
<tr>
<td>Non user</td>
<td>351 (94.6)</td>
</tr>
<tr>
<td><strong>Duration (hours per day)</strong> (n= 20)</td>
<td></td>
</tr>
<tr>
<td>Less than 5</td>
<td>13 (65.0)</td>
</tr>
<tr>
<td>5 hours and more</td>
<td>7 (35.0)</td>
</tr>
</tbody>
</table>

Mean (range): 7.4 (1-10)

4.1.8 Prevalence of WRULS

As stated earlier, WRULS is defined as respondents who reported to have symptoms of pain, aching, stiffness, burning, tingling or numbness in neck, shoulder, elbow, forearms, wrist and/or fingers. The symptoms developed since work in the current job and occurring at least once a month within the past year. There should not be any previous injury or trauma to the symptomatic area. Based on the criteria, it was found that 33.0% (95% CI: 28.8 %, 37.3%) of the respondents had WRULS (Table 7).

Table 7. Prevalence of WRULS among 463 respondents

<table>
<thead>
<tr>
<th>WRULS status</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>153 (33.0)</td>
</tr>
<tr>
<td>No</td>
<td>310 (67.0)</td>
</tr>
</tbody>
</table>
4.2 Statistical association between independent variables and WRULS

Further analysis in the form of r x c table analysis was carried out to answer the following questions:

i) Is there an association between the exposure or independent variables and the outcome (WRULS)?

ii) If there is, what is the magnitude of this association?

iii) Is the effect of exposure of interest (computer usage) is independent of any potential confounders?

For this analysis, only Malay respondents were analysed (Chinese, Indian and other races were omitted. Non-Malay was omitted in this analysis because their number was very small (8.4%).

4.2.1 Socio-demography and WRULS

There was no statistically significant association for age group and gender with WRULS, as shown in Table 8. However, education was found to have statistically significant association with WRULS (p<0.05).

Age group was found to be not statistically significant with WRULS (p=0.78). There were no differences in the risk of WRULS in all the age group when compared to age group of less than 30 years old.
With regards to gender, there was no statistically significant association between gender and WRULS (p=0.848). There was also no significant difference in the risk of WRULS between male and female respondents.

Education was statistically significant associated with WRULS (p=0.026). When looking at the risk to get WRULS, respondents with lower secondary education were found to have 1.1 (95% CI: 0.5 to 2.1) more risk of WRULS than tertiary level education. However respondents with upper secondary education had less risk of WRULS with OR=0.6, 95% CI: 0.4 to 0.9 than tertiary level education.

Table 8. Association between socio-demographic variables and WRULS among 424 respondents

<table>
<thead>
<tr>
<th>Variables</th>
<th>WRULS n (%)</th>
<th>No WRULS n (%)</th>
<th>p-value</th>
<th>Unadjusted Odds Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age group (years old)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Less than 30</td>
<td>59 (29.8%)</td>
<td>139 (70.2%)</td>
<td>0.78</td>
<td>1.0</td>
</tr>
<tr>
<td>30-39</td>
<td>30 (34.1%)</td>
<td>58 (65.9%)</td>
<td></td>
<td>1.2 (0.7, 2.1)</td>
</tr>
<tr>
<td>40-49</td>
<td>34 (34.7%)</td>
<td>64 (65.3%)</td>
<td></td>
<td>1.3 (0.8, 2.1)</td>
</tr>
<tr>
<td>50 and more</td>
<td>14 (35.0%)</td>
<td>26 (65.0%)</td>
<td></td>
<td>1.3 (0.6, 2.6)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Male</td>
<td>37 (33.0%)</td>
<td>75 (67.0%)</td>
<td>0.848</td>
<td>1.0</td>
</tr>
<tr>
<td>Female</td>
<td>100 (32.1%)</td>
<td>212 (67.9%)</td>
<td></td>
<td>1.0 (0.6, 1.5)</td>
</tr>
<tr>
<td>Education level</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Tertiary</td>
<td>68 (37.8%)</td>
<td>112 (62.2%)</td>
<td>0.026</td>
<td>1.0</td>
</tr>
<tr>
<td>Upper secondary</td>
<td>52 (25.9%)</td>
<td>149 (74.1%)</td>
<td></td>
<td>0.6 (0.4, 0.9)</td>
</tr>
<tr>
<td>Lower secondary</td>
<td>17 (39.5%)</td>
<td>26 (60.5%)</td>
<td></td>
<td>1.1 (0.5, 2.1)</td>
</tr>
</tbody>
</table>

Footnote: * Reference group
4.2.2 Hand intensive hobby and WRULS

Hand intensive hobby was found to have statistically significant association with WRULS (p<0.001). Respondents with hand intensive hobby had higher proportion (40.9%) of having WRULS. Having hand intensive hobby was found to increase the risk of WRULS by 2.9 (95% CI: 1.8 to 4.6) than respondents without hand intensive hobby (Table 9).

