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職業性肌肉骨骼疾病與就業場所相關暴露因子之探討：

腕道症候群及腰部椎間盤疾患

The Relationship Between Work-related Musculoskeletal
Disorders and Workplace Exposure Factors - CTS and HIVD

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本論文係楊善園君 (R00841014) 在國立臺灣大學職業醫學與工業衛生研究所完成之碩士學位論文，於民國 102 年 06 月 07 日承下列考試委員審查通過及口試及格，特此證明

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祝福大家都順利平安、身體健康。

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摘要



職業性肌肉骨骼疾病 (Work-related musculoskeletal disorders, WMSDs) 在國際間已成為最常見的職業疾病，因職業性肌肉骨骼疾病連帶而來財務花費也高居所有職業性疾病之冠。在台灣，職業性肌肉骨骼疾病幾乎佔了所有職業性疾病的一半，而且也耗費了相當多的勞保補償。

本研究希望能找到罹患職業性肌肉骨骼疾病的高風險行業，以及釐清人因相關因子與勞工自覺肌肉骨骼症狀與罹患職業性肌肉骨骼疾病之關係；另外，亦期望能以工作場所人因暴露以及勞工自覺痠痛症狀調查，發展偵測罹患職業性肌肉骨骼疾病風險之方法。職業性肌肉骨骼疾病種類繁多，本研究選取腕道症候群 (Carpal tunnel syndrome, CTS) 為上肢部位代表、腰部椎間盤疾患 (Herniation of intervertebral disc, HIVD) 為頸椎、腰椎部位代表，進行深入的探討。

利用生態研究架構，將兩個互相獨立的資料庫依 89 個行業別作為連結：(1) 臺灣職業傷病通報系統，取得 2008-2011 四年間腕道症候群及腰部椎間盤疾患的通報資料，並分性別算出調整年齡之標準化發生率為依變項；(2) 勞研所 2010 年之工作環境安全衛生狀況認知調查，取得勞工自填之工作環境人因暴露因子及勞工自覺痠痛且影響工作表現在各行業之暴露比例為自變項。

以各行業總就業人口數為比重，線性迴歸分析結果顯示：「重複性手部動作」 ($\beta: 0.027, 95\% \text{ CI: } 0.008, 0.046$) 是男性罹患腕道症候群主要的危險因子、「使用震



動的手部工具」 (β : 0.124, 95% CI: 0.063, 0.185)則是女性罹患腕道症候群主要的危險因子;在腰部椎間盤疾患部分,男性以「全身震動」 (β : 0.106, 95% CI: 0.082, 0.133)及「搬運重物」 (β : 0.008, 95% CI: 0.001, 0.015)、女性以「全身震動」 (β : 0.086, 95% CI: 0.016, 0.157)及「不自然的姿勢」 (β : 0.030, 95% CI: 0.008, 0.052)為主要危險因子,此外,更發現男性與女性與各別的二種因子都有顯著的加成作用,同時暴露於二種因子而罹患腰部椎間盤疾患的危險性,高於僅暴露於單一危險因子。

本研究亦針對一光電廠進行上肢肌肉骨骼問題的調查,結果顯示:在填答問卷之 359 位員工之中,76 位有自覺肌肉骨骼不適症狀,而其中有 19 位被超音波診斷出確實有肌肉骨骼的問題。最常見的上肢肌肉骨骼問題為旋轉肌袖症候群 (N=17) 以及肩峰鎖骨關節腫脹 (N=7)。

工作場所人因暴露因子以及勞工自覺痠痛症狀,與職業性肌肉骨骼疾病確實有其相關性,更深入探討相關貢獻量以及機轉有其必要性。且此方法可以使用相當簡單的問卷取得相關資料,未來應可以用來發展篩檢各種工作場所,以評估或預測各職業場所引起職業性肌肉骨骼疾病之相關風險。

關鍵字: 職業性肌肉骨骼疾病、腕道症候群、腰部椎間盤疾患、人因工程、自覺症狀、通報系統、共同作用


Abstract



Work-related musculoskeletal disorders (WMSDs) have become the most common occupational diseases internationally. Expenses due to WMSDs are most important among all occupational diseases. In Taiwan, WMSDs accounted for almost 50% of the total occupational diseases, and caused a significant portion of labor insurance payments.

The aim of this study is to find the high risk industries which have higher WMSDs incidence. Therefore, we wish to develop a method which use workplace factors to detect the risk of workers suffering from WMSDs. Because carpal tunnel syndrome (CTS) and herniation of intervertebral disc (HIVD) was the most two common WMSDs, this study chose these two WMSDs as outcome variables.

We designed an ecological study using two separate databases: (1) Taiwan's occupational disease and injury notification system (ODIS). (2) Survey of Perceptions of Safety and Health in the Work Environment in 2010. We used the CTS and HIVD as cases reported on ODIS from 2008 to 2011 to calculate the age-adjusted standardized incidence rates (SIR) as dependent variable. The independent variables included the self-reported ergonomic factors and self-reported musculoskeletal discomforts. The two databases were connecting by 89 job divisions.



In this study, linear regression was used to find the relationship between workplace factors and CTS and HIVD, and we used the number of employed workers in each job category as weighting. From this study, we found out that “repetitive hand movements” (β : 0.027, 95% CI: 0.008, 0.046) was a major risk factor for male with CTS and “vibration from hand tools” (β : 0.124, 95% CI: 0.063, 0.185) for female with CTS. As for HIVD, the risk factors were “whole body vibration” (β : 0.106, 95% CI: 0.082, 0.133) and “heavy lifting” (β : 0.008, 95% CI: 0.001, 0.015) for male, and “whole body vibration” (β : 0.086, 95% CI: 0.016, 0.157) and “awkward posture” (β : 0.030, 95% CI: 0.008, 0.052) for female respectively. Moreover, “whole body vibration” and “heavy lifting” showed significant additive effect for the male and “whole body vibration”; “awkward posture” showed significant additive effect for the female.

A field study was conducted in a factory, in order to understand the gap between self-reported symptoms and diagnosed musculoskeletal disorders in upper extremities. A total of 359 questionnaires were completed. There were 76 workers having self-reported musculoskeletal symptoms and a total of 19 workers were diagnosed as having musculoskeletal disorders by ultrasound. The most frequently diagnosed conditions were rotator cuff syndrome (N=17) and acromioclavicular joint distention (N=7).

In conclusion, the workplace factors had relationship with the incidence of WMSDs.

Such factors can be identified by sample screening tools as questionnaire. By using this approach, it is possible to screen various kinds of workplaces and assess or predict the risk of WMSDs. Also, this will promote future efforts to improve the effectiveness in ergonomic intervention in workplaces and also establish the model for prevention against WMSDs.

Key words: WMSDs; Carpal tunnel syndrome (CTS); Herniation of intervertebral disc (HIVD); Ergonomic; Self-reported discomforts; Surveillance; combination of risk factors

4.4.1 Workplace exposure factors - ergonomic factors	23
4.4.2 Workplace exposure factors - self-reported musculoskeletal discomforts	25
4.5 The relationship between Work-related musculoskeletal disorders and workplace ergonomic factors	26
4.5.1 Log-transformed SIR (case/year/million workers) and workplace ergonomic factors (% reported +) - CTS	27
4.5.2 Log-transformed SIR (case/year/million workers) and workplace ergonomic factors (% reported +) -HIVD	27
4.6 The relationship between the geometric mean of SIR and different levels of workplace exposure factors	28
4.6.1 Geometric Mean SIR of CTS and ergonomic factors.....	29
4.6.2 Geometric Mean SIR of HIVD and ergonomic factors.....	30
4.6.3 Combination of risk factors - HIVD.....	33
4.7 The relationship between the geometric mean of SIR and different levels of self-reported musculoskeletal discomforts	35
4.7.1 Geometric Mean SIR of CTS and hands or wrists musculoskeletal discomfort.....	35
4.7.2 Geometric Mean SIR of HIVD and low back or waist musculoskeletal discomfort.....	36
Chapter 5 Field study.....	37
5.1 The objective of the field study	37
5.2 Material and method of the field study.....	37
5.3 Results of the field study	38
5.4 Conclusion and future works.....	39
Chapter 6 Discussion.....	40
6.1 WMSDs accounted for the largest part of occupational diseases.....	40
6.2 The high risk industrial categories suffering from WMSDs	41
6.3 The risk factors of WMSDs.....	42
6.4 Secondary self-reported questionnaire	44
6.5 Limitation	45
Chapter 7 Conclusion	47
Reference.....	48
Appendix	147
1. Questionnaire of field study	147
2. Scandinavian criteria of physical examination.....	152



List of Tables

Table 1. Standard Industrial Classification System of the republic of china.....	53
Table 2. Incidence rate of occupational diseases	56
Table 3. Demographic data of 2008-2011 ODIS cases.....	57
Table 4. Classification and selection for WMSDs.....	58
Table 5. The CTS cases by age and industry sector distribution.....	58
Table 6. SIR of CTS in 89 job divisions (Cases per 10 ⁶ population per year).....	59
Table 7. The HIVD cases by age and industry sector distribution	64
Table 8. SIR of HIVD in 89 job divisions (Cases per 10 ⁶ population per year).....	65
Table 9. Workplace ergonomic factors in difference job divisions, Male	70
Table 10. Workplace ergonomic factors in difference job categories, Female.....	76
Table 11. Self-reported musculoskeletal discomforts in different job divisions	82
Table 12. Simple linear regression of log transformed SIR of CTS (case/yr/million workers) and workplace ergonomic factors (% reported +)	87
Table 13. Multiple linear regression of SIR in CTS and ergonomic risk factors	87
Table 14. Simple linear regression of log transformed SIR of HIVD (case/yr/million workers) and workplace ergonomic factors (% reported +)	87
Table 15. Multiple linear regression of SIR in HIVD and ergonomic risk factors.....	87
Table 16. Level of groups and its included job divisions covering the percentage range and the groups in “vibration from hand tools”	88
Table 17. Level of groups and its included job divisions covering the percentage range and the groups in “repetitive hand movements”	93
Table 18. Level of groups and its included job divisions covering the percentage range and the groups in “heavy tools used”	97
Table 19. Level of groups and its included job divisions covering the percentage range and the groups in “whole body vibration”	102
Table 20. Level of groups and its included job divisions covering the percentage range and the groups in “heavy lifting”.....	106
Table 21. Level of groups and its included job divisions covering the percentage range and the groups in “awkward posture”	110
Table 22. Relationship between SIR of HIVD and combination of ergonomic factors, Male.....	114
Table 23. Relationship between SIR of HIVD and combination of ergonomic factors, Female	114

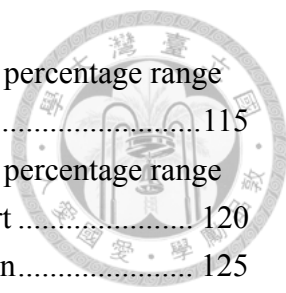


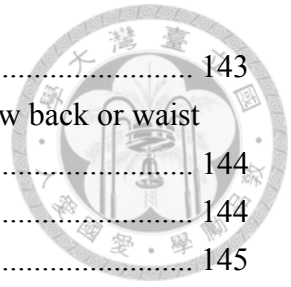
Table 24. Level of groups and its included job divisions covering the percentage range and the groups in “hands or wrists musculoskeletal discomfort”	115
Table 25. Level of groups and its included job divisions covering the percentage range and the groups in “low back or waist musculoskeletal discomfort”	120
Table 26. Results of physical examination and ultrasound examination.....	125
Table 27. Distribution of demographics and working conditions of workers	131



List of Figures

Figure 1. A conceptual model of the possible roles and influences that various factors may play in the development of musculoskeletal disorders [25].	133
Figure 2. The network for Occupational Disease and Injury Services in Taiwan	134
Figure 3. Calculated process of SIR	135
Figure 4. Flow chart of statistical methods	135
Figure 5. Results of selected and recognized the WMSDs.....	136
Figure 6. The SIR of CTS with the self-reported percentage of workers exposure to “vibration from hand tools” levels, Male	137
Figure 7. The SIR of CTS with the self-reported percentage of workers exposure to “vibration from hand tools” levels, Female.....	137
Figure 8. The SIR of CTS with the self-reported percentage of workers exposure to “repetitive hand movements” levels, Male.....	138
Figure 9. The SIR of CTS with the self-reported percentage of workers exposure to “heavy tools used” levels, male.....	138
Figure 10. The SIR of HIVD with the self-reported percentage of workers exposure to “whole body vibration” levels, Male.....	139
Figure 11. The SIR of HIVD with the self-reported percentage of workers exposure to “whole body vibration” levels, Female	139
Figure 12. The SIR of HIVD with the self-reported percentage of workers exposure to “heavy lifting” levels, Male.....	140
Figure 13. The SIR of HIVD with the self-reported percentage of workers exposure to “heavy lifting” levels, Female	140
Figure 14. The SIR of HIVD with the self-reported percentage of workers exposure to “heavy tools used” levels, Male	141
Figure 15. The SIR of HIVD with the self-reported percentage of workers exposure to “heavy tools used” levels, Female.....	141
Figure 16. The SIR of HIVD with the self-reported percentage of workers exposure to “awkward posture” levels, Male.....	142
Figure 17. The SIR of HIVD with the self-reported percentage of workers exposure to “awkward posture” levels, Female	142
Figure 18. The SIR of CTS with the self-reported percentage of “hands or wrists musculoskeletal discomfort” levels, Male.....	143
Figure 19. The SIR of CTS with the self-reported percentage of “hands or wrists	

musculoskeletal discomfort” levels, Female	143
Figure 20. The SIR of HIVD with the self-reported percentage of “low back or waist musculoskeletal discomfort” levels, Male and Female	144
Figure 21. Case including criteria in the field study	144
Figure 22. Flow chart of field study	145
Figure 23. Flow chart of workers inclusion in field study.....	146



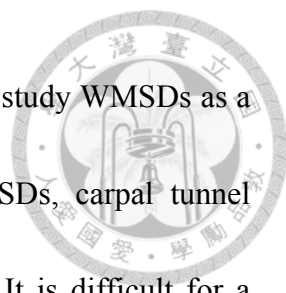


Chapter 1 Introduction

Work-related musculoskeletal disorders (WMSDs) are common health problem in the working population. WMSDs include many conditions that affect the muscles, tendons, ligaments, and joint cartilage, and spinal discs, as well as the anatomically associated peripheral motor and sensory nerves [1-4]. As well, these include such ailments as low back pain, shoulder disorders, and distal upper extremity disorders, including tendonitis, epicondylitis, and carpal tunnel syndrome. WMSDs are the leading nature of injury among non-fatal occupational injuries and illnesses [5].

WMSDs have caused serious social problems such as wage compensation, medical expenses and reduced productivity, as well as worker's physical and psychological pain [6, 7]. WMSDs are a worldwide concern and distributed among both industrialized countries and industrially developing countries [8]. In Taiwan, WMSDs accounted for almost 50% of the total occupational diseases, and caused a significant portion of labor insurance payments.

For most WMSDs, both onset and duration are more often chronic or sub-chronic than acute. Typically, they tend to develop after months or years of overuse of the soft tissues. It has been observed that within a population occupationally exposed to particular ergonomic stressors, several different types of clinical disorders may arise in



different individuals. Thus, it has often been statistically efficient to study WMSDs as a group [9]. However, each type of WMSD (e.g., low back WMSDs, carpal tunnel syndrome, tendinitis, epycondilitis, etc.) has different risk factors. It is difficult for a single study to satisfy all criteria to determine a causal relationship between risk factors and WMSDs [4]. Thus, it is important to integrate information derived from a comprehensive database to identify factors contributing to different types of WMSD. This way, risk factors and the level of evidence of their relationship with each WMSD can be evaluated. WMSDs of the back and upper extremity appear to be more common than those affecting the lower extremity [9].

In 2011, Thomas compared 2002 and 2006 General Social Survey about WMSDs, concluded that new strategies for preventing both low back and upper extremity MSDs should focus on work stress, heavy lifting, and hand movement [10]. Therefore, in this study, we emphasized on carpal tunnel syndrome (CTS) and herniation of intervertebral disc (HIVD) as the targets. The aim of this study was to find the high risk industries which have higher WMSDs (CTS and HIVD) incidence rate. Furthermore, we anticipate to develop the research methods which use the workplace factors to detect the risk of WMSDs and identifying the relationship between Work-related musculoskeletal disorders and workplace exposure factors.