Table 9: Association between hand intensive hobby and WRULS among 424 respondents

<table>
<thead>
<tr>
<th>Hand intensive hobby</th>
<th>WRULS n (%)</th>
<th>No WRULS n (%)</th>
<th>p-value</th>
<th>Unadjusted Odds Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>* No</td>
<td>135 (80.8)</td>
<td>32 (19.2)</td>
<td>&lt;0.001</td>
<td>1.0</td>
</tr>
<tr>
<td>Yes</td>
<td>152 (59.1)</td>
<td>105 (40.9)</td>
<td></td>
<td>2.9 (1.8, 4.6)</td>
</tr>
</tbody>
</table>

Footnote:
* Reference group

4.2.3 Job factors and WRULS

Job group was statistically significant with WRULS (p=0.011). In term of risk to get WRULS, respondents in supportive group had less risk of WRULS compared to respondents in managerial and professional group. The odds ratio was 0.6 (95% CI: 0.4 to 0.9) for supportive group (Table 10).
Work duration had no statistically significant association with the occurrence of WRULS (p=0.336), as shown in Table 10.

### Table 10. Association between job factors and WRULS among 424 respondents

<table>
<thead>
<tr>
<th>Variables</th>
<th>No WRULS n (%)</th>
<th>WRULS n (%)</th>
<th>p-value</th>
<th>Unadjusted Odds Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Job group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Managerial &amp; Professional</td>
<td>66 (39.5)</td>
<td>101 (60.5)</td>
<td>0.011</td>
<td>1.0</td>
</tr>
<tr>
<td>Supportive</td>
<td>71 (27.6)</td>
<td>186 (72.4)</td>
<td></td>
<td>0.6 (0.4, 0.9)</td>
</tr>
<tr>
<td><strong>Work duration (years)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Less than 10</td>
<td>95 (34.4)</td>
<td>181 (65.6)</td>
<td>0.336</td>
<td>1.0</td>
</tr>
<tr>
<td>10- 20</td>
<td>24 (31.2)</td>
<td>53 (68.8)</td>
<td></td>
<td>0.9 (0.5, 1.5)</td>
</tr>
<tr>
<td>More than 20</td>
<td>18 (25.4)</td>
<td>53 (74.6)</td>
<td></td>
<td>0.6 (0.4, 1.2)</td>
</tr>
</tbody>
</table>

Footnote:
* Reference group

### 4.2.4 Computer usage at work and WRULS

As shown in Table 11, analysis had found that both computer usage at work and duration of the usage were statistically significant with WRULS (p<0.05).

Computer usage at work pose a risk to WRULS, whereby it was found that computer user had 1.8 (95% CI: 1.0 to 3.2) higher risk of WRULS compared to non computer user.
When analyzing the duration of computer usage at work, it was found that the longer the duration of computer usage, the higher the risk of respondents to get WRULS. Respondents who used computer at work for 5 hours and more per day, were found to have 1.8 (95% CI: 1.1 to 3.1) higher risk of WRULS compared to respondents who used computer less than 5 hours per day.