Chapter 2 Literature review

2.1 The significance of WMSDs

Musculoskeletal disorders (MSDs) are injuries or dysfunctions affecting muscles, bones, nerves, tendons, ligaments, joints, cartilages, and spinal discs. MSDs include sprains, strains, tears, soreness, pain, carpal tunnel syndrome, hernias, and connective tissue injuries of the structures previously mentioned [4].

WMSDs are a major cause of health problems, disability and health care utilization in industrialized countries [11], and are widespread in many countries, with substantial costs and impact on quality of life. Although not uniquely caused by work, they constitute a major proportion of all registered and/or compensable Work-related diseases in many countries. Accurate data on the incidence and prevalence of musculoskeletal disorders are difficult to obtain, and official statistics are difficult to compare across countries. Nevertheless, WMSDs are the single largest category of Work-related illness, representing a third or more of all registered occupational diseases in the United States, the Nordic countries, and Japan [12, 13]. WMSDs are not directly related to high mortality but still giving a major contribution to the burden of disease and perceived health [14]. WMSDs also cause great demands on health care services, constituting about one-third of all visits to primary care [15]. WMSDs are a major cause of sickness absence from work. Moreover, WMSDs are the most expensive form of



work disability [16, 17].

In Sweden, they have been the most common cause for sick leave and disability pension since the 1960s [18]. It was estimated that the cost of WMSD was approximately 215 billion dollars in 1995 in the US; 26 billion Canadian dollars in 1998 in Canada, and 38 billion Euros in 2002 in Germany [16, 19, 20]. The United Kingdom Health and Safety Executive estimated, on the basis of a Labor Force Survey, in 2009-2010 musculoskeletal disorders were the most commonly reported illness types and 37% of working days lost were due to musculoskeletal disorders [21]. In the state of Washington between 1997 and 2005, 27% of all state fund-accepted claims were due to Work-related musculoskeletal disorders (WMSDs) of the neck, back and upper extremities [22].

Also, musculoskeletal conditions are both common and have a major impact on pain, function, activity, participation in society and self-reported health. Musculoskeletal conditions have been reported to be responsible for 40% of all chronic conditions, 54% of all long-term disability and 24% of all restricted activity days [11]. In the UK, approximately 20 million working days are lost each year because of low back pain (LBP), and the latter accounts for 40% of the time lost due to industrial injury [23]. In Korea, the number of compensated workers for WMSDs including LBP was 1,954 in 2007, which amounted to about 34.3% of total occupational diseases [24].



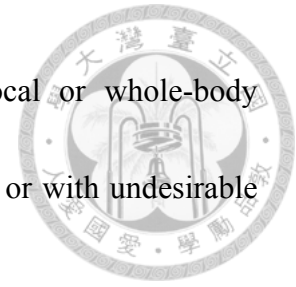
Regardless of the actual costs, the problem is large both in health and economic terms [5].

2.2 The risk factors of WMSDs, CTS and HIVD

Figure 1 shows a conceptual model of the possible roles and influences that various factors may play in the development of MSDs. The dotted box outline on the right indicates the possible pathways and processes that could occur within the person, including the biomechanical load-tolerance relationship and the factors that may mediate the load-tolerance relationship, such as individual factors and adaptation. Outcomes may be a result of this relationship and may be influenced by individual factors, such as conditioning or psychological state. The dotted box on the left indicates the possible influences of the workplace on the sequence of events that can lead to musculoskeletal disorders in the person. Arrows between “the workplace” factors and “the person” box indicate the various research disciplines (epidemiology, biomechanics, physiology, etc.) that have attempted to explain the relationship [25].

The physical job features that are frequently cited as risk factors for WMSDs, based on both experimental science and epidemiologic investigations, include rapid work pace and repetitive motion patterns; insufficient recovery time; heavy lifting and forceful manual exertions; non-neutral body postures (either dynamic or static); mechanical

pressure concentrations; segmental or whole body vibration; local or whole-body exposure to cold; and any of these in combination with each other or with undesirable features of the psychosocial [13].



The enormous scope of the problem is confirmed by statistics from the Annual Survey of Occupational Injuries and Illnesses, conducted by the Bureau of Labor Statistics (BLS). For those cases involving days away from work, BLS reports that in 2001 there were 522,528 WMSDs cases, 75% of those were due to overexertion and another 11.5% were due to repetitive motion disorders. The report indicated that 219,665 of these injuries involved lifting and another 69,247 were associated with bending, climbing, reaching, and twisting. Also, 60,099 injuries or illnesses occurred as a result of repetitive motion, including typing or key entry, repetitive use of tools, and repetitive placing, grasping, or moving of objects other than tools [26].

2.2.1 Risk factors of CTS

Carpal tunnel syndrome (CTS) is one of the most common upper limb compression neuropathies [27]. CTS derives from entrapment of the median nerve within the carpal canal of the wrist. Biomechanical risk factors: repetitive work, manual force, vibration transmitted to the hand, combination of risk factors (e.g., force and repetition, force and wrist bending) [28].




2.2.2 Risk factors of HIVD

Low-Back Disorders include low back syndrome which is soft tissue injury characterized by back pain with localized symptoms and no neurological deficits, and lumbosacral disc herniation disease which is lumbosacral disk degeneration or herniation, typically with nerve root compromise and associated neurological deficits [28]. The traditional view of intervertebral disc degeneration has been that it was a process related to normal ageing as well as changes related to physical loading over the lifetime [29]. Low back pain, have been associated with heavy workload, repetitive and static work, bending and twisting, whole body vibration, job dissatisfaction, imbalance between demand and control, and lack of psychological and social support at work [30-32].

2.3 WMSDs in different industries and occupations

Many industries and occupations have rates that are as much as three to four times higher than the overall frequencies. High risk industries are as varied as nursing facilities, air transportation, mining, food processing, leather tanning, heavy manufacturing of vehicles, furniture, appliances and electrical equipment, and light manufacturing, including electronic products, textiles, shoes, apparel, and upholstery [28].



The Annual Survey of Occupational Injuries and Illnesses, conducted by the Bureau of Labor Statistics (BLS) noted 41% of all reported MSDs were accounted for by one occupation—operators, fabricators, and laborers. Industries with the largest numbers of MSDs were services, manufacturing, and retail trade, with 25.8, 22.9, and 16.0%, respectively [26].

Upper extremity musculoskeletal disorders have been found to be highly prevalent in manual-intensive occupations such as clerical work, postal service work, janitorial work, industrial inspection, and packaging. Back and lower limb disorders often occur in occupations that require heavy work such as manual material handling, non-neutral trunk postures, or exposure to whole-body vibration, especially while seated. The occupations at highest risk were truck drivers, operators of cranes and other large vehicles, warehouse workers, airplane baggage handlers, various construction trades, nurses, nursing aides, and other patient-care workers [2, 33].

Saftic et al. [34] investigated that risk factors for lumbar disc herniation were severe enough to require surgery in a cohort of 1,001 Croatians. Their occupational analysis included those occupations involving sitting or standing and occupations involving hard physical activity, such as agricultural work, construction work, and mechanics, fishing and soldiering. These study suggested that the heritable risk of intervertebral disc surgery was independent of the risk conferred by heavy physical

occupations.

In a small occupational study, Luoma et al. [35] examined 164 men aged 40–45 years, including 53 machine drivers, 51 construction carpenters and 60 office workers, who underwent MRI imaging and assessment for back pain. An increased risk of back pain was found in relation to signs of disc degeneration, and LBP was strongly associated with occupational factors. For example, the adjusted OR of LBP for machine drivers was 8.1 (add 95% CI). LBP was more common among machine drivers and carpenters than officer workers.





Chapter 3 Material and Method

3.1 Research Design

An ecological study was designed to identify the high risk industries (groups) and the relationship between working place related factors and WMSDs. This ecological study using two separate databases as sources which using 89 job divisions to connect :


(1) Taiwan's occupational disease and injury notification system (ODIS), reported occupational WMSDs from 2008 to 2011, calculating the age-adjusted standardized incidence rates (SIR) as dependent variable.

(2) Survey of Perceptions of Safety and Health in the Work Environment in 2010, as independent variables including self-reported of the proportion of ergonomic factors, and self-reported musculoskeletal discomforts in workplace by each job category.

By comparing the SIR, we can find out that the high risk industries (groups) in different WMSDs. Furthermore, linear regression was used to delineate the relationship between workplace exposure and WMSDs.

3.2 Subjects/Materials

The subjects for this study were employees belonging to the 89 job categories of




Standard Industrial Classification System. Data were collected using two separate databases as sources which connecting by 89 job categories: (1) Taiwan's occupational disease and injury notification system (ODIS) and (2) Survey of Perceptions of Safety and Health in the Work Environment.

3.2.1 Standard Industrial Classification System

The Standard Industrial Classification (SIC) is a system for classifying industries by a four-digit code, which was established in the United States in 1937. It is used by government agencies to classify industry areas. The SIC system is also used by agencies in other countries. In this study, we used the Standard Industrial Classification System of the Republic of China (Rev.9, 2011).

The SIC codes can be grouped into progressively broader industry classifications: industry group, section (major group) and division. The first three digits of the SIC code indicate the industry group, and the first two digits indicate the major group. Each division encompasses a range of SIC codes. From 0100 till 0999, it stand for the division Agriculture, Forestry and Fishing; from 1000 till 1999, it stand for the division Mining; from 2000 till 3999, it stand for the division Manufacturing; from 4000 till 4999, it stand for the division Transportation, Communications, Electric, Gas and Sanitary service; from 5000 till 5199, it stand for the division Wholesale Trade; from



5200 till 5999, it stand for the division Retail Trade; from 6000 till 6799, it stand for the division Finance, Insurance and Real Estate; from 7000 till 8999, it stand for the division Services and from 9100 till 9729, it stand for the division Public Administration. The codes that start with 99 are No classifiable [36].

The 19 major groups and 89 divisions were listed in Table 1.

3.2.2 Collected and classified the WMSDs cases nearly four years (2008-2011)

In 2003, the system of occupational disease and injury services was launched, and the first center for Center of Occupational Disease and Injury Service (CODIS) was established. In 2007, a coordination center, Center of occupational Disease and Injury Management and Service (CODIMS), was also established [37]. In 2009, there were nine CODISs to provide the services, including three centers in northern, three in central, two in southern, and one in eastern Taiwan. Furthermore, each CODIS collaborates with surrounding hospitals to develop a network for occupational disease and injury services. By the end of 2012, 56 network hospitals were established (Figure 2). The CODISs and network hospitals provide occupational health services, including diagnosing and preventing occupational diseases or injuries, occupational rehabilitation or return-to-work, and insurance compensation assistant.

The main tasks of CODIMS are:



(1) To provide the professional consultation on the management of occupational disease and injury.

(2) To establish the standard operation procedures for CODISs' services, to ensure the quality of CODISs' services.

(3) To investigate the clusters of occupational diseases, to develop the strategy for the prevention of occupational diseases or injuries.

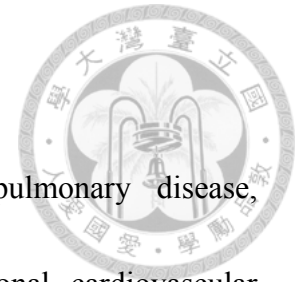
(4) To maintain the reporting system of occupational diseases and injuries.

The reporting system of occupational diseases and injuries was formally launched in September 2007, which was based on the principle of previous reporting system at Department of Health [38].

The workers with injury or disease went the CODISs or network hospitals for help, and assessing, diagnosing and comparing with epidemiology studies that the occupational exposure factors were related more than 50% from the disease. Then, the doctor will report the case to Taiwan's occupational disease and injury notification system (ODIS).

In this study, we collected the reported-cases from ODIS from 2008 to 2011 and exported data as excel form for data analysis. The reported cases used the "date of visit" to collect cases, and its quality was examined by the reviewer who classified the cases to "probable", "possible", "not related" and "cannot be determined". In our study, we

only choose the “probable” and “possible” cases for analysis.



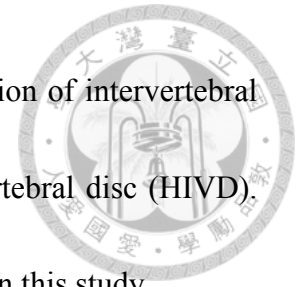
We classified all the reported cases to occupational pulmonary disease, occupational liver disease, occupational skin disease, occupational cardiovascular disease, occupational neurological disease, occupational hematological disease, occupational renal diseases, occupational musculoskeletal diseases, occupational hearing loss, occupational eye disease, occupational physical disease, biological hazard and others. Base on the total number of employed population, the incidence of cases per 10^6 populations per year could be calculated.

3.2.3 Selected and recognized the disease types of WMSDs

The WMSDs reported cases from 2008 to 2011 were 2,239 cases in total, accounting for 46.8% of all the occupational disease notification. We used International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) to classify WMSDs. It was divided into upper extremities (including hand / wrist, elbow, shoulder), cervical and lumbar region and lower extremities (knee, foot / ankle) three categories according to the diseased parts and two or more diseased parts of the case will be classified in others.

In the upper extremities, we selected carpal tunnel syndrome (CTS) (ICD 354.0 Carpal tunnel syndrome), and in the cervical and lumbar region 722.93 Other and

unspecified disc disorder of lumbar region and 722.73 Lumbar region of intervertebral disc disorder with myelopathy were classified in herniated intervertebral disc (HIVD). Furthermore, the joint region and lower extremities did not include in this study.



3.2.4 Survey of Perceptions of Safety and Health in the Work Environment


In order to provide workers with an equitable, humane, secure, and dignified environment it has always been the objective and responsibility of the Government. The Institute of Occupational Safety and Health (IOSH) has conducted surveys every three years since 1994 to characterize demand and perception of employees, employers and self-employed people for safety and health in the workplace [39].

Our study used the Survey of Perceptions of Safety and Health in the Work Environment in 2010 to get the self-reported information about working conditions such as workplace environmental ergonomic factors and musculoskeletal discomfort in the workers. We took the proportion of ergonomic factors, and the proportion of musculoskeletal discomforts in each job category.

3.3 Data analysis

Flow chart of the statistical methods was shown in Figure 4.

First, sex and age adjusted standardized Incidence Rate (SIR) for CTS and HIVD in every job category (89 divisions) were calculated. Then, the Survey of Perceptions of



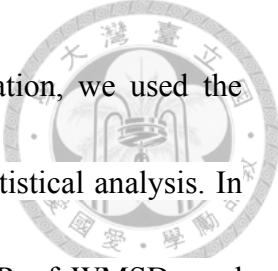
Safety and Health in the Work Environment 2010 were used to count the situation of workplace in self-reported ergonomics, and musculoskeletal discomforts in each job category. Finally, simple and multiple linear regressions were to identify the relationship between WMSDs SIR and the risk factors.

3.3.1 Standardized incidence rates (SIR)

Because musculoskeletal disorders are, more common in women and will increase with age [40]. And the population component in every industry was not equivalent, it was necessary to standardize the incidence rate. In this study, SIR calculated by direct standardization using sex and age group, and use national total workforce as standard. Incidence was calculated by 2008-2011 reported WMSDs from Taiwan's occupational disease and injury notification system (ODIS) by estimated numbers of employees in each job category. The denominator was the averaged manpower in each job category in 2008-2010 from Yearbook of manpower survey statistics. The calculation process of SIR was shown in Figure 3.

3.3.2 Linear regression

Simple and multiple linear regressions were to identify the relationship between SIR of WMSDs and the risk factors. Since the incidences of every industry were not normal distribution, we did a log-transformed to the SIR in every job category before



simple linear regression. Considering the different working population, we used the manpower survey statistical working population as weight in the statistical analysis. In the statistical model, dependent variables were log-transformed SIR of WMSDs and independent variables were the workplace environmental ergonomic factors, and musculoskeletal discomfort from Survey of Perceptions of Safety and Health in the Work Environment.

Then chose those p-values less than 0.05 from the results of simple linear regression as variables of multiple linear regression. The backward stepwise multiple linear regression was adopted here. The remained risk factors had greater contribution to WMSDs. Finally, the remained variables from multiple linear regression were chosen. By using the median as the cut point and setting the dummy variables for the multiple linear regression, it can be checked whether there was any combination of risk factors for WMSDs.

3.3.3 Geometric mean of SIR

In order to show the relationship between the SIR of WMSDs and the risk factors clearly when finding the high correlation in WMSDs and risk factors, transforming the log-SIR back to the original SIR was needed. Furthermore, divided the exposure factors into four groups (Q1-Q3 as the cut point), and showed the relationship between the SIR

od WMSDs and the percentage level of exposure. By comparing the four groups to its SIR, we got the trend of exposure factors in every industries and the risk level of suffering from WMSDs.





Chapter 4 Results

4.1 The collected and classified WMSDs cases for nearly four years (2008-2011)

The ODIS from 2008/01/01 to 2011/12/31 had 4,781 probable or possible cases. The incidence was 114.1 cases per (10^6) million working population per year. According to the diseases category, the calculated incidence rate cases per 10^6 working population per year was shown in Table 2. The highest incidence of occupational disease was the occupational musculoskeletal disease (53.5 cases per 10^6 working population per year), and the second highest one was occupational hearing loss (31.9 cases per 10^6 working population per year). The following ones were the occupational pulmonary disease (9.6 cases per 10^6 working population per year), occupational dermal disease (7.4 cases per 10^6 working population per year), occupational neurological disease (1.1 cases per 10^6 working population per year) and occupational physical disease (0.4 cases per 10^6 working population per year). The cases of ODIS, classified by age, sex, disease and industrial sectors from 2008 to 2011, were shown in Table 3.

There were 2,239 WMSDs cases in 2008-2011 accounts for 46.8% of the ODIS reported cases. In Taiwan, WMSDs contributed most in occupational disease. The group of 40-59 years-old was the main age group with 3086 cases (64.5%). From

industrial sector perspective, industry, which accounted for the highest proportion with 2964 cases (62%).



4.2 Selected and recognized the disease types of WMSDs

There were 2,239 reported WMSDs cases from 2008 to 2011, which accounted for 46.8% of all the occupational disease notification. It was divided into four categories according to the diseased parts. The first category was the upper extremities (including hand / wrist, elbow, shoulder). The second one included the cervical and lumbar region. The third one was the lower extremities (knee, foot / ankle). Two or more diseased parts of the case would be classified in others.

There were 1,467 cases (65.5%) from the upper extremities disease while 637 cases (28.5%) were from cervical and lumbar region disease. Furthermore, there were 56 (2.5%) and 79 (3.6%) cases from the lower extremities disease and other disease, respectively.

There were 1,269 cases from four selected four main diseases from upper extremities and cervical and lumbar region disease, which included 724 cases from carpal tunnel syndrome (CTS), and 545 cases from herniated intervertebral disc (HIVD), respectively. Classification and selection for CTS and HIVD cases were shown in Table 4 and the flow chart of the selected WMSDs cases was shown in Figure 5.



4.3 Standardized incidence rates in different job categories of WMSDs

4.3.1 Different job categories with CTS: case numbers and SIR

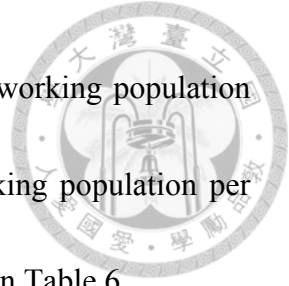
The reported cases of CTS from 2008 to 2011 were 724 cases in total.

In 226 CTS cases for male, the mean age was 46.4 (SD=10.1) years old. The highest two contributors were the sector Industrial (120 cases) and Service (103 cases), respectively. Top three major groups with reported cases were the group Manufacturing (71 cases), Construction (45 cases) and Accommodation and Food Services (39 cases).

In 498 CTS cases for female, the mean age was 47.3 (SD=8.0) years old. The highest two contributors were the sector Service (320 cases) and Industrial (172 cases), respectively. Top three major groups with reported cases were the group Manufacturing (136 cases), Accommodation and Food Services (107 cases) and Other Service (52 cases). The CTS cases with age and industry sector distribution were shown in Table 5.

The three major industrial divisions with the highest SIR for male workers with CTS were the division Wood and Bamboo Products Manufacturing (120.9 cases per 10⁶ working population per year), Sand, Stone and Clay Quarrying (91.9 cases per 10⁶ working population per year) and Postal and Courier Services (58.5 cases per 10⁶ working population per year), respectively. As for female workers, it became the division Non-metallic Mineral Products Manufacturing (171.4 cases per 10⁶ working

population per year), Buildings Construction (157.0 cases per 10^6 working population per year) and Residential Care Services (156.1 cases per 10^6 working population per year), respectively. All the SIR of CTS in job divisions were shown in Table 6.




4.3.2 Different job categories with HIVD: case numbers and SIR

There were 545 cases in total for the HIVD reported from 2008 to 2011.

The mean age was 45.3 (SD=8.9) years old for male in 418 cases with HIVD. Among these cases, the highest two sectors were from the sector Industrial and Service, which included 250 and 163 cases, respectively. The major group was mainly distributed in the group Manufacturing (126 cases), Transportation and Storage (122 cases) and Construction (106 cases).

The mean age was 49.1 (SD=9.1) years old for female in 127 cases with HIVD. Among these cases, the highest two sectors were from the sector Industrial and Service, which included 70 and 57 cases, respectively. The major group was mainly distributed in the group Construction (37 cases), Manufacturing (33 cases) and Human Health and Social Work Services (20 cases). The HIVD cases with different age and industry sector distribution were shown in Table 7.

The three job divisions with the highest SIR for male workers with HIVD were the division Warehousing and Storage (213.4 cases per 10^6 working population per year),



Land Transportation (114.9 cases per 10^6 working population per year) and Electricity and Gas Supply (114.2 cases per 10^6 working population per year), respectively. As for female workers, it became the division Residential Care Services (114.5 cases per 10^6 working population per year), Warehousing and Storage (36.2 cases per 10^6 working population per year) and Accommodation Services (26.3 cases per 10^6 working population per year), respectively. All the SIR of HIVD in job divisions were shown in Table 8.

4.4 Survey of Perceptions of Safety and Health in the Work Environment

Survey of Perceptions of Safety and Health in the Work Environment in 2010, including self-reported of the proportion of ergonomic factors and self-reported musculoskeletal discomforts in workplace. The proportion of self-reported ergonomic factors and self-reported musculoskeletal discomfort in workplace were calculated for each job division.

4.4.1 Workplace exposure factors - ergonomic factors


The workplace ergonomic factors for male and female in each job category were from the Survey of Perceptions of Safety and Health in the Work Environment in 2010. The workplace ergonomic factors for male and female were shown in Table 9-10. From this table, the information about workplace ergonomic factors in 89 job divisions were

given.



For the male, the division Sand, Stone and Clay Quarrying had the largest self-reported proportion that workplace exposure to “whole body vibration” (38.9%); the division Wood and Bamboo Products Manufacturing had the largest self-reported proportion that workplace exposure to “vibration from hand tools” (30.0%); the division Data Processing and Information Supply Services had the largest self-reported proportion that workplace exposure to “repetitive hand movements” (50.0%); the division Buildings Construction had the largest self-reported proportion that workplace exposure to “heavy tool used” (27.4%); the division Wholesale Trade had the largest self-report proportion that workplace exposure to “heavy lifting” (50%); the division Tobacco Manufacturing had the largest self-reported proportion that workplace exposure to” awkward posture” (33.3%); the division Tobacco Manufacturing had the largest self-reported proportion that workplace exposure to “cannot control working pace ” (33.3%); and division the Tobacco Manufacturing had the largest self-reported proportion that workplace exposure to “unacceptable desk” (50%).

For the female, the division Furniture Manufacturing had the largest self-reported proportion that workplace exposure to “whole body vibration” (9.1%); the division Wearing Apparel and Clothing Accessories Manufacturing had the largest self-reported proportion that workplace exposure to “vibration from hand tools” (7.1%); the division




Electrical Equipment Manufacturing had the largest self-reported proportion that workplace exposure to “repetitive hand movements” (60.0%); the division Buildings Construction had the largest self-reported proportion that workplace exposure to “heavy tool used” (12.1%); the division Wood and Bamboo Products Manufacturing had the largest self-report proportion that workplace exposure to “heavy lifting” (25%); the division Agriculture and Animal Husbandry had the largest self-reported proportion that workplace exposure to” awkward posture” (22.6%); the division Beverages Manufacturing had the largest self-reported proportion that workplace exposure to “cannot control working pace ” (27.3%); and the division Sand, Stone and Clay Quarrying had the largest self-reported proportion that workplace exposure to “unacceptable desk” (50%).

4.4.2 Workplace exposure factors - self-reported musculoskeletal discomforts

The self-reported musculoskeletal discomforts for male and female in each job category were from Survey of Perceptions of Safety and Health in the Work Environment 2010. The workplace self-reported musculoskeletal discomforts for male and female were shown in Table 11. From this table we could get the information about workplace self-reported musculoskeletal discomforts in 89 job divisions.

For the male, the division Data Processing and Information Supply Services had



the largest self-reported proportion that subjectively experienced to “hand or wrists discomfort” (25.0%); the division Water Transportation had the largest self-reported proportion that subjectively experienced to “low back and waist discomforts” (31.6%).

As for the female, the division Fishing had the largest self-reported proportion that subjectively experienced to “hand or wrists discomfort” (36.8%); the division Fishing also had the largest self-reported proportion that subjectively experienced to “low back and waist discomforts” (47.4%).

4.5 The relationship between Work-related musculoskeletal disorders and workplace ergonomic factors

From the literature [4, 12, 28, 29, 34, 41, 42], we chose occupational risk factors that were reported frequently for CTS and HIVD. The factors for CTS were “vibration from hand tools”, “repetitive hand movement”, “heavy tools used” and “cold temperatures”, and factors for HIVD were “whole body vibration”, “heavy tools used”, “heavy lifting”, “awkward posture” and “unacceptable desk” respectively.

Because the SIR of 89 job divisions were not in normal distribution, we did logarithmic transformation to the SIR of 89 job divisions. Then, simple linear regression was to identify the relationship between SIR of WMSDs (case/year/million workers)



and the workplace ergonomic factors (% reported +).

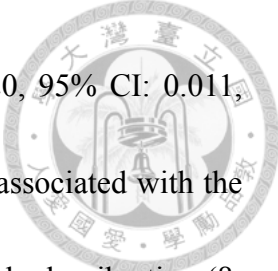
4.5.1 Log-transformed SIR (case/year/million workers) and workplace ergonomic factors (% reported +) - CTS

For the male, the increase of the proportion of vibration from hand tools (β : 0.035, 95% CI: 0.016, 0.055), repetitive hand movements (β : 0.036, 95% CI: 0.020, 0.052), and heavy tools used (β : 0.027, 95% CI: 0.006, 0.048) were associated with the increase in log-transformed SIR of CTS. As for the female, the increase of vibration from hand tools (β : 0.124, 95% CI: 0.063, 0.185) were associated with the increased in log-transformed SIR of CTS. The simple linear regressions in log transformed SIR of CTS and workplace ergonomic factors for the male and female were shown in Table 12.

Then, the multiple linear regression was done for male, and the only chosen risk factors was repetitive hand movements ($P=0.0171$, $aR^2=0.19$). Multiple linear regression of SIR in CTS and ergonomic risk factors was shown in Table 13.

4.5.2 Log-transformed SIR (case/year/million workers) and workplace ergonomic factors (% reported +) -HIVD

For the male, the increase of the proportion of whole body vibration (β : 0.120, 95% CI: 0.095, 0.144), vibration from hand tools (β : 0.049, 95% CI: 0.032, 0.066), heavy



tools used (β : 0.058, 95% CI: 0.041, 0.075), heavy lifting (β : 0.020, 95% CI: 0.011, 0.029) and awkward posture (β : 0.053, 95% CI: 0.033, 0.072) were associated with the increase in log transformed SIR of HIVD. As for the female, whole body vibration (β : 0.114, 95% CI: 0.043, 0.184), heavy tools used (β : 0.085, 95% CI: 0.039, 0.131), heavy lifting (β : 0.023, 95% CI: 0.008, 0.038) and awkward posture (β : 0.038, 95% CI: 0.016, 0.060) were associated with the increased in log transformed SIR of HIVD. The simple linear regressions in log transformed SIR of HIVD and workplace ergonomic factors in male and female were shown in Table 14.

Then, the multiple linear regression was done for both male and female. For the male, the remained variables were whole body vibration and heavy lifting ($P < 0.0001$, $aR^2 = 0.55$). As for the female, the remained variables were whole body vibration and awkward posture ($P = 0.0002$, $aR^2 = 0.17$). Multiple linear regression of SIR in HIVD and ergonomic risk factors was shown in Table 15.

4.6 The relationship between the geometric mean of SIR and different levels of workplace exposure factors

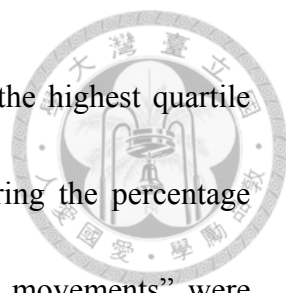
Chose those p-values less than 0.05 from the results of simple linear regression as factors and showed the relationship between the SIR and the percentage of exposure factors.



4.6.1 Geometric Mean SIR of CTS and ergonomic factors

The SIR of CTS was associated with the self-reported percentage of workers exposure to “vibration from hand tools” levels, shown in Figure 6-7. For the male, 1.0 case per 10^6 working population per year for the lowest quartile of SIR of CTS (range 0%), 2.9 cases per 10^6 working population per year for the second lowest quartile (0–3%), 3.6 cases per 10^6 working population per year for the third lowest quartile (3–6.5%), and 5.5 cases per 10^6 working population per year for the highest quartile (>6.5%). As for the female, 6.4 cases per 10^6 working population per year for two lowest quartile of SIR of CTS (range 0%), 22.6 cases per 10^6 working population per year for the third lowest quartile (0–2%), and 32.3 cases per 10^6 working population per year for the highest quartile (>2%). Each level of groups which included job divisions while covering the percentage range and the groups with their job divisions in “vibration from hand tools” were shown in Table 16.

The SIR of CTS was associated with the self-reported percentage of workers exposure to “repetitive hand movements” levels, shown in Figure 8. For the male, 0.4 cases per 10^6 working population per year for lowest quartile of SIR of CTS (range <15%), 1.7 cases per 10^6 working population per year for the second lowest quartile (15%–23%), 5.3 cases per 10^6 working population per year for the third lowest quartile

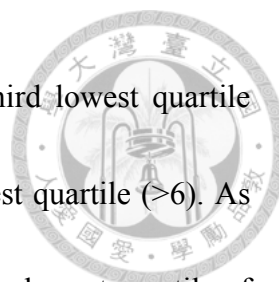


(23-30%), and 6.9 cases per 10^6 working population per year for the highest quartile (>30%). Each level of groups included job divisions which covering the percentage range and the groups with their job divisions in “repetitive hand movements” were shown in Table 17.

The SIR of CTS was associated with the self-reported percentage of workers exposure to “heavy tools used” levels, shown in Figure 9. For the male, 0.9 cases per 10^6 working population per year for lowest quartile of SIR of CTS (range 0%), 2.9 cases per 10^6 working population per year for the second lowest quartile (0%-2.9%), 5.0 cases per 10^6 working population per year for the third lowest quartile (2.9-8.6%), and 4.1 cases per 10^6 working population per year for the highest quartile (>8.6%). Each level of groups included job divisions which covering the percentage range and the groups with their job divisions in “heavy tools used” were shown in Table 18.

4.6.2 Geometric Mean SIR of H1VD and ergonomic factors

The SIR of H1VD was associated with the self-reported percentage of workers exposure to “whole body vibration” levels, shown in Figure 10-11. For the male, 1.4 cases per 10^6 working population per year for lowest quartile of SIR of H1VD (range 0%), 1.8 cases per 10^6 working population per year for the second lowest quartile



(0–2%), 5.1 cases per 10^6 working population per year for the third lowest quartile (2–6%), and 27.0 per 10^6 working population per year for the highest quartile (>6). As for the female, 0.7 cases per 10^6 working population per year for two lowest quartile of SIR of HIVD (range 0%), 1.5 cases per 10^6 working population per year for the third lowest quartile (0–1.5%), and 2.2 cases per 10^6 working population per year for the highest quartile (>1.5%). Each level of groups included job divisions which covering the percentage range and the groups with their job divisions in “whole body vibration” were shown in Table 19.