Table 11. Association between computer usage at work and WRULS

<table>
<thead>
<tr>
<th>Variables</th>
<th>WRULS n (%)</th>
<th>No WRULS n (%)</th>
<th>p-value</th>
<th>Unadjusted Odds Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Computer usage (n =424)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Non user</td>
<td>19 (22.6)</td>
<td>65 (77.4) 222</td>
<td>0.034</td>
<td>1.0</td>
</tr>
<tr>
<td>Computer user</td>
<td>118 (34.7)</td>
<td>(65.3)</td>
<td></td>
<td>1.8 (1.1, 3.2)</td>
</tr>
<tr>
<td><strong>Duration of computer usage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(hours per day) (n =340)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Less than 5</td>
<td>26 (25.5)</td>
<td>76 (74.5)</td>
<td>0.019</td>
<td>1.0</td>
</tr>
<tr>
<td>5 hours and more</td>
<td>92 (38.7)</td>
<td>146 (61.3)</td>
<td></td>
<td>1.8 (1.1, 3.1)</td>
</tr>
</tbody>
</table>

Footnote: * Reference group

4.2.5 Computer usage at home and WRULS

There were no statistically significant association between computer usage at home and WRULS, as shown in Table 12. However, it was found that respondents who used computer at home had higher risk of WRULS compared to respondents who did not use computer at home with odds ratio of 1.2 (95% CI: 0.4 to 3.2). The risk for WRULS
was slightly higher among respondents who used computer for 5 hours and more per day compared to respondents who used computer less than 5 hours per day (odds ration of 1.1 (95% CI:0.1 to 8.7)

Table 12. Association between computer usage at home and WRULS

<table>
<thead>
<tr>
<th>Variables</th>
<th>WRULS</th>
<th>No WRULS</th>
<th>p-value</th>
<th>Unadjusted Odds Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Computer usage</strong> (n=340)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Non user</td>
<td>111 (34.5)</td>
<td>211 (65.5)</td>
<td>0.702</td>
<td>1.0</td>
</tr>
<tr>
<td>Computer user at home</td>
<td>7 (38.9)</td>
<td>11 (61.1)</td>
<td></td>
<td>1.2 (0.4, 3.2)</td>
</tr>
<tr>
<td><strong>Duration of computer usage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(hours per day) (n=18)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Less than 5</td>
<td>4 (33.3)</td>
<td>8 (66.7)</td>
<td>0.494</td>
<td>1.0</td>
</tr>
<tr>
<td>5 hours and more</td>
<td>3 (5.0)</td>
<td>3 (5.0)</td>
<td></td>
<td>1.1 (0.1, 8.7)</td>
</tr>
</tbody>
</table>

Footnote: * Reference group
Fisher's Exact Test was used for duration of computer usage at home because 3 cells (75%) have expected count less than 5

49
4.3 Multivariate analyses

In this section, multivariate analyses were carried out in order to assess the role of computer usage in WRULS.

4.3.1 The role of computer usage in WRULS

Logistic regression modeling was used to determine whether computer usage is independently associated with WRULS. The variables (potential confounders) selected for the logistic regression modeling were age, gender, education, hand intensive hobby and job group (Table 13). After controlling for the confounder, it was found that computer usage at work was statistically significant with WRULS. The risk of WRULS was 2.0 (95% CI: 1.1, 3.4) for computer users compared to non computer user at work.

In this modeling, the variance in the WRULS as explained by the independent variables was only 11.6% (Nagelkerke $R^2 = 0.116$).
Table 13. Logistic regression modeling of computer usage in WRULS

<table>
<thead>
<tr>
<th>variables</th>
<th>Unadjusted Odds Ratio (95% CI)</th>
<th>β</th>
<th>Adjusted Odds Ratio (95% CI)</th>
<th>p-value (Wald)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age group (years)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 30</td>
<td>1.0</td>
<td>1.0</td>
<td>0.9 (0.5, 1.6)</td>
<td>0.981</td>
</tr>
<tr>
<td>30-39</td>
<td>1.2 (0.7, 2.1)</td>
<td>-0.071</td>
<td>0.9 (0.5, 1.6)</td>
<td></td>
</tr>
<tr>
<td>40-49</td>
<td>1.3 (0.8, 2.1)</td>
<td>0.012</td>
<td>1.0 (0.6, 1.8)</td>
<td></td>
</tr>
<tr>
<td>50 and more</td>
<td>1.3 (0.6, 2.6)</td>
<td>0.017</td>
<td>1.1 (0.5, 2.4)</td>
<td></td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>1.0</td>
<td>1.0</td>
<td>0.9 (0.6, 1.6)</td>
<td>0.841</td>
</tr>
<tr>
<td>Female</td>
<td>1.0 (0.6, 1.5)</td>
<td>-0.051</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tertiary</td>
<td>1.0</td>
<td>1.0</td>
<td>0.9 (0.5, 1.6)</td>
<td>0.223</td>
</tr>
<tr>
<td>Upper secondary</td>
<td>0.6 (0.4, 0.9)</td>
<td>0.204</td>
<td>1.2 (0.5, 2.9)</td>
<td></td>
</tr>
<tr>
<td>Lower secondary</td>
<td>1.1 (0.5, 2.1)</td>
<td>0.815</td>
<td>2.3 (0.8, 6.5)</td>
<td></td>
</tr>
<tr>
<td><strong>Hand intensive hobby</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>1.0</td>
<td>1.0</td>
<td>3.1 (1.9, 4.9)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Yes</td>
<td>2.9 (1.8, 4.6)</td>
<td>1.123</td>
<td>1.2 (0.5, 2.9)</td>
<td></td>
</tr>
<tr>
<td><strong>Job group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Managerial &amp; Professional</td>
<td>1.0</td>
<td>1.0</td>
<td>0.9 (0.5, 1.6)</td>
<td>0.126</td>
</tr>
<tr>
<td>Supportive</td>
<td>0.6 (0.4, 0.9)</td>
<td>-0.66</td>
<td>0.5 (0.2, 1.2)</td>
<td></td>
</tr>
<tr>
<td><strong>Computer usage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>1.0</td>
<td>1.0</td>
<td>2.0 (1.1, 3.4)</td>
<td>0.019</td>
</tr>
<tr>
<td>Yes</td>
<td>1.8 (1.0, 3.2)</td>
<td>0.712</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Footnote:
Nagelkerke $R^2 = 0.116$
CHAPTER 5

DISCUSSION

5.1 Prevalence of WRULS

In this study, the prevalence of WRULS was 33.0 % and this constitutes one in every three respondents. This finding was laid in between 14 to 66 percents of the prevalence of WRULS as found in previous studies.\(^7,27,28,29,31,44,54\)

Prevalence in this study was similar with study done by Palmer et al whereby previous author had found prevalence of neck or upper limbs symptoms were 30 percents among the non manual workers of which 30 percents of them were keyboard user.\(^29\)

Another study reported slightly lower prevalence of WRULS compared to the this study.\(^7,29\) Blatter and Bongers found the prevalence of 31 % among secretaries and typists and 23% in other administrative occupation and 13% among policy maker.\(^31\) However, if only the prevalence of supportive staffs was considered, this study found 27.6% of WRULS among this job group and the prevalence still laid between their ranges. The difference in prevalence between previous and this study might also occur because of difference in definition used for WRULS. Previous study used “regular and long lasting pain or discomfort during the past 12 months” whereas this study used “frequency at least once a month within the past 12 months”.

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Hales et al in his study among the video display terminal users had found lower prevalence (only 22%). The difference in the prevalence may be partly be attributed to the fact that previous study confirmed their cases by physical examination apart from self-administered questionnaire but this study did not conduct any medical examination to confirm the symptom as claimed in the self-administered questionnaire.

Analysis of self reported musculoskeletal conditions across the European member state showed that the prevalence of musculoskeletal symptoms were from 14.0 - 39.7%. Even though the prevalence of this study laid between previous study’s percentages, type of occupation was not comparable because previous study involved workers in general industries. Similarly, Lemasters et al found the prevalence of WRULS were between 20-24% based on the body parts affected. However, it is difficult to compare the prevalence because previous study was only specific to carpenters.

There were also previous studies that reported higher prevalence of WRULS. Harrington and Walker reported 44% of limbs discomfort. However the reported pain or discomfort were not confined to only upper limbs but also involved other parts of the body such as back, eyes and headache. For these reasons, the prevalence found in this study was not comparable.

Cherry et al reported 62% upper limbs cases. However, only small percentages of office workers that reported upper limbs disorders - 6 percents were secretaries, 5 percents were clerks, 3 percents were computer operator and 1.5 percents was typist).
Even though the prevalence in this study was very low compared to previous study, comparison should be made with caution because only 15.5 percent of office workers contributed to upper limbs symptoms in the previous study.

Cherry et al. reported the incidence of WRULS as high as 66%. All their cases came from rheumatology clinic. They also reported that the largest numbers of cases were seen among clerical and secretarial workers apart from craft occupations.\textsuperscript{27} High prevalence of WRULS seen was probably because all type of occupations involved and not only confined to office workers.