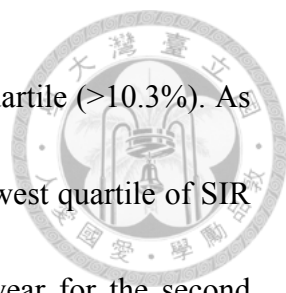
The SIR of HIVD associated with the self-reported percentage of workers exposure to “heavy lifting” levels, shown in Figure 12-13. For the male, 0.7 cases per 10^6 working population per year for lowest quartile of SIR of HIVD (range <2%), 1.9cases per 10^6 working population per year for the second lowest quartile (2–10%), 9.6 cases per 10^6 working population per year for the third lowest quartile (10–25%), and 8.6 cases per 10^6 working population per year for the highest quartile (>25%). As for the female, 0.4 cases per 10^6 working population per year for lowest quartile of SIR of HIVD (range 0%), 0.8 cases per 10^6 working population per year for the second lowest quartile (0–3%), 1.8 cases per 10^6 working population per year for the third lowest quartile (3–9%), and 1.8 cases per 10^6 working population per year for the highest quartile (>9%). Each level of groups included job divisions which covering the



percentage range and the groups with their job divisions in “heavy lifting” were shown in Table 20.

The SIR of HIVD associated with the self-reported percentage of workers exposure to “heavy tools used” levels, shown in Figure 14-15. For the male, 1.0 cases per 10^6 working population per year for lowest quartile of SIR of HIVD (range 0%), 1.4 cases per 10^6 working population per year for the second lowest quartile (0-2.9%), 6.3 cases per 10^6 working population per year for the third lowest quartile (2.9-8.6%), and 11.9 cases per 10^6 working population per year for the highest quartile (>8.6%). As for the female, 0.6 cases per 10^6 working population per year for two lowest quartile of SIR of HIVD (range 0%), 1.3 cases per 10^6 working population per year for the second lowest quartile (0-2.8%), and 1.8 cases per 10^6 working population per year for the third lowest quartile (>2.8%). Each level of groups included job divisions which covering the percentage range and the groups with their job divisions in “heavy tools used” were shown in Table 18.

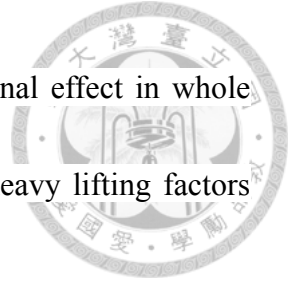
The SIR of HIVD associated with the self-reported percentage of workers exposure to “awkward posture” levels, shown in Figure 16-17. For the male, 1.7 cases per 10^6 working population per year for lowest quartile of SIR of HIVD (range <2.1%), 1.1 cases per 10^6 working population per year for the second lowest quartile (2.1-7.4%), 7.5 cases per 10^6 working population per year for the third lowest quartile (7.4-10.3%),



and 9.6 cases per 10^6 working population per year for the highest quartile ($>10.3\%$). As for the female, 0.4 cases per 10^6 working population per year for lowest quartile of SIR of HIVD (range 0%), 0.8 cases per 10^6 working population per year for the second lowest quartile (0-4.3%), 1.2 cases per 10^6 working population per year for the third lowest quartile (4.3-8.7%), and 2.3 cases per 10^6 working population per year for the highest quartile ($>8.7\%$). Each level of groups included job divisions which covering the percentage range and the groups with their job divisions in “awkward posture” were shown in Table 21.

4.6.3 Combination of risk factors - HIVD

For the male, in the multiple linear regression, workplace without whole body vibration and heavy lifting were used as reference group. When the workers exposed to the workplace with whole body vibration and no exposure to heavy lifting, there was no significant positive relationship between SIR of HIVD and vibration from hand tools. However, while the workers were exposed to heavy lifting and no exposure to whole body vibration, there had positive relationship between SIR of HIVD and heavy lifting (β : 0.174, 95% CI: 0.011, 0.337). Moreover, when the workers exposed to both whole body vibration and heavy lifting, there were also positive relationship between SIR of HIVD and whole body vibration and heavy lifting (β : 0.532, 95% CI: 0.403, 0.661). For



the male with HIVD, we could find out that there had combinational effect in whole body vibration and heavy lifting. And whole body vibration and heavy lifting factors had an additive effect to HIVD.

As for the female, in the multiple linear regression, workplace without whole body vibration and awkward posture were used as reference group. When the workers exposed to the workplace with whole body vibration and no exposure to awkward posture, there was positive relationship between SIR of HIVD and vibration from hand tools (β : 0.171, 95% CI: 0.002, 0.341). Then, while the workers were exposed to awkward posture and no exposure to whole body vibration, there had positive relationship between SIR of HIVD and repetitive hand movements (β : 0.191, 95% CI: 0.043, 0.339). Moreover, when the workers exposed to both whole body vibration and awkward posture, there were also positive relationship between SIR of HIVD and whole body vibration and awkward posture (β : 0.334, 95% CI: 0.204, 0.465). For the female with HIVD, we could find out that there had combinational effect in whole body vibration and awkward posture. And the whole body vibration and awkward posture factors had an additive effect to HIVD.

The relationship between SIR of HIVD and ergonomic factors within and without combination of risk factors was shown in Table 22-23.

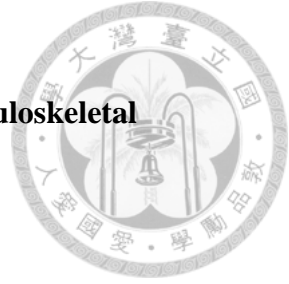


4.7 The relationship between the geometric mean of SIR and different levels of

self-reported musculoskeletal discomforts

4.7.1 Geometric Mean SIR of CTS and hands or wrists musculoskeletal discomfort

The SIR of CTS associated with the self-reported percentage of workers having “hands or wrists musculoskeletal discomfort” levels, shown in Figure 18-19. For the male, 0.6 cases per 10^6 working population per year for lowest quartile of SIR of CTS (range 0-3.5%), 3.3 cases per 10^6 working population per year for the second lowest quartile (3.5-7.5%), 5.5 cases per 10^6 working population per year for the third lowest quartile (7.5-11.5%), and 3.8 cases per 10^6 working population per year for the highest quartile (>11.5%). As for the female, 4.2 cases per 10^6 working population per year for lowest quartile of SIR of CTS (range 0-4.5%), 17.3 cases per 10^6 working population per year for the second lowest quartile (4.5-11%), 27.6 cases per 10^6 working population per year for the third lowest quartile (11-16%), and 15.0 cases per 10^6 working population per year for the highest quartile (>16%). Each level of groups included job divisions which covering the percentage range and the groups with their job divisions in “hands or wrists musculoskeletal discomfort” were shown in Table 24.



4.7.2 Geometric Mean SIR of HIVD and low back or waist musculoskeletal

discomfort

The SIR of CTS associated with the self-reported percentage of workers having “low back or waist musculoskeletal discomfort” levels, shown in Figure 20. For the male and female, 1.0/0.4 cases per 10^6 working population per year for lowest quartile of SIR of CTS (range <6%), 2.1/0.7 cases per 10^6 working population per year for the second lowest quartile (6-10%), 8.1/1.7 cases per 10^6 working population per year for the third lowest quartile (10-14%), and 10.5/1.5 cases per 10^6 working population per year for the highest quartile (>14%). Each level of groups included job divisions which covering the percentage range and the groups with their job divisions in “low back or waist musculoskeletal discomfort” were shown in Table 25.



Chapter 5 Field study

5.1 The objective of the field study

Violante et al. [43] defined a “disorder” as a condition that includes both symptoms (subjective evidence perceived by patient) and signs (objective evidence from physical examination) as well as any positive result arising from a diagnostic procedure to identify musculoskeletal pathology. On the other hand, “symptoms” (including discomfort, complaint and pain) represent subjective feelings [44] and are often self-reported. In order to understand the gap between self-reported symptoms and diagnosed musculoskeletal disorders in upper extremities, a field study was conducted in a factory (division Computers, Electronic and Optical Products Manufacturing).


5.2 Material and method of the field study

First, classified the similar exposure groups by the departments, and chose the departments to conduct the questionnaire. Then, analyzed the questionnaire and screened out the workers who reported to have upper extremity musculoskeletal symptoms (neck, shoulder, elbow, hand or wrist). Case including criteria was shown in Figure 21. Third, doctors with professional training would arrange to do the physical examination to those who reported to have upper extremity musculoskeletal symptoms

(neck, shoulder, elbow, hand or wrist). Finally, if the worker got positive result of physical examination, he/she should have a musculoskeletal ultrasound examination to make sure whether he/she had upper extremity disorders (shoulder, elbow, and wrist) or not. Flow chart of the field study was shown in Figure 22.

5.3 Results of the field study

A total of 359 questionnaires were completed. There were 76 workers having self-reported musculoskeletal symptoms and in accordance with our including criteria. However, 20 workers were loss of follow-up, six workers were missing the ID and six workers could not be diagnosed by ultrasound examination. There were 44 workers going to next physical examination stage. Among those examined, 31 workers were found to have positive sign of MSDs. They were sent for ultrasound examination on shoulder, elbow, and wrist. A total of 19 workers were diagnosed as having musculoskeletal disorders by ultrasound. Flow chart of workers inclusion in field study was shown in Figure 23. The results of physical examination and ultrasound examination were shown in Table 26. The most frequently diagnosed conditions are rotator cuff syndrome (N=17) and acromioclavicular joint distention (N=7). In addition, radiating neck complaints were suspected in 21 participants, and these workers were advised to seek medical attention.



Shift work was the only demographic difference between workers reported with musculoskeletal symptoms and workers did not have any musculoskeletal symptoms. Nevertheless, workers had musculoskeletal symptoms reported to expose to repetitive hand movement (71.1%) was more than workers with no symptom (28.9%) in working condition. We could also find out that this situation in the awkward posture and force factors (59.2%/40.8%; 60.5%/39.5%). Distribution of demographics and working conditions of workers were shown in Table 27.

5.4 Conclusion and future works

From the preliminary result of the field study, we can roughly speculate the prevalence of upper extremities musculoskeletal disorders was 9.1%.



Chapter 6 Discussion

6.1 WMSDs accounted for the largest part of occupational diseases


In Taiwan, the ODIS from 2008/01/01 to 2011/12/31 had 4,781 reported cases, and WMSDs accounted for 46.8% (2,239 cases). Moreover, the WMSDs accounted for 87% of the compensation by Taiwan Labor Insurance in average from this period. Also, WMSDs constitute the most frequent diagnoses underlying sickness absence and disability pensions most Western countries [45]. Musculoskeletal problems are common amongst the general and working population and can result in serious social and economic impacts on individuals and communities [46, 47]. Therefore, the WMSDs are worth of further research and discussion.

In this study, we emphasized on CTS and HIVD. However, there were Other WMSDs should be of concern. The limitations of available diagnostic technologies for WMSDs have been discussed by others [48, 49]. The lack of standardized case definitions in part reflects the constraints of the diagnostic categories relative to the wide variety of symptoms and signs reported by affected workers. Conditions with well-defined identifiable pathology such as CTS and spinal disc herniation, account for only a small proportion of all WMSD morbidity [50].



6.2 The high risk industrial categories suffering from WMSDs

We concluded the top five risk industries of WMSDs in this study. Male who worked in the division Wood And Bamboo Products Manufacturing (120.9 cases per 10⁶ population per year), Sand, Stone And Clay Quarrying (91.9 cases per 10⁶ population per year), Postal And Courier Services (58.5 cases per 10⁶ population per year), Specialized Design Services (57.2 cases per 10⁶ population per year) and Electricity And Gas Supply (52.4 cases per 10⁶ population per year) had higher risk with CTS. As for female, who worked in the division Non-Metallic Mineral Products Manufacturing (171.4 cases per 10⁶ population per year), Buildings Construction (157.0 cases per 10⁶ population per year), Residential Care Services (156.1 cases per 10⁶ population per year), Warehousing And Storage (153.2 cases per 10⁶ population per year) and Wood And Bamboo Products Manufacturing (150.2 cases per 10⁶ population per year) had higher risk with CTS. While male who worked in the division Warehousing And Storage (213.4 cases per 10⁶ population per year), Land Transportation (114.9 cases per 10⁶ population per year), Electricity And Gas Supply (114.2 cases per 10⁶ population per year), Air Transportation (95.2 cases per 10⁶ population per year) and Wood And Bamboo Products Manufacturing (94.42 cases per 10⁶ population per year) had higher risk with HIIVD. As for female, there were the division Residential Care Services (114.5




cases per 10⁶ population per year), Warehousing And Storage (36.2 cases per 10⁶ population per year), Accommodation Services (26.3 cases per 10⁶ population per year), Wood And Bamboo Products Manufacturing (25.2 cases per 10⁶ population per year) and Buildings Construction (16.9 cases per 10⁶ population per year) which had higher risk with HIVD.

To our best knowledge, this is the first study to emphasize the WMSDs on the job divisions by The Standard Industrial Classification (SIC). There were also some studies which focused on occupations and WMSDs. In a Danish study which looked at specific occupations or job titles, Jensen et al. [51] conducted a 10-year follow-up study of 2,175 long-haul truck drivers, 5,060 other truck drivers and 6,174 bus drivers. Compared with the general working population in Denmark, the standardized hospitalization ratios (SHRs) for being hospitalized for intervertebral disc disorders were increased in long-haul drivers and bus drivers (SHRs 133 and 141, respectively) compared with other types of truck drivers (SHR 109). It was concluded that professional driving was a risk factor for intervertebral disc disease. In our study, the division land transportation also had high risk with HIVD.

6.3 The risk factors of WMSDs


In addition to industry, other environmental factors, such as obesity and smoking,



have been reported to be associated with prevalent LBP, although the quantitative effect of the majority of these has been found to be small [52-55]. However, our study was an ecological design. The information we could obtained was in group level. Also, we could conduct the risk of WMSDs by industries, ergonomic and self-reported symptoms.

In 2001, the NORA MSD team published a national occupational research agenda for musculoskeletal disorders conducted that many risk factors associated with development of musculoskeletal disorders have been identified or suggested. Biomechanical risk factors include exposures to excessive force, awkward posture, movement, and vibration. These can be characterized in terms of their magnitude and temporal factors, such as frequency, repetition, duty cycle, and duration of exposure. Psychological and social factors included work organization arrangements (extended work hours, shift work, piecework, machine pacing), lack of training, inadequate conditioning, and cognitive or emotional stress. Personal factors included variables associated with size, strength, age, gender, cultural factors, and history of injury [56]. This article pointed to new possible way for future research in WMSDs and its risk factors.

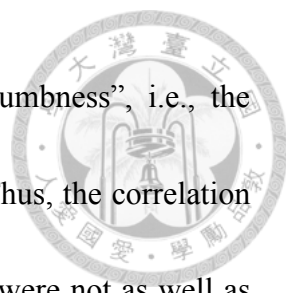
The figure about Self-reported percentage level of workers having hands or wrists musculoskeletal discomfort or some ergonomic factors showed a trend that the increase



in exposure percentage levels with the increase of SIR in the first to third group levels. But the trend went down in the final or the largest exposure group. This condition might explain with the “healthy worker effect”. The exposed persons who developed Work-related MSDs may have left employment disproportionately. This problem, which results from actual selection processes in the workplace, leads to an underestimate of the relationship with exposure and thus does not invalidate associations found between MSDs and workplace features [13].

6.4 Secondary self-reported questionnaire

The exposure data was from a secondary self-reported questionnaire. Our study was limited to the secondary data, and the existing questionnaire was also a limitation. Our study emphasized on exposure factors, but the questionnaire was not designed to evaluate the workplace ergonomic factors and the musculoskeletal symptoms. The questionnaire about these parts did not exactly answer our research questions. There were also other risk factors which might cause WMSDs, including forceful grip, forceful movements of the hands and repetitious flexion and extension of the wrist for CTS [28, 57]. Also, other risk factor, such as frequent bending and twisting might cause HIVD [29]. In another example, the questionnaire about the musculoskeletal discomforts was only asked that if there was any “sore or pain” with the hands or wrist.