In this study, majority (about 70 percent) had symptoms at least once a month and one in every four of them went to see doctors. Among those with medical consultation, nearly half had to be away from work due to medical leave ranging from one day to more than one month based on the severity of symptoms or duration of exposure. This may affect their productivity at work. Friedman had suggested that employers and occupational health provider should made every effort to prevent absenteeism through early detection of symptoms, early treatment, modification of work duties and systematic management of health care.\textsuperscript{21}

Apart from productivity issue, employer has to bear the health care cost and it can be very costly as reported in the study done in United States which amounted to US $418 billion.\textsuperscript{6} In the Malaysian government setting, the cost may not be very obvious and not appreciated by workers or immediate management because all the cost were
automatically absorbed and paid by government if they get treatment or consultation in government health care facilities.

Under OSHA 1994, it is responsibility of employer to provide safe working environment for their staff. There were also guidelines describing on safety issues pertaining to office work including computer usage.

5.2 Factors influencing WRULS

Age is a factor that has biological plausibility to account for relationship observed in any epidemiological study. However, in this study age was not found to be statistically associated with WRULS and it agreed by other studies.

Several epidemiological studies had found that women were at higher risk for WRULS with the exception of a study by Friedman. However, this study showed no significant difference in the risk of WRULS between male and female workers which contradicted to most other findings.

Education was found to be statistically associated with WRULS, whereby workers with lower secondary level of education had slightly higher risk of WRULS than tertiary level of education but upper secondary level had lower risk of WRULS. However when adjusted for other factors namely socio demographic, hobby, job group and computer usage, the risk was higher for lower secondary level. This might be due to the
fact that lower education level are involved more with manual work (example lifting objects and packing) compared to workers with tertiary education. Another possibility was that workers with a lower level of education had less awareness and knowledge on the risk for WRULS.

Hand intensive hobby was found to be statistically associated with WRULS even after adjustment for socio demographic, type of job and computer usage. Workers with hand intensive hobby had higher risk of WRULS compared to workers without hobby. This finding was expected as workers with hand intensive hobby used their hands intensely and may cause or exacerbate the symptoms. This finding was also consistent with study by Melhorn. Thus, it was important for occupational health physicians or medical personnel to exclude hobby when assessing symptoms related to work as this may implies litigation.

In contrast, Fogleman and Lewis found no significant association between hobbies and occurrence of self reported musculoskeletal discomfort among video display terminal user. However, they were no obvious explanation for their findings apart from conclusion that their population was most probably more responsive to pain and discontinued hobby after the onset of musculoskeletal symptoms.

Job group was found to be statistically associated with WRULS. Supportive group had lesser risk of WRULS compared to managerial and professional group. Even though this finding was unexpected, it occurred most probably because the managerial and professional group of workers was likely spend longer duration on their deskwork.
including computer work. The nature of their work requires them to concentrate on their computer screen and keyboards apart from writing papers. Since previous studies had found that computer work had a relationship with WRULS, this may also explain the same conditions as found in this study. ²⁰, ³⁶, ³⁷

Opposite finding was also found for duration of work, whereby the longer the duration of work, the less the risk of WRULS. However this finding had no statistical significant with WRULS. As mentioned earlier by Coury et al, those exposed and had WRULS may leave the organization early because of their symptoms.³² However, this study cannot support that notion regarding early retirement or resignation due to upper limbs symptoms.

5.3 Computer usage and its association with WRULS

This study found that computer usage in the office was statistically significant with WRULS even after controlling for confounder factors. The risk of computer user getting WRULS was twice compared to non computer user. This finding was consistent with previous studies that found association of computer usage and WRULS. ²⁰, ³⁴, ³⁵, ⁴³-⁴⁷

Previous studies had shown that office workers were at risk for WRULS.³², ³³, ³⁶ In this new era of technology computer usage in the office is a necessity; this finding was rather alarming because most of office workers are involved with computer task and they may not be aware of the risk associated with it. Therefore, there is a need to educate
workers on the correct handling of computers and hence minimize the potential health effect of computer use.\textsuperscript{8}

Duration of computer usage per day was also statistically significant with WRULS. This study found that the longer the duration of computer usage per day, the higher the risk of WRULS and this remains significant even after controlling for confounders. This result concurs with findings from previous studies.\textsuperscript{29, 34-36, 41, 42, 44} Workers who worked with computer for 5 hours and more per day in the office had 7.5 higher risks of WRULS compared to those using computer less than 5 hours per day.

5.4 Methodological limitations of this study

As mentioned earlier, the author had taken various steps to ensure that this study was carried out properly to minimize systematic error as well as random error. The response rate in this study was very high (87\%) despite it being a self-administered questionnaire. However, the author realized that this study inevitably pose some unavoidable limitations. This will be elaborated in this section.

Work-related Upper Limb Symptoms is an umbrella term used to describe a variety of related symptoms to the muscles, nerves, tendons and other soft body tissues of the hand, wrist, arm, shoulder and spine. Symptoms that may arise from the use of a computer include pain, numbness, aching, tiredness and tingling in these areas. As these symptoms can be diverse and may not appear consistently; it may make recognition or
recalling of the problems difficult for workers especially if they were asked to self-report their symptoms.2, 4, 15, 25

Another methodological limitation in this study was definition of WRULS. It may differ from other studies. Thus, direct comparison of prevalence was not easy.

Self-reporting of symptoms is very subjective, which limits the strength of interpretation. Self reported hours per day of computer work was used for classification of computer user and also generally considered as a crude measure of exposure, probably weakening observed association between exposure and health outcome (WRULS).

The health outcome (WRULS) in this study was not confirmed with physical examination to verify the claim of self reported symptoms. Unlike, Punnet and Bergqvist in their study they were able to confirmed the symptoms by physical examinations that verified the self-reported symptoms.36
CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

6.1. Conclusions

From this study it can be concluded that;

6.1.1 The prevalence of WRULS was 33.0% (95% C.I.: 28.8, 37.3%)

6.1.2 Computer usage was associated with an increased risk of WRULS by 2.0
(95% C.I.: 1.1, 3.4)

6.1.3 Computer usage of 5 hours and more per day was associated with an
increased risk of WRULS by 7.5 (95% C.I.: 2.3, 24.2)

6.2. Recommendations

6.2.1 Pre-employment examination

Every worker who joins the organization should undergo pre-employment
examination as the government has already introduced mandatory general medical
checkup prior to employment. For the office workers, it should also include the
examination pertaining to the risk in office setting for instances musculoskeletal
examination. The examination is important so as to screen worker’s health status prior to starting their work to ensure that workers do not pose a direct threat to the health and safety of themselves. Apart from that, the examination is also important in order to prevent from unnecessary litigation if the condition were proven to be acquired during work.

6.2.2. Periodic medical examination

Periodic medical examination should be conducted to all workers especially to those at high risk for WRULS due to unsafe work exposure. In this contact, office workers should be checked periodically for any musculoskeletal symptoms. The medical history and medical records will provide information about the onset of symptoms and its relation to work.

6.2.3 Future research

Future research is recommended to include medical examination to confirm the diagnosis of self-reported symptoms as to increase the validity of the classification of cases.
REFERENCES


45. Musculoskeletal disorders. NIOSH Fact Sheet. (Internet communication, 2 July 1997 at http://www.cdc.gov/niosh/musksfs.html)
50. Dutch Musculoskeletal Discomfort Questionnaire. (Internet communication, 1 June 2003 at http://ergo.human.cornell.edu/ahdutchmsquest.html)
55. Salient provision of the Occupational Safety and Health Act 1994. Department of Occupational Safety and Health
## Operational definition of variables