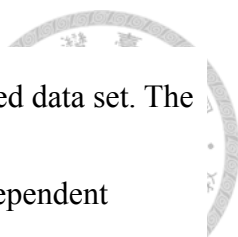
To the best of our knowledge, the symptom about CTS was “numbness”, i.e., the questionnaire did not ask the correct question for some situations. Thus, the correlation between SIR of CTS and self-reported hands or wrists discomforts were not as well as HIVD with self-reported back and waist discomforts.

Self-reported symptoms or functional impairments may thus often be more informative than the available physical examination maneuvers [13]. Some individuals with different symptoms, ranged from specific to non-specific, suffer severe pain and disability. Even though their findings do not conform to specific diagnostic entities such as CTS, rotator cuff tendinitis, or de Quervain’s disease. Examination techniques still do not exist that can serve as a “gold standard” for many of the symptoms that are frequently reported in workplace studies [49]. MSDs symptoms are often intermittent and episodic, especially in the early stages. However, even when they do not correspond to defined clinical syndromes, they may be of major public health significance [13].

6.5 Limitation

First of all, the WMSDs cases were collected from the ODIS which might underestimate the actual conditions.

Second, the independent variables were from the National Survey of Recognition of Occupational Safety and Health in employees which limited to define more detailed



conditions. Dependent and independent variables were from two separated data set. The dependent variables were from the ODIS from 2008 to 2011, but the independent variables were from the National Survey of Recognition of Occupational Safety and Health in employees in 2010. There are defects about the time sequence. Because the latency period of HIVD is up to 8 to 10 years, the relationship between HIVD and its risk factors should not be an issue. However, the latency period of CTS is less than the latency period of HIVD. Therefore, the relationship between CTS and its risk factors might not correlate as well as HIVD. Besides, this study was under the assumption that the workplace conditions did not have big change in this few years.

Finally, since the research belongs to ecological design, correlation observed is mainly at group level. Extrapolation of the observed relationship to individual level has to be cautious.

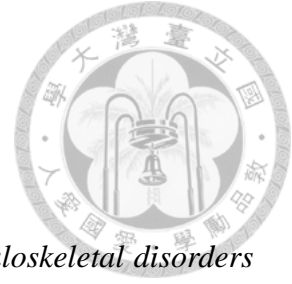


Chapter 7 Conclusion

In conclusion, WMSDs accounted for almost half of the occupational diseases, and CTS and HIVD was the most two common WMSDs.

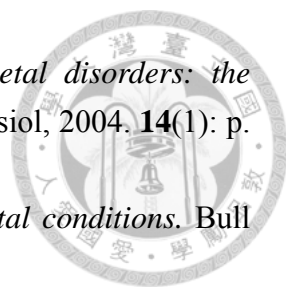
From this study, we found out that “repetitive hand movements” was a major risk factor for male with CTS and “vibration from hand tools” for female with CTS. While in HIVD, the risk factors turned to “whole body vibration” and “heavy lifting” for male, and “whole body vibration” and “awkward posture” for female respectively. Moreover, “whole body vibration” and “heavy lifting” were showed significant combination of risk factors for the male and “whole body vibration” and “awkward posture” showed significant combination of risk factors for the female.

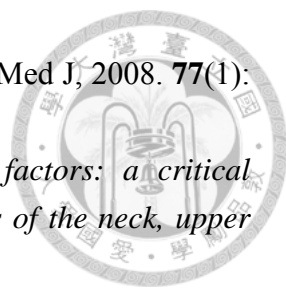
The ergonomic factors and musculoskeletal discomforts can be identified in workplace with ease by using questionnaire as screening tools. It is possible to screen various kinds of workplaces and assess or predict the risk of WMSDs.

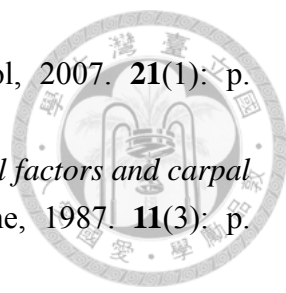


Reference

1. Gerr, F., R. Letz, and P.J. Landrigan, *Upper-extremity musculoskeletal disorders of occupational origin*. Annu Rev Public Health, 1991. **12**: p. 543-66.
2. Pope, M.H., et al., *Occupational low back pain: assessment, treatment, and prevention*. Medicine & Science in Sports & Exercise, 1992. **24**(6): p. 737.
3. Rempel, D.M., R.J. Harrison, and S. Barnhart, *Work-related cumulative trauma disorders of the upper extremity*. JAMA, 1992. **267**(6): p. 838-42.
4. da Costa, B.R. and E.R. Vieira, *Risk factors for Work-related musculoskeletal disorders: a systematic review of recent longitudinal studies*. American Journal of Industrial Medicine, 2010. **53**(3): p. 285-323.
5. Waters, T.R., *National efforts to identify research issues related to prevention of Work-related musculoskeletal disorders*. Journal of Electromyography and Kinesiology, 2004. **14**(1): p. 7-12.
6. Ayoub, M.M. and A. Mital, *Manual materials handling*. 1989: CRC Press I Llc.
7. Chaffin, D.B., G. Andersson, and B.J. Martin, *Occupational biomechanics*. 1991: Wiley New York.
8. Choobineh, A., et al., *Perceived demands and musculoskeletal symptoms among employees of an Iranian petrochemical industry*. International Journal of Industrial Ergonomics, 2009. **39**(5): p. 766-770.
9. Punnett, L. and R. Herbert, *Work-related musculoskeletal disorders: is there a gender differential, and if so, what does it mean*. Women and health. New York, Academic Press. p, 2000: p. 474-492.
10. Waters, T.R., R.B. Dick, and E.F. Krieg, *Trends in Work-related Musculoskeletal Disorders: A Comparison of Risk Factors for Symptoms Using Quality of Work Life Data From the 2002 and 2006 General Social Survey*. Journal of Occupational and Environmental Medicine, 2011. **53**(9): p. 1013-1024
10.1097/JOM.0b013e3181fc8493.
11. Badley, E., I. Rasooly, and G. Webster, *Relative importance of musculoskeletal disorders as a cause of chronic health problems, disability, and health care utilization: findings from the 1990 Ontario Health Survey*. The Journal of rheumatology, 1994. **21**(3): p. 505.
12. Disorders, N.R.C.P.o.M., t. Workplace, and I.o. Medicine, *Musculoskeletal disorders and the workplace: low back and upper extremities*. 2001: Natl Academy Pr.

- 
13. Punnett, L. and D.H. Wegman, *Work-related musculoskeletal disorders: the epidemiologic evidence and the debate*. J Electromyogr Kinesiol, 2004. **14**(1): p. 13-23.
14. Woolf, A.D. and B. Pfleger, *Burden of major musculoskeletal conditions*. Bull World Health Organ, 2003. **81**(9): p. 646-56.
15. De Inocencio, J., *Epidemiology of musculoskeletal pain in primary care*. Arch Dis Child, 2004. **89**(5): p. 431-4.
16. Thiehoff, R., [*Economic significance of work disability caused by musculoskeletal disorders*]. Der Orthopade, 2002. **31**(10): p. 949.
17. Guo, H.-R., et al., *Prevalence of musculoskeletal disorder among workers in Taiwan: a nationwide study*. Journal of occupational health, 2004. **46**(1): p. 26-36.
18. Mansson, N.O., L. Rastam, and A. Adolfsson, *Disability pension in Malmohus county: aspects on long-term financial effects*. Scand J Soc Med, 1998. **26**(2): p. 102-5.
19. Coyte, P.C., et al., *The economic cost of musculoskeletal disorders in Canada*. Arthritis & Rheumatism, 1998. **11**(5): p. 315-325.
20. Praemer, A.F., S, *In Musculoskeletal Conditions in the United States, 1999*, National Center for Health Statistics, National Health Interview Survey: American Academy of Orthopaedic Surgeons.
21. Health and Safety Executive, N.S., *The health and Safety executive Statistics 2009/10.*, 2010.: Health and Safety Executive.
22. Silverstein, B., Adams, D., *Work-related Musculoskeletal Disorders of the Neck, Back, and Upper Extremity in Washington State, 1997-2005.*, 2007, Safety and Health Assessment and Research for Prevention (SHARP) and Washington State Dept. of Labor and Industries
23. Savage, R., G. Whitehouse, and N. Roberts, *The relationship between the magnetic resonance imaging appearance of the lumbar spine and low back pain, age and occupation in males*. European Spine Journal, 1997. **6**(2): p. 106-114.
24. *Statistics of Industrial Accident in 2007.*, 2008, Korean Ministry of Labor: Seoul, Korea.
25. *Musculoskeletal Disorders and the Workplace: Low Back and Upper Extremities*. 2001: The National Academies Press.
26. OSHA, *Occupational Safety and Health Administration. Table of non-fatal occupational injuries and illnesses with days away from work involving musculoskeletal disorders by selected worker and case characteristics*, 2001, OSHA.

- 
27. Aroori, S. and R.A. Spence, *Carpal tunnel syndrome*. *Ulster Med J*, 2008. **77**(1): p. 6-17.
 28. Bernard, B.P., *Musculoskeletal disorders and workplace factors: a critical review of epidemiologic evidence for Work-related disorders of the neck, upper extremities, and low back*. NASA, 1997(19980001289).
 29. Williams, F. and P. Sambrook, *Neck and back pain and intervertebral disc degeneration: role of occupational factors*. *Best Practice & Research Clinical Rheumatology*, 2011. **25**(1): p. 69-79.
 30. Armstrong, T., et al., *Musculoskeletal Disorders: Work-related Risk Factors and Prevention*. *International journal of occupational and environmental health*, 1996. **2**(3): p. 239.
 31. Walker-Bone, K. and C. Cooper, *Hard work never hurt anyone: or did it? A review of occupational associations with soft tissue musculoskeletal disorders of the neck and upper limb*. *Annals of the rheumatic diseases*, 2005. **64**(10): p. 1391-1396.
 32. Theorell, T., et al., *Psychosocial job factors and symptoms from the locomotor system--a multicausal analysis*. *Scand J Rehabil Med*, 1991. **23**(3): p. 165-73.
 33. Andersson, G., M. Nordin, and M.H. Pope, *Musculoskeletal disorders in the workplace: principles and practice*. 1997: Mosby.
 34. Saftić, R., et al., *Case-control study of risk factors for lumbar intervertebral disc herniation in Croatian island populations*. *Croatian medical journal*, 2006. **47**(4): p. 593-600.
 35. Luoma, K., et al., *Low back pain in relation to lumbar disc degeneration*. *Spine*, 2000. **25**(4): p. 487-492.
 36. (NAICS), N.A.I.C.S. *Standard Industrial Classification (SIC) System*. 1997; Available from: <http://www.census.gov/epcd/www/sic.html>.
 37. *Labor Safety and Health Act*, Announced on 1974.04.16; Modified on 2002.06.12.
 38. 朱柏青、傅還然、杜宗禮、邱曉玲、林彥君、簡惠燕、郭育良, *Establishing occupational disease and injury services in Taiwan*. *勞工安全衛生研究季刊*, 2010. **18**: p. 330-336.
 39. 徐徹暉、巫宇舜, *工作環境安全衛生狀況認知調查-2010年*, 2011: 行政院勞委會勞工安全衛生研究所.
 40. Bergman, S., et al., *Chronic musculoskeletal pain, prevalence rates, and sociodemographic associations in a Swedish population study*. *J Rheumatol*, 2001. **28**(6): p. 1369-77.
 41. Bergman, S., *Public health perspective--how to improve the musculoskeletal*

- 
- health of the population*. Best Pract Res Clin Rheumatol, 2007. **21**(1): p. 191-204.
42. Silverstein, B.A., L.J. Fine, and T.J. Armstrong, *Occupational factors and carpal tunnel syndrome*. American Journal of Industrial Medicine, 1987. **11**(3): p. 343-358.
 43. Violante, F., L. Isolani, and G.B. Raffi, *Case definition for upper limb disorders*. Occupational ergonomics. Work related musculoskeletal disorders of the upper limb and back, 2000: p. 120-128.
 44. Burton, A.K., et al., *Management of upper limb disorders and the biopsychosocial model*. 2008.
 45. Gjesdal, S., et al., *Sickness absence with musculoskeletal or mental diagnoses, transition into disability pension and all-cause mortality: a 9-year prospective cohort study*. Scandinavian journal of public health, 2009. **37**(4): p. 387-394.
 46. Buckle, P.W. and J. Jason Devereux, *The nature of Work-related neck and upper limb musculoskeletal disorders*. Applied ergonomics, 2002. **33**(3): p. 207-217.
 47. Hanson, M.A., et al., *The costs and benefits of active case management and rehabilitation for musculoskeletal disorders*. Health and Safety Executive Research Report, 2006. **493**.
 48. Mackinnon, S.E. and C.B. Novak, *Clinical commentary: pathogenesis of cumulative trauma disorder*. The Journal of hand surgery, 1994. **19**(5): p. 873.
 49. Viikari-Juntura, E. and H. Riihimäki, *New avenues in research on musculoskeletal disorders*. Scandinavian Journal of Work, Environment & Health, 1999: p. 564-568.
 50. Marx, R.G., C. Bombardier, and J.G. Wright, *What do we know about the reliability and validity of physical examination tests used to examine the upper extremity?* The Journal of hand surgery, 1999. **24**(1): p. 185-193.
 51. Jensen, A., et al., *Locomotor diseases among male long-haul truck drivers and other professional drivers*. International archives of occupational and environmental health, 2008. **81**(7): p. 821-827.
 52. MacGregor, A.J., et al., *Structural, psychological, and genetic influences on low back and neck pain: a study of adult female twins*. Arthritis Care & Research, 2004. **51**(2): p. 160-167.
 53. Battié, M.C. and T. Videman, *Lumbar disc degeneration: epidemiology and genetics*. The Journal of Bone & Joint Surgery, 2006. **88**(suppl_2): p. 3-9.
 54. Macfarlane, G.J., et al., *Investigating the determinants of international differences in the prevalence of chronic widespread pain: evidence from the European Male Ageing Study*. Annals of the rheumatic diseases, 2009. **68**(5): p.

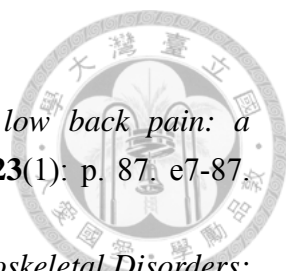
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- 690-695.
55. Shiri, R., et al., *The association between smoking and low back pain: a meta-analysis*. *The American journal of medicine*, 2010. **123**(1): p. 87. e7-87. e35.
56. NIOSH, *National Occupational Research Agenda for Musculoskeletal Disorders: Research Topics for the Next Decade, A Report by the NORA Musculoskeletal Disorders Team.*, 2001, NIOSH: Cincinnati, Ohio.
57. Palmer, K.T., E.C. Harris, and D. Coggon, *Carpal tunnel syndrome and its relation to occupation: a systematic literature review*. *Occupational Medicine*, 2007. **57**(1): p. 57-66.