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Operational definition</th>
<th>Scale</th>
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</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Sex of responders</td>
<td>• Male</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Female</td>
</tr>
<tr>
<td>Age</td>
<td>Age on 1\textsuperscript{st} of January 2003</td>
<td>Years</td>
</tr>
<tr>
<td>Ethnic group</td>
<td>As stated by respondent</td>
<td>• Malay</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Chinese</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Indian</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Others</td>
</tr>
<tr>
<td>Education level</td>
<td>Highest level of formal education attained by respondents.</td>
<td>• Lower secondary</td>
</tr>
<tr>
<td></td>
<td>Lower secondary refers to completed education up to MCE/SRP/PMR</td>
<td>• Upper secondary</td>
</tr>
<tr>
<td></td>
<td>Upper secondary refers to completed education up to SPM/STP</td>
<td>• Tertiary</td>
</tr>
<tr>
<td></td>
<td>Tertiary education refers to Diploma/First degree/Master/PhD</td>
<td></td>
</tr>
<tr>
<td>Medical history</td>
<td>Any medical illness that was diagnosed by medical doctor. The medical diseases related to WRULS are thyroid dysfunction, diabetes mellitus, rheumatoid arthritis, gout, cervical spondylosis, osteoarthritis and frozen shoulder $^{34}$</td>
<td>• Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• No</td>
</tr>
<tr>
<td>Characteristics</td>
<td>Operational definition</td>
<td>Scale</td>
</tr>
<tr>
<td>-------------------</td>
<td>----------------------------------------------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Hobby</td>
<td>Hand intensive hobby</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- musical instruments</td>
<td>• Yes</td>
</tr>
<tr>
<td></td>
<td>- racquet sports (eg. Badminton, squash, tennis etc)</td>
<td>• No</td>
</tr>
<tr>
<td></td>
<td>- sports club (eg. Netball, basketball, golf etc)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- handcraft, gardening, sewing, knitting</td>
<td></td>
</tr>
<tr>
<td>Occupation</td>
<td>Job title:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Managerial and Professional</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Supportive (Secretarial, Clerical, Typist, General work)</td>
<td></td>
</tr>
<tr>
<td>Office workers</td>
<td>Permanent office staffs in the Ministry of Health Headquartes that had worked at least one year duration</td>
<td></td>
</tr>
<tr>
<td>Duration of work</td>
<td>Duration of work in the current job title</td>
<td>Years</td>
</tr>
<tr>
<td>Computer user</td>
<td>Use computer in daily work task for more than 2 hour per day</td>
<td>• Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• No</td>
</tr>
</tbody>
</table>
Dear Mrs. Zarina,

I wish you success with your thesis.

You may incorporate some parts of “Dutch Musculoskeletal Questionnaires” into your questionnaires. I wish you success with your thesis.

Yours sincerely,

[Signature]

Dear Jeffrey Lewis, Ph.D.

I have no objection to you using my questionnaire.

So you may want to contact them.

Commonly, I don’t know whether the journal must give permission or not, to use the copyright on to aso get permission from the journal. They have the copyright on and study into your thesis questionnaire. However, I’m wondering if you need consent from author of questionnaire.

Hello,

Best regards,

[Signature]
SOAL SELIDIK KESIHATAN PEKERJAAN DIKALANGAN PEKERJA IBU PEJABAT
KEMENTERIAN KESIHATAN MALAYSIA

Soal selidik ini mengandungi 5 bahagian dengan bilangan mukasurat sebanyak lima (5) helai termasuk mukasurat hadapan.

1. Biodata
2. Gejala penyakit muskuloskeletal
3. Sejarah penyakit
4. Hobi
5. Faktor kerja

Tolong jawab soalan yang diberikan dan ikut arahan yang tertulis.

Tidak perlu menulis nama anda pada borang soal-selidik ini.

Sebahagian daripada soalan memberi pilihan jawapan "Ya" atau "Tidak" sahaja.
Sila jawab salah satu daripadanya dan jangan jawab kedua-duanya sekali dengan serentak kerana jawapan anda tidak akan dapat di proses kelak.

Segala maklumat dan jawapan yang anda berikan adalah sulit. Hanya pekerja yang terlibat dalam soal selidik ini sahaja yang boleh mengetahui maklumat anda tanpa perlu meminta kebeneran daripada anda.

Dalam laporan berkaitan kajian ini, maklumat peribadi anda tidak akan tertera atau diketahui.

Terima kasih atas kerjasama yang anda berikan.
Maklumat ini diharap dapat memperbaiki keadaan di tempat kerja anda.
1. BIODATA

1) Berapakah umur anda (pada 1 Januari 2003) [ ] tahun

2) Jantina
   1 [ ] perempuan
   2 [ ] Lelaki

3) Bangsa
   1 [ ] Melayu
   2 [ ] Cina
   3 [ ] India
   4 [ ] Lain-lain (nyatakan) [ ]

4) Apakah pendidikan formal anda yang tertinggi
   1 [ ] SRP/MCE
   2 [ ] SPM/STP
   3 [ ] Diploma/Ijazah/Phd