Table 1. Standard Industrial Classification System of the republic of china

Standard Industrial Classification System of the republic of china (Rev.9 , 2011)	
Code	Description
A	Agriculture, Forestry, Fishing and Animal Husbandry
01	Agriculture and Animal Husbandry
02	Forestry
03	Fishing
B	Mining and Quarrying
05	Crude Petroleum and Natural Gas Extraction
06	Sand, Stone and Clay Quarrying
07	Other Mining and Quarrying
C	Manufacturing
08	Food Manufacturing
09	Beverages Manufacturing
10	Tobacco Manufacturing
11	Textiles Mills
12	Wearing Apparel and Clothing Accessories Manufacturing
13	Leather, Fur and Related Products Manufacturing
14	Wood and Bamboo Products Manufacturing
15	Pulp, Paper and Paper Products Manufacturing
16	Printing and Reproduction of Recorded Media
17	Petroleum and Coal Products Manufacturing
18	Chemical Material Manufacturing
19	Chemical Products Manufacturing
20	Medical Goods Manufacturing
21	Rubber Products Manufacturing
22	Plastic Products Manufacturing
23	Non-metallic Mineral Products Manufacturing
24	Basic Metal Manufacturing
25	Fabricated Metal Products Manufacturing
26	Electronic Parts and Components Manufacturing
27	Computers, Electronic and Optical Products Manufacturing
28	Electrical Equipment Manufacturing
29	Machinery and Equipment Manufacturing
30	Motor Vehicles and Parts Manufacturing
31	Other Transport Equipment Manufacturing
32	Furniture Manufacturing



33	Manufacturing Not Elsewhere Classified
34	Repair and Installation of Industrial Machinery and Equipment
D	Electricity and Gas Supply
35	Electricity and Gas Supply
E	Water Supply and Remediation Services
36	Water Supply
37	Wastewater (Sewage) Treatment
38	Waste Collection, Treatment and Disposal; Materials Recovery
F	Construction
41	Buildings Construction
42	Civil Engineering
43	Specialized Construction
G	Wholesale and Retail Trade
45-46	Wholesale Trade
47-48	Retail Trade
H	Transportation and Storage
49	Land Transportation
50	Water Transportation
51	Air Transportation
52	Supporting Services to Transportation
53	Warehousing and Storage
54	Postal and Courier Services
I	Accommodation and Food Services
55	Accommodation Services
56	Food and Beverage Services
J	Financial
58	Publishing
59	Motion Picture and Video Services, Sound Recording and Music Publishing
60	Broadcasting and Programming
61	Telecommunications
62	Computer Systems Design Services
63	Data Processing and Information Supply Services
K	Financial and Insurance
64	Financial Intermediation
65	Insurance Carriers
66	Securities, Futures and Other Financing
L	Real Estate





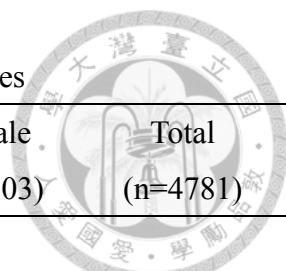
67	Real Estate Development
68	Real Estate Operation and Relative Services
M	Professional, Scientific and Technical Services
69	Legal and Accounting Services
70	Head Offices and Management Consultancy Services
71	Architecture and Engineering Services; Technical Testing and Analysis Services
72	Research and Development Services
73	Advertising and Market Research
74	Specialized Design Services
75	Veterinary Services
76	Other Professional, Scientific and Technical Services
N	Support Services
77	Rental and Leasing
78	Employment Services
79	Travel Agency
80	Security and Investigation Services
81	Buildings and Greenery Services
82	Business and Office Support Services
O	Public Administration and Defence; Compulsory Social Security
83	Public Administration and Defence; Compulsory Social Security
84	Extra-territorial Organizations and Bodies
P	Education
85	Education
Q	Human Health and Social Work Services
86	Human Health Services
87	Residential Care Services
88	Other Social Work Services
R	Arts, Entertainment and Recreation
90	Creative and Performing Arts
91	Libraries, Archives, Museums and Similar Institutions
92	Gambling
93	Sports, Amusement and Recreation
S	Other Services
94	Religious, Trade and Similar Organizations
95	Maintenance and Repair of Personal and Household Goods
96	Other Services Not Elsewhere Classified

Table 2. Incidence rate of occupational diseases

Occupational disease	N(%)	Incidence rate
Occupational pulmonary disease	404 (8.5)	9.6
Occupational liver disease	33 (0.7)	0.8
Occupational dermal disease	310 (6.5)	7.4
Occupational cardiovascular disease	57 (1.2)	1.4
Occupational neurological disease	47 (0.1)	1.1
Occupational hematological disease	63 (1.3)	1.5
Occupational renal diseases	5 (0.1)	0.1
Occupational musculoskeletal diseases	2239 (46.8)	53.5
Occupational hearing loss	1337 (28.0)	31.9
Occupational eye disease	11 (0.2)	0.3
Occupational physical disease	177 (3.7)	4.2
Biological hazard	16 (0.3)	0.4
Others	82 (1.7)	2.0
Total cases	4781	114.1

(cases per 10⁶ working population per year)

Table 3. Demographic data of 2008-2011 ODIS cases



	Male (n=3278)	Female (n=1503)	Total (n=4781)
Occupational disease			
Occupational pulmonary disease	314 (9.6)	90 (6.0)	404 (8.5)
Occupational liver disease	32 (1.0)	1 (0.0)	33 (0.7)
Occupational dermal disease	186 (5.7)	124 (8.3)	310 (6.5)
Occupational cardiovascular disease	53 (1.6)	4 (0.0)	57 (1.2)
Occupational neurological disease	32 (1.0)	15 (0.1)	47 (1.0)
Occupational hematological disease	36 (1.1)	27 (0.2)	63 (1.3)
Occupational renal diseases	4 (0.0)	1 (0.0)	5 (0.1)
Occupational musculoskeletal diseases	1,130 (34.4)	1,109 (73.8)	2,239 (46.8)
Occupational hearing loss	1,253 (38.2)	84 (5.6)	1,337 (28.0)
Occupational eye disease	7 (0.0)	4 (0.0)	11 (0.2)
Occupational physical disease	177 (5.4)	0 (0.0)	177 (3.7)
Biological hazard	6 (0.0)	10 (0.1)	16 (0.3)
Others	48 (1.5)	34 (2.3)	82 (1.7)
Age n (%)			
20-29	206 (6.3)	145 (9.6)	351 (7.3)
30-39	680 (20.7)	264 (17.6)	944 (19.7)
40-49	1,045 (31.9)	460 (30.6)	1,505 (31.5)
50-59	1,036 (31.6)	545 (36.3)	1,581 (33.1)
>=60	311 (9.5)	89 (5.9)	400 (8.4)
Industrial sector n (%)			
Agriculture, Forestry, Fishing and Animal Husbandry	119 (3.6)	20 (1.3)	139 (2.9)
Industry	2,387 (72.8)	577 (38.4)	2,964 (62.0)
Services	772 (23.6)	906 (60.3)	1,678 (35.1)

Table 4. Classification and selection for WMSDs

Disease	ICD9 Code	N
Carpal tunnel syndrome	354.0 Carpal tunnel syndrome	724
Herniated intervertebral disc	722.93 Other and unspecified disc disorder of lumbar region	451
	722.73 Lumbar region of intervertebral disc disorder with myelopathy	94
	Total	545
Total case numbers selected into data analysis		1,269

Table 5. The CTS cases by age and industry sector distribution

	Male (n=226)	Female (n=498)	Total (n=724)
Age Mean (SD)	46.4 (10.1)	47.3 (8.0)	47.0 (8.7)
Stratified by age (N, %)			
20-29	10 (4.4)	10 (2.0)	20 (2.8)
30-39	53 (23.5)	81 (16.3)	134 (18.5)
40-49	68 (30.1)	196 (39.4)	264 (36.5)
50-59	79 (35.0)	193 (38.8)	272 (37.6)
>=60	16 (7.1)	16 (3.6)	34 (4.7)
Industry sector (N, %)			
Agriculture, Forestry, Fishing and Animal Husbandry	3 (1.3)	6 (1.2)	9 (1.2)
Industry	120 (53.1)	172 (34.5)	292 (40.3)
Services	103 (45.6)	320 (64.3)	423 (58.4)

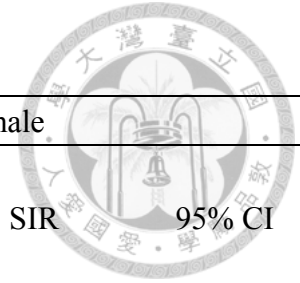
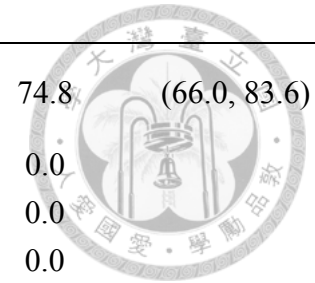


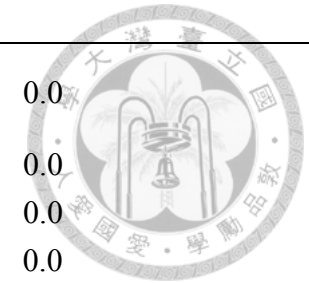
Table 6. SIR of CTS in 89 job divisions (Cases per 10⁶ population per year)

Job Division	Male				Female			
	Case (N)	Total # of working population	SIR	95% CI	Case (N)	Total # of working population	SIR	95% CI
Agriculture and Animal Husbandry	2	407.3	0.4	(0.0, 1.1)	4	78.4	7.8	(5.0, 10.7)
Forestry	0	3.6	0.0		1	1.7	52.9	(45.5, 60.3)
Fishing	1	45.3	7.9	(4.5, 11.3)	1	6.2	19.1	(14.7, 23.6)
Mining and Quarrying	0	0.0	0.0		0	0.0	0.0	
Crude Petroleum and Natural Gas Extraction	0	1.0	0.0		0	0.0	0.0	
Sand, Stone and Clay Quarrying	1	3.4	91.9	(80.2, 103.5)	0	0.4	0.0	
Other Mining and Quarrying	0	0.0	0.0		0	0.0	0.0	
Food Manufacturing	4	76.1	11.8	(7.6, 16.0)	16	67.1	53.5	(46.0, 60.9)
Beverages Manufacturing	0	12.1	0.0		0	4.4	0.0	
Tobacco Manufacturing	0	1.0	0.0		0	0.0	0.0	
Textiles Mills	1	54.0	3.3	(1.1, 5.5)	1	44.8	3.2	(1.4, 5.1)
Wearing Apparel and Clothing Accessories Manufacturing	3	20.2	36.8	(29.4, 44.2)	34	63.1	115.5	(104.6, 126.5)
Leather, Fur and Related Products Manufacturing	1	26.2	9.2	(5.5, 12.9)	0	22.1	0.0	
Wood and Bamboo Products Manufacturing	4	14.8	120.9	(107.5, 134.2)	3	8.9	150.2	(137.7, 162.7)
Pulp, Paper and Paper Products Manufacturing	4	34.3	37.0	(29.6, 44.4)	3	18.4	30.8	(25.1, 36.4)

Printing and Reproduction of Recorded Media	2	43.1	10.3	(6.4, 14.2)	3	16.9	74.8	(66.0, 83.6)
Petroleum and Coal Products Manufacturing	0	16.9	0.0		0	1.1	0.0	
Chemical Material Manufacturing	1	47.5	5.9	(3.0, 8.9)	0	14.7	0.0	
Chemical Products Manufacturing	0	23.4	0.0		0	16.4	0.0	
Medical Goods Manufacturing	0	11.1	0.0		1	18.9	11.2	(7.8, 14.7)
Rubber Products Manufacturing	0	19.6	0.0		1	5.9	28.4	(23.0, 33.8)
Plastic Products Manufacturing	3	79.9	12.1	(7.9, 16.3)	9	44.6	48.8	(41.7, 56.0)
Non-metallic Mineral Products Manufacturing	3	53.1	13.7	(9.2, 18.2)	5	13.4	171.4	(158.1, 184.8)
Basic Metal Manufacturing	7	67.6	21.3	(15.7, 26.9)	4	11.9	137.6	(125.6, 149.5)
Fabricated Metal Products Manufacturing	13	310.7	10.1	(6.3, 14.0)	11	99.0	25.2	(20.1, 30.3)
Electronic Parts and Components Manufacturing	2	310.7	7.6	(4.2, 10.9)	12	296.8	14.9	(10.9, 18.8)
Computers, Electronic and Optical Products Manufacturing	5	135.8	9.4	(5.6, 13.1)	10	88.4	42.1	(35.4, 48.7)
Electrical Equipment Manufacturing	1	72.4	4.2	(1.7, 6.7)	1	51.1	5.0	(2.7, 7.2)
Machinery and Equipment Manufacturing	6	157.8	8.3	(4.8, 11.8)	8	55.4	38.0	(31.7, 44.2)
Motor Vehicles and Parts Manufacturing	6	54.5	26.7	(20.4, 32.9)	2	29.7	19.1	(14.7, 23.6)
Other Transport Equipment Manufacturing	0	47.3	0.0		2	21.9	34.3	(28.4, 40.3)
Furniture Manufacturing	1	30.8	8.7	(5.1, 12.3)	2	8.7	63.7	(55.6, 71.9)
Manufacturing Not Elsewhere Classified	4	45.7	22.0	(16.3, 27.7)	8	42.0	58.8	(51.0, 66.6)



Repair and Installation of Industrial Machinery and Equipment	0	36.6	0.0		0	2.6	0.0	
Electricity and Gas Supply	1	24.7	52.4	(43.6, 61.2)	0	4.1	0.0	
Water Supply	1	4.9	11.3	(7.2, 15.4)	0	1.1	0.0	
Wastewater (Sewage) Treatment	0	6.1	0.0		0	1.4	0.0	
Waste Collection, Treatment and Disposal; Materials Recovery	1	46.6	6.2	(3.1, 9.2)	0	14.2	0.0	
Buildings Construction	27	267.5	22.2	(16.5, 28.0)	29	42.3	157.0	(144.3, 169.8)
Civil Engineering	2	72.4	6.4	(3.3, 9.5)	2	15.6	17.2	(13.0, 21.5)
Specialized Construction	16	388.4	9.2	(5.5, 12.9)	5	28.1	43.6	(36.8, 50.3)
Wholesale Trade	2	358.1	1.1	(0.0, 2.4)	5	253.4	5.3	(2.9, 7.6)
Retail Trade	2	572.9	0.9	(0.0, 2.0)	30	569.6	15.1	(11.1, 19.0)
Land Transportation	10	224.9	10.9	(6.9, 14.9)	2	29.1	18.9	(14.5, 23.3)
Water Transportation	1	9.5	13.8	(9.3, 18.3)	0	4.0	0.0	
Air Transportation	0	12.8	0.0		0	9.0	0.0	
Supporting Services to Transportation	1	38.0	3.0	(0.9, 5.1)	2	21.2	45.2	(38.3, 52.0)
Warehousing and Storage	1	6.9	48.1	(39.7, 56.6)	2	3.6	153.2	(140.6, 165.8)
Postal and Courier Services	4	32.0	58.5	(49.2, 67.8)	2	17.3	21.4	(16.7, 26.1)
Accommodation Services	2	21.9	32.7	(25.8, 39.7)	8	31.6	81.6	(72.4, 90.8)
Food and Beverage Services	37	286.0	34.8	(27.6, 41.9)	99	369.2	61.9	(53.9, 69.9)
Publishing	1	16.1	20.5	(15.0, 26.0)	0	22.9	0.0	
Motion Picture and Video Services, Sound Recording and Music Publishing	0	7.8	0.0		0	4.7	0.0	



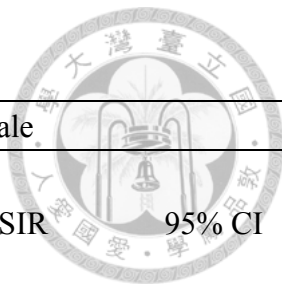
Broadcasting and Programming	1	12.1	12.1	(7.8, 16.3)	0	12.1	0.0	
Telecommunications	0	29.4	0.0		0	16.6	0.0	
Computer Systems Design Services	2	58.8	7.1	(3.9, 10.4)	1	19.2	18.2	(13.9, 22.6)
Data Processing and Information Supply Services	0	3.6	0.0		6	5.4	123.5	(112.2, 134.8)
Financial Intermediation	2	81.4	5.8	(2.9, 8.8)	2	119.1	5.9	(3.4, 8.4)
Insurance Carriers	0	56.4	0.0		3	109.6	5.8	(3.4, 8.3)
Securities, Futures and Other Financing	0	21.1	0.0		0	32.1	0.0	
Real Estate Development	0	2.8	0.0		0	3.4	0.0	
Real Estate Operation and Relative Services	0	46.5	0.0		0	23.0	0.0	
Legal and Accounting Services	0	27.4	0.0		2	58.1	11.6	(8.1, 15.0)
Head Offices and Management Consultancy Services	1	13.9	10.7	(6.8, 14.7)	5	14.6	81.8	(72.6, 91.1)
Architecture and Engineering Services; Technical Testing and Analysis Services	5	46.1	24.6	(18.5, 30.6)	5	21.4	72.5	(63.8, 81.2)
Research and Development Services	0	20.8	0.0		0	16.9	0.0	
Advertising and Market Research	1	28.1	6.4	(3.3, 9.4)	1	19.4	8.9	(5.8, 11.9)
Specialized Design Services	3	11.6	57.2	(48.0, 66.4)	3	17.1	73.2	(64.5, 81.9)
Veterinary Services	0	3.2	0.0		0	2.1	0.0	
Other Professional, Scientific and Technical Services	1	12.8	12.4	(8.1, 16.7)	0	10.5	0.0	
Rental and Leasing	0	12.4	0.0		0	5.1	0.0	
Employment Services	0	4.9	0.0		1	11.6	40.8	(34.3, 47.3)