2. GEJALA PENYAKIT MUSKULOSKELETAL

5) a) Adakah anda pernah merasakan sakit, kebas, menyucuk dan/atau ketidakselesaan pada anggota badan tersenarai di bawah dalam masa 12 bulan (setahun) kebelakangan ini:

Sila tandakan (\(\checkmark\)) pada kotak yang berkaitan; boleh tanda lebih dari satu anggota

<table>
<thead>
<tr>
<th></th>
<th>Ya</th>
<th>Tidak</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leher</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Bahu</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Lengan</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Siku</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Pergelangan tangan</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Jari</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

Sekiranya semua jawapan anda pada soalan 5 (a) adalah "Tidak", terus kan ke soalan 14

Sekiranya jawapan anda pada soalan 5 (a) adalah "Ya", terus kan ke soalan 5 (b)
b) Sila tandakan pada gambar A bahagian badan anda yang mengalami gejala tersebut (boleh tanda lebih dari satu bahagian badan yang terlibat).

Gambar A

1. Leher
2. Bahu
3. Lengan
4. Siku
5. Pergelangan tangan
6. Jari

6) Adakah gejala penyakit anda bermula semenjak anda memulakan pekerjaan sekarang?

   1. Ya
   2. Tidak

7) Adakah anda pernah mengalami apa-apa kecederaan pada bahagian badan yang anda tandakan di gambar A?

   1. Ya
   2. Tidak

8) Berapa kerap anda mengalami gejala tersebut dalam masa **12 bulan (setahun)** kebelakangan ini?

   **Tandakan satu sahaja**

   1. Berterusan tanpa henti
   2. Dirasai setiap hari
   3. beberapa kali **seminggu**
   4. sekurang-kurangnya sekali dalam **setiap bulan**
   5. Sekali dalam setiap 2-3 bulan
   6. 1-2 kali setahun
9) Adakah anda pernah mendapatkan rawatan doktor kerana gejala tersebut

1. Ya
2. Tidak

10) Berapakah hari anda terpaksa mengambil cuti sakit disebabkan gejala tersebut

1. Tidak pernah
2. 1-7 hari
3. 7-14 hari
4. 15-30 hari
5. Melebihi satu bulan

3. SEJARAH PENYAKIT

11) a) Adakah anda sedang/pernah menghidap penyakit (yang di diagnose/disahkan oleh doktor perubatan)

1. Ya
2. Tidak

b) Sekiranya jawapan anda adalah "Ya", sila nyatakan penyakit anda ____________________________

4. HOBI

12) Adakah anda mempunyai hobi seperti di bawah (anda boleh tandakan lebih dari satu)

1. Penggunaan alat muzik (contoh: piano, biola, gitar dll)
2. Sukan menggunakan reket (contoh: badminton, tenis, ping-pong dll)
3. Sukan kelab (contoh: bola jaring, bola tampar, golf, takraw dll)
4. Hobi yang menggunakan tangan secara intensif (contoh; kraftangan, menyulam, menjahit, berkebun dll)
5. Tidak berkaitan

5. FAKTOR KERJA

13) Apakah jenis pekerjaan yang anda lakukan sekarang

1. Pengurusan (managerial)
2. Sekretari (secretarial)
3. Pengkeranian (clerical)
4. Jurutaip (typist)
5. Lain-lain (nyatakan) ________________________

14) Berapa lamaakah anda telah berada dalam pekerjaan sekarang?

_______ tahun _______ bulan
15) Adakah anda menggunakan "komputer" dalam menjalankan tugas harian anda di pejabat?

1 □ Ya
2 □ Tidak

Sekiranya jawapan anda "Tidak", soal selidik anda berakhir di sini.
Sekiranya jawapan anda "Ya", terus ke soalan berikutnya yang berkaitan dengan penggunaan komputer dalam kerja seharian anda.

16) Secara purata, berapa jam seharian pada hari bekerja anda menggunakan komputer?

(bulatkan satu jawapan) 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7 □ 8 □ 9 □ 10 □ 10 +

17) a) Adakah anda menggunakan komputer di rumah untuk aktiviti tidak berkaitan dengan kerja anda?

1 □ Ya
2 □ Tidak

b) Sekiranya "Ya", anggaran berapa JAM SEMINGGU: _____________ jam