Travel Agency	0	15.9	0.0		0	20.4	0.0	
Security and Investigation Services	0	69.3	0.0		0	4.4	0.0	
Buildings and Greenery Services	5	27.2	35.9	(28.6, 43.1)	23	38.3	118.9	(107.8, 130.0)
Business and Office Support Services	1	15.5	16.5	(11.6, 21.5)	7	11.5	141.7	(129.5, 153.8)
Public Administration and Defence; Compulsory Social Security	1	216.0	0.9	(0.0, 2.1)	8	158.7	11.1	(7.7, 14.5)
Extra-territorial Organizations and Bodies	0	0.0	0.0		0	0.0	0.0	
Education	1	204.0	1.1	(0.0, 2.4)	18	412.5	26.7	(21.5, 32.0)
Human Health Services	5	94.6	12.7	(8.4, 17.1)	16	243.4	26.8	(21.6, 32.1)
Residential Care Services	2	5.0	50.7	(42.0, 59.3)	15	19.8	156.1	(143.4, 168.8)
Other Social Work Services	0	3.9	0.0		0	12.3	0.0	
Creative and Performing Arts	0	9.5	0.0		1	5.0	20.2	(15.6, 24.7)
Libraries, Archives, Museums and Similar Institutions	0	4.8	0.0		0	6.7	0.0	
Gambling	0	4.1	0.0		0	2.9	0.0	
Sports, Amusement and Recreation	0	30.9	0.0		1	32.1	7.6	(4.8, 10.4)
Religious, Trade and Similar Organizations	0	38.4	0.0		0	36.3	0.0	
Maintenance and Repair of Personal and Household Goods	6	173.7	10.7	(6.8, 14.7)	0	23.3	0.0	
Other Services Not Elsewhere Classified	5	66.2	19.7	(14.3, 25.1)	52	192.8	61.8	(53.8, 69.8)

Table 7. The HIVD cases by age and industry sector distribution

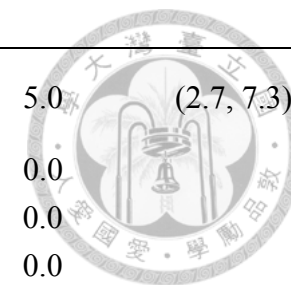
	Male (n=418)	Female (n=127)	Total (n=545)
Age Mean (SD)	45.3 (8.9)	49.1 (9.1)	46.1 (9.1)
Stratified by age (N, %)			
20-29	18 (4.3)	6 (4.7)	24 (4.4)
30-39	98 (23.4)	13 (10.2)	111 (20.4)
40-49	150 (35.9)	39 (30.7)	189 (34.7)
50-59	135 (32.3)	53 (41.7)	188 (34.5)
>=60	17 (4.1)	16 (12.6)	33 (6.1)
Industry sector (N, %)			
Agriculture, Forestry, Fishing and Animal Husbandry	5 (1.2)	0 (0.0)	5 (0.9)
Industry	250 (59.8)	70 (55.1)	320 (58.7)
Services	163 (39.0)	57 (44.9)	220 (40.4)

Table 8. SIR of HIVD in 89 job divisions (Cases per 10⁶ population per year)

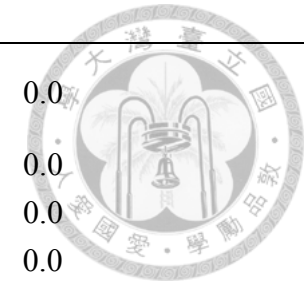


Job Division	Male				Female			
	Case (N)	Total # of working population	SIR	95% CI	Case (N)	Total # of working population	SIR	95% CI
Agriculture and Animal Husbandry	4	407.3	3.0	(0.9, 5.1)	0	78.4	0.0	
Forestry	0	3.6	0.0		0	1.7	0.0	
Fishing	1	45.3	2.5	(0.6, 4.4)	0	6.2	0.0	
Mining and Quarrying	0	0.0	0.0		0	0.0	0.0	
Crude Petroleum and Natural Gas Extraction	0	1.0	0.0		0	0.0	0.0	
Sand, Stone and Clay Quarrying	1	3.4	86.7	(75.3, 98.0)	0	0.4	0.0	
Other Mining and Quarrying	0	0.0	0.0		0	0.0	0.0	
Food Manufacturing	5	76.1	19.2	(13.9, 24.5)	3	67.1	5.6	(3.2, 8.0)
Beverages Manufacturing	0	12.1	0.0		0	4.4	0.0	
Tobacco Manufacturing	0	1.0	0.0		0	0.0	0.0	
Textiles Mills	0	54.0	0.0		0	44.8	0.0	
Wearing Apparel and Clothing Accessories Manufacturing	2	20.2	22.5	(16.7, 28.2)	2	63.1	2.9	(1.1, 4.6)
Leather, Fur and Related Products Manufacturing	2	26.2	12.8	(8.4, 17.1)	0	22.1	0.0	
Wood and Bamboo Products Manufacturing	4	14.8	94.4	(82.6, 106.2)	2	8.9	25.2	(20.1, 30.3)
Pulp, Paper and Paper Products Manufacturing	4	34.3	20.9	(15.4, 26.5)	2	18.4	8.1	(5.2, 11.0)

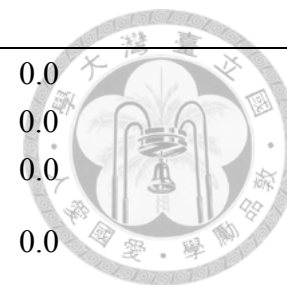
Printing and Reproduction of Recorded Media	5	43.1	28.7	(22.2, 35.2)	1	16.9	5.0	(2.7, 7.3)
Petroleum and Coal Products Manufacturing	0	16.9	0.0		0	1.1	0.0	
Chemical Material Manufacturing	0	47.5	0.0		0	14.7	0.0	
Chemical Products Manufacturing	0	23.4	0.0		0	16.4	0.0	
Medical Goods Manufacturing	2	11.1	64.1	(54.3, 73.8)	0	18.9	0.0	
Rubber Products Manufacturing	0	19.6	0.0		0	5.9	0.0	
Plastic Products Manufacturing	6	79.9	16.0	(11.1, 20.8)	2	44.6	5.4	(3.0, 7.7)
Non-metallic Mineral Products Manufacturing	10	53.1	50.1	(41.5, 58.7)	2	13.4	6.5	(3.9, 9.1)
Basic Metal Manufacturing	4	67.6	13.1	(8.7, 17.5)	1	11.9	2.2	(0.7, 3.7)
Fabricated Metal Products Manufacturing	32	310.7	24.6	(18.6, 30.7)	11	99.0	6.2	(3.7, 8.7)
Electronic Parts and Components Manufacturing	2	310.7	1.7	(0.1, 3.2)	2	296.8	1.0	(0.0, 2.0)
Computers, Electronic and Optical Products Manufacturing	0	135.8	0.0		0	88.4	0.0	
Electrical Equipment Manufacturing	0	72.4	0.0		0	51.1	0.0	
Machinery and Equipment Manufacturing	26	157.8	40.7	(32.9, 48.4)	2	55.4	2.1	(0.6, 3.6)
Motor Vehicles and Parts Manufacturing	7	54.5	31.2	(24.4, 38.0)	1	29.7	3.4	(1.5, 5.2)
Other Transport Equipment Manufacturing	2	47.3	10.1	(6.2, 13.9)	1	21.9	4.1	(2.1, 6.2)
Furniture Manufacturing	1	30.8	8.7	(5.1, 12.3)	0	8.7	0.0	
Manufacturing Not Elsewhere Classified	4	45.7	27.8	(21.4, 34.2)	1	42.0	2.3	(0.8, 3.9)



Repair and Installation of Industrial Machinery and Equipment	2	36.6	18.5	(13.3, 23.8)	0	2.6	0.0	
Electricity and Gas Supply	9	24.7	114.2	(101.2, 127.2)	0	4.1	0.0	
Water Supply	0	4.9	0.0		0	1.1	0.0	
Wastewater (Sewage) Treatment	1	6.1	37.6	(30.1, 45.0)	0	1.4	0.0	
Waste Collection, Treatment and Disposal; Materials Recovery	7	46.6	35.7	(28.5, 43.0)	0	14.2	0.0	
Buildings Construction	80	267.5	64.3	(54.6, 74.0)	30	42.3	16.9	(12.7, 21.1)
Civil Engineering	5	72.4	16.8	(11.8, 21.8)	0	15.6	0.0	
Specialized Construction	22	388.4	12.1	(7.8, 16.3)	7	28.1	3.3	(1.4, 5.1)
Wholesale Trade	11	358.1	7.0	(3.8, 10.3)	6	253.4	2.1	(0.6, 3.6)
Retail Trade	6	572.9	2.9	(0.8, 5.0)	6	569.6	1.4	(0.2, 2.7)
Land Transportation	107	224.9	114.9	(101.8, 127.9)	4	29.1	3.6	(1.7, 5.5)
Water Transportation	1	9.5	13.8	(9.3, 18.3)	0	4.0	0.0	
Air Transportation	5	12.8	95.2	(83.3, 107.0)	1	9.0	8.2	(5.3, 11.1)
Supporting Services to Transportation	2	38.0	11.2	(7.1, 15.2)	0	21.2	0.0	
Warehousing and Storage	7	6.9	213.4	(195.6, 231.1)	1	3.6	36.2	(30.1, 42.3)
Postal and Courier Services	2	32.0	12.3	(8.1, 16.6)	1	17.3	7.8	(5.0, 10.7)
Accommodation Services	1	21.9	10.3	(6.4, 14.2)	3	31.6	26.3	(21.0, 31.5)
Food and Beverage Services	4	286.0	4.3	(1.8, 6.8)	4	369.2	1.5	(0.2, 2.7)
Publishing	0	16.1	0.0		0	22.9	0.0	
Motion Picture and Video Services, Sound Recording and Music Publishing	1	7.8	52.9	(44.1, 61.8)	0	4.7	0.0	



Broadcasting and Programming	0	12.1	0.0		0	12.1	0.0	
Telecommunications	0	29.4	0.0		0	16.6	0.0	
Computer Systems Design Services	0	58.8	0.0		0	19.2	0.0	
Data Processing and Information Supply Services	0	3.6	0.0		0	5.4	0.0	
Financial Intermediation	0	81.4	0.0		0	119.1	0.0	
Insurance Carriers	0	56.4	0.0		0	109.6	0.0	
Securities, Futures and Other Financing	0	21.1	0.0		0	32.1	0.0	
Real Estate Development	0	2.8	0.0		0	3.4	0.0	
Real Estate Operation and Relative Services	0	46.5	0.0		0	23.0	0.0	
Legal and Accounting Services	0	27.4	0.0		0	58.1	0.0	
Head Offices and Management Consultancy Services	0	13.9	0.0		0	14.6	0.0	
Architecture and Engineering Services; Technical Testing and Analysis Services	6	46.1	31.5	(24.7, 38.3)	1	21.4	3.6	(1.7, 5.6)
Research and Development Services	0	20.8	0.0		0	16.9	0.0	
Advertising and Market Research	0	28.1	0.0		0	19.4	0.0	
Specialized Design Services	0	11.6	0.0		0	17.1	0.0	
Veterinary Services	0	3.2	0.0		0	2.1	0.0	
Other Professional, Scientific and Technical Services	0	12.8	0.0		0	10.5	0.0	
Rental and Leasing	0	12.4	0.0		0	5.1	0.0	
Employment Services	0	4.9	0.0		0	11.6	0.0	



Travel Agency	0	15.9	0.0		0	20.4	0.0	
Security and Investigation Services	0	69.3	0.0		0	4.4	0.0	
Buildings and Greenery Services	2	27.2	15.0	(10.3, 19.7)	5	38.3	13.7	(10.0, 17.5)
Business and Office Support Services	0	15.5	0.0		0	11.5	0.0	
Public Administration and Defence; Compulsory Social Security	1	216.0	1.2	(-0.1, 2.5)	0	158.7	0.0	
Extra-territorial Organizations and Bodies	0	0.0	0.0		0	0.0	0.0	
Education	0	204.0	0.0		2	412.5	0.7	(-0.1, 1.6)
Human Health Services	3	94.6	7.4	(4.1, 10.7)	8	243.4	5.9	(3.4, 8.3)
Residential Care Services	1	5.0	26.7	(20.5, 33.0)	12	19.8	114.5	(103.6, 125.4)
Other Social Work Services	0	3.9	0.0		0	12.3	0.0	
Creative and Performing Arts	0	9.5	0.0		0	5.0	0.0	
Libraries, Archives, Museums and Similar Institutions	0	4.8	0.0		0	6.7	0.0	
Gambling	0	4.1	0.0		0	2.9	0.0	
Sports, Amusement and Recreation	0	30.9	0.0		0	32.1	0.0	
Religious, Trade and Similar Organizations	0	38.4	0.0		0	36.3	0.0	
Maintenance and Repair of Personal and Household Goods	4	173.7	5.7	(2.8, 8.6)	1	23.3	1.6	(0.3, 2.8)
Other Services Not Elsewhere Classified	0	66.2	0.0		2	192.8	1.8	(0.4, 3.2)

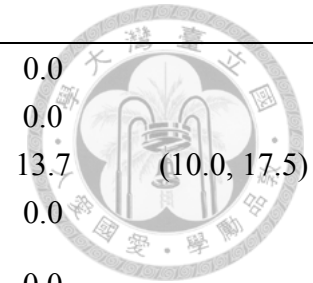
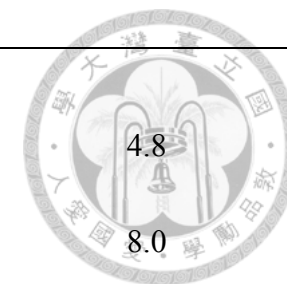




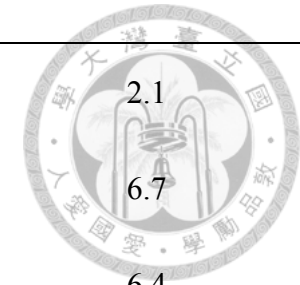
Table 9. Workplace ergonomic factors in difference job divisions, Male

Job Division	N=	Work postures, movements and working environment, Male (%)							
		Whole body vibration	Vibration from hand tools	Repetitive hand movements	Heavy tools used	Heavy lifting	Awkward posture	Cannot control working pace	Unacceptable desk
Agriculture and Animal Husbandry	987	1.9	2.7	19.6	9.7	25.4	14.6	0.5	0.4
Forestry	13	7.7	15.4	15.4	7.7	7.7	0.0	0.0	0.0
Fishing	139	5.8	5.0	23.7	15.9	48.2	10.1	0.7	1.4
Mining and Quarrying	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crude Petroleum and Natural Gas Extraction	5	20.0	0.0	20.0	0.0	0.0	0.0	0.0	0.0
Sand, Stone and Clay Quarrying	18	38.9	11.1	27.8	11.1	11.1	5.6	5.6	5.6
Other Mining and Quarrying	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Food Manufacturing	204	1.5	3.4	28.6	4.4	26.0	9.3	5.4	2.0
Beverages Manufacturing	30	3.3	6.7	30.0	3.3	10.0	10.0	16.7	6.7
Tobacco Manufacturing	3	0.0	0.0	33.3	0.0	33.3	33.3	33.3	50.0
Textiles Mills	147	3.4	6.1	25.9	6.8	19.7	8.2	4.1	0.7
Wearing Apparel and Clothing Accessories Manufacturing	54	5.6	7.4	28.3	5.6	9.3	9.3	5.6	1.9
Leather, Fur and Related Products Manufacturing	51	5.9	2.0	23.5	2.0	19.6	9.8	2.0	2.0
Wood and Bamboo Products	40	12.5	30.0	37.5	17.5	32.5	20.0	5.0	2.5

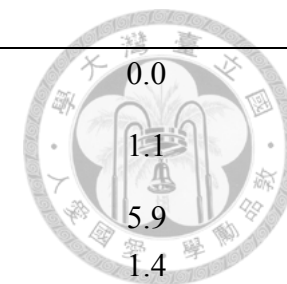
Manufacturing									
Pulp, Paper and Paper Products Manufacturing	84	2.4	3.6	23.8	8.3	27.4	9.5	4.8	0.0
Printing and Reproduction of Recorded Media	87	3.4	2.3	32.2	2.3	26.4	8.0	8.0	2.3
Petroleum and Coal Products Manufacturing	32	0.0	3.1	15.6	0.0	9.4	3.1	0.0	0.0
Chemical Material Manufacturing	116	4.3	6.0	18.1	4.3	10.3	6.0	5.2	1.7
Chemical Products Manufacturing	47	0.0	2.1	19.1	6.4	17.0	6.4	2.1	2.1
Medical Goods Manufacturing	27	0.0	0.0	18.5	0.0	0.0	0.0	3.7	0.0
Rubber Products Manufacturing	67	6.0	6.0	38.8	11.9	34.3	9.0	9.0	1.5
Plastic Products Manufacturing	163	3.1	4.9	30.9	4.9	17.3	7.4	8.0	1.9
Non-metallic Mineral Products Manufacturing	123	11.4	13.8	30.1	10.7	20.3	9.8	4.1	0.8
Basic Metal Manufacturing	164	6.2	13.5	26.4	16.0	19.6	12.3	2.5	3.1
Fabricated Metal Products Manufacturing	681	8.7	19.7	33.1	16.6	29.5	13.8	4.3	1.9
Electronic Parts and Components Manufacturing	671	1.3	3.0	27.4	2.8	7.2	4.6	4.6	2.1
Computers, Electronic and Optical Products Manufacturing	281	0.4	2.5	23.5	0.7	3.6	2.8	3.6	2.8
Electrical Equipment Manufacturing	156	3.2	5.8	27.6	5.8	13.5	13.5	5.1	3.2



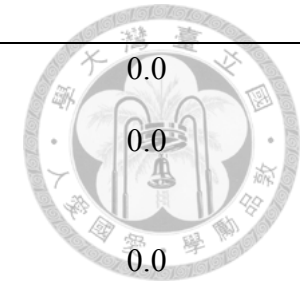
Machinery and Equipment Manufacturing	333	5.7	15.9	29.8	12.3	19.5	8.7	2.1	3.0
Motor Vehicles and Parts Manufacturing	134	3.7	7.5	32.3	9.0	20.9	7.5	6.7	2.2
Other Transport Equipment Manufacturing	110	6.4	11.8	40.0	12.7	22.7	11.8	6.4	1.8
Furniture Manufacturing	78	9.0	25.6	39.7	17.9	34.6	14.1	3.8	6.4
Manufacturing Not Elsewhere Classified	98	4.1	16.3	48.0	7.1	14.3	8.2	6.1	2.0
Repair and Installation of Industrial Machinery and Equipment	97	7.2	16.5	23.7	19.6	17.5	16.5	2.1	2.1
Electricity and Gas Supply	91	4.4	4.4	15.4	6.6	5.5	3.3	1.1	1.1
Water Supply	17	0.0	5.9	35.3	0.0	0.0	11.8	0.0	0.0
Wastewater (Sewage) Treatment	21	0.0	0.0	4.8	0.0	0.0	0.0	4.8	0.0
Waste Collection, Treatment and Disposal; Materials Recovery	128	10.2	3.2	30.7	4.7	25.2	12.6	3.9	0.8
Buildings Construction	626	9.9	18.7	34.4	27.4	43.4	24.0	1.6	1.6
Civil Engineering	185	15.2	18.9	22.7	20.5	24.9	10.3	2.2	2.2
Specialized Construction	828	9.7	23.1	33.0	19.0	29.2	22.2	1.6	1.7
Wholesale Trade	691	5.3	4.5	27.0	8.6	50.0	10.3	1.4	2.6
Retail Trade	1237	2.1	6.7	38.1	8.5	44.0	14.2	0.5	3.1
Land Transportation	565	15.9	2.7	31.3	5.8	23.9	14.3	0.9	1.8
Water Transportation	19	10.5	10.5	31.6	10.5	15.8	21.1	0.0	5.3



Air Transportation	17	0.0	5.9	5.9	5.9	5.9	11.8	0.0	0.0
Supporting Services to Transportation	93	4.3	5.4	21.7	5.4	10.8	3.2	1.1	4.3
Warehousing and Storage	17	0.0	0.0	35.3	0.0	23.5	0.0	5.9	0.0
Postal and Courier Services	74	8.1	2.7	31.1	4.1	25.7	6.8	1.4	2.7
Accommodation Services	75	1.3	0.0	6.7	2.7	8.0	4.0	1.3	1.3
Food and Beverage Services	622	0.8	2.3	31.7	4.0	10.5	7.6	0.3	1.9
Publishing	36	0.0	0.0	22.2	2.8	11.1	5.6	0.0	0.0
Motion Picture and Video Services, Sound Recording and Music Publishing	15	0.0	0.0	6.7	0.0	0.0	0.0	0.0	0.0
Broadcasting and Programming	27	0.0	3.7	25.9	7.4	18.5	7.4	0.0	0.0
Telecommunications	67	0.0	3.0	20.9	1.5	0.0	9.0	0.0	4.5
Computer Systems Design Services	116	0.0	0.9	28.4	1.7	1.7	2.6	0.9	3.4
Data Processing and Information Supply Services	4	0.0	0.0	50.0	0.0	0.0	25.0	0.0	0.0
Financial Intermediation	171	0.6	0.0	22.2	0.0	1.2	0.6	0.6	1.8
Insurance Carriers	135	2.2	1.5	8.9	0.7	0.0	0.7	0.7	0.7
Securities, Futures and Other Financing	48	0.0	0.0	22.9	0.0	0.0	2.1	0.0	2.1
Real Estate Development	5	0.0	0.0	20.0	0.0	0.0	0.0	0.0	20.0
Real Estate Operation and Relative Services	105	1.0	0.0	6.7	0.0	1.9	2.9	1.0	1.0



Legal and Accounting Services	52	1.9	0.0	3.9	0.0	0.0	0.0	0.0	1.9
Head Offices and Management Consultancy Services	18	0.0	0.0	16.7	0.0	5.6	0.0	0.0	0.0
Architecture and Engineering Services; Technical Testing and Analysis Services	97	2.1	2.1	21.6	2.1	4.1	2.1	0.0	3.1
Research and Development Services	53	0.0	0.0	11.3	0.0	0.0	1.9	0.0	3.8
Advertising and Market Research	48	4.3	10.6	25.0	4.4	16.7	6.4	0.0	2.1
Specialized Design Services	23	4.3	4.3	21.7	0.0	8.7	0.0	0.0	4.3
Veterinary Services	6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Professional, Scientific and Technical Services	28	0.0	0.0	21.4	3.6	0.0	3.6	0.0	0.0
Rental and Leasing	27	0.0	3.7	14.8	11.1	25.9	18.5	0.0	11.1
Employment Services	8	0.0	12.5	12.5	0.0	12.5	0.0	12.5	0.0
Travel Agency	42	2.4	0.0	9.5	2.4	7.1	4.8	2.4	0.0
Security and Investigation Services	172	0.0	0.6	2.9	0.6	1.7	2.9	0.0	0.6
Buildings and Greenery Services	74	4.1	6.8	24.7	16.2	25.7	18.9	1.4	1.4
Business and Office Support Services	31	6.5	3.2	41.9	0.0	12.9	9.7	0.0	3.2
Public Administration and Defence; Compulsory Social Security	562	1.2	1.3	12.7	2.9	4.1	5.0	1.2	2.1
Extra-territorial Organizations and Bodies	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0



Education	499	1.4	1.0	17.5	0.4	0.4	3.6	0.0	2.2
Human Health Services	223	0.0	4.9	21.5	0.4	2.2	7.6	0.4	1.8
Residential Care Services	16	6.3	0.0	6.3	0.0	6.3	0.0	0.0	0.0
Other Social Work Services	8	0.0	0.0	0.0	0.0	12.5	0.0	0.0	12.5
Creative and Performing Arts	17	0.0	5.9	35.3	11.8	23.5	5.9	0.0	5.9
Libraries, Archives, Museums and Similar Institutions	13	0.0	0.0	15.4	0.0	0.0	7.7	0.0	0.0
Gambling	10	0.0	0.0	20.0	0.0	0.0	0.0	0.0	0.0
Sports, Amusement and Recreation	75	1.3	0.0	10.7	0.0	2.7	8.0	0.0	1.3
Religious, Trade and Similar Organizations	110	3.6	1.8	5.5	0.9	4.5	3.6	0.0	0.9
Maintenance and Repair of Personal and Household Goods	388	6.0	19.4	29.5	15.8	18.1	26.1	1.8	2.3
Other Services Not Elsewhere Classified	145	0.0	2.8	17.9	2.1	3.4	7.6	0.0	0.7

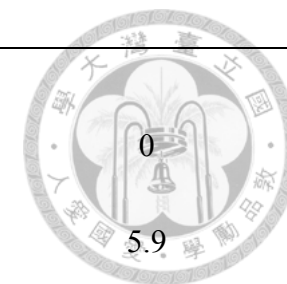




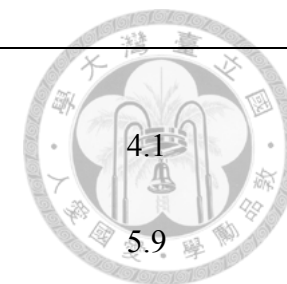
Table 10. Workplace ergonomic factors in difference job categories, Female

Job Division	N=	Work postures, movements and working environment, Male (%)							
		Whole body vibration	Vibration from hand tools	Repetitive hand movements	Heavy tools used	Heavy lifting	Awkward posture	Cannot control working pace	Unacceptable desk
Agriculture and Animal Husbandry	190	0.5	1.1	34.2	6.3	16.8	22.6	1.6	0.5
Forestry	6	0	0	16.7	0	0	0	0	0
Fishing	19	0	0	52.6	10.5	15.8	15.8	0	36.8
Mining and Quarrying	0	0	0	0	0	0	0	0	0
Crude Petroleum and Natural Gas Extraction	0	0	0	0	0	0	0	0	0
Sand, Stone and Clay Quarrying	2	0	0	50	0	0	0	0	50
Other Mining and Quarrying	0	0	0	0	0	0	0	0	0
Food Manufacturing	180	0	1.7	40.8	0.6	8.3	7.2	6.1	1.7
Beverages Manufacturing	11	0	0	36.4	9.1	10	0	27.3	0
Tobacco Manufacturing	0	0	0	0	0	0	0	0	0
Textiles Mills	122	0.8	0.8	38.5	0.8	8.2	8.2	9	3.3
Wearing Apparel and Clothing Accessories Manufacturing	169	3	7.1	51.5	1.8	3.6	8.9	1.8	1.8
Leather, Fur and Related Products Manufacturing	43	0	2.3	37.2	0	0	11.6	2.3	4.7
Wood and Bamboo Products	24	4.2	0	54.2	8.3	25	8.3	0	4.2

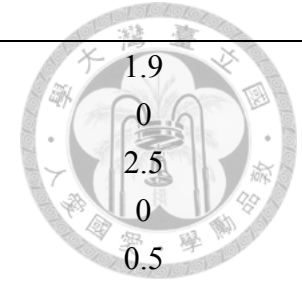
Manufacturing									
Pulp, Paper and Paper Products Manufacturing	45	0	0	45.5	0	15.9	15.6	0	4.4
Printing and Reproduction of Recorded Media	34	5.9	5.9	47.1	8.8	11.8	2.9	5.9	5.9
Petroleum and Coal Products Manufacturing	2	0	0	50	0	0	0	0	0
Chemical Material Manufacturing	36	0	0	33.3	2.8	8.3	2.8	5.6	0
Chemical Products Manufacturing	33	0	6.1	48.5	3	18.2	12.1	9.1	9.1
Medical Goods Manufacturing	46	0	4.3	39.1	0	2.2	2.2	8.7	0
Rubber Products Manufacturing	20	0	0	45	0	10	10	0	10
Plastic Products Manufacturing	91	1.1	4.4	44	2.2	14.3	9.9	9.9	0
Non-metallic Mineral Products Manufacturing	31	0	0	29	0	9.7	16.1	9.7	0
Basic Metal Manufacturing	29	6.9	6.9	44.8	3.4	10.3	6.9	3.4	0
Fabricated Metal Products Manufacturing	217	3.2	4.6	39.6	5.5	12.9	6	3.2	3.7
Electronic Parts and Components Manufacturing	641	0	1.6	48.8	2.2	6.2	7.6	10.1	5
Computers, Electronic and Optical Products Manufacturing	183	0	0.5	41	0	5.5	6	8.2	6
Electrical Equipment Manufacturing	110	0.9	2.7	60	4.5	9.1	5.5	10.9	3.6
Machinery and Equipment Manufacturing	117	2.6	3.4	37.9	2.6	6.8	7.7	6	4.3



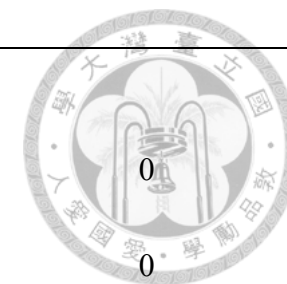
Manufacturing									
Motor Vehicles and Parts Manufacturing	73	2.7	6.8	37	5.5	6.8	4.1	4.1	2.7
Other Transport Equipment Manufacturing	51	0	5.9	47.1	3.9	15.7	5.9	5.9	0
Furniture Manufacturing	22	9.1	0	45.5	4.5	13.6	4.5	4.5	9.5
Manufacturing Not Elsewhere Classified	90	0	4.4	51.1	4.4	10	8.9	8.9	2.2
Repair and Installation of Industrial Machinery and Equipment	7	0	0	14.3	0	0	0	0	0
Electricity and Gas Supply	15	0	0	13.3	0	0	0	0	0
Water Supply	4	0	0	25	0	0	0	0	0
Wastewater (Sewage) Treatment	5	0	0	20	0	0	0	0	0
Waste Collection, Treatment and Disposal; Materials Recovery	39	7.7	0	43.6	2.6	17.9	10.3	5.1	0
Buildings Construction	99	4	6.1	34.3	12.1	16.2	9.1	1	1
Civil Engineering	40	2.5	5	32.5	7.5	10	2.5	2.5	2.5
Specialized Construction	60	1.7	5	26.7	5	10	5	0	3.3
Wholesale Trade	489	0.9	0	41	1.3	8.3	5.5	1.1	8
Retail Trade	1230	2.1	1.8	39.5	3.9	20.2	12.7	0.7	6.6
Land Transportation	73	0	2.7	30.1	1.4	2.7	2.7	0	1.4
Water Transportation	8	0	0	25	0	0	0	0	12.5
Air Transportation	12	8.3	0	25	0	8.3	16.7	0	8.3



Supporting Services to Transportation	52	1.9	0	32.7	0	0	5.8	1.9	5.8
Warehousing and Storage	9	0	0	22.2	0	0	11.1	0	0
Postal and Courier Services	40	7.5	0	40	5.1	2.5	10	2.5	0
Accommodation Services	108	0.9	0.9	21.3	0	2.8	2.8	0	0
Food and Beverage Services	803	0.8	1.8	29.1	2	6.6	7	0.5	1.5
Publishing	51	0	0	19.6	0	2	0	0	2
Motion Picture and Video Services, Sound Recording and Music Publishing	9	0	0	22.2	0	0	11.1	0	0
Broadcasting and Programming	27	0	3.7	40.7	0	3.7	7.4	0	7.4
Telecommunications	38	0	2.6	52.6	2.6	0	2.6	0	0
Computer Systems Design Services	38	0	0	36.8	0	0	5.3	0	2.6
Data Processing and Information Supply Services	6	0	0	33.3	0	0	0	0	0
Financial Intermediation	250	0	0	29.6	0.4	0	4.8	0.8	4.4
Insurance Carriers	262	0	0	11.5	0	0	0	0	1.5
Securities, Futures and Other Financing	73	0	0	32.9	0	1.4	1.4	0	1.4
Real Estate Development	6	0	0	33.3	0	0	0	0	16.7
Real Estate Operation and Relative Services	52	3.8	0	15.4	0	1.9	1.9	0	1.9
Legal and Accounting Services	110	0	0	28.2	0	0.9	0	0	4.5
Head Offices and Management	19	0	0	15.8	0	0	0	0	10.5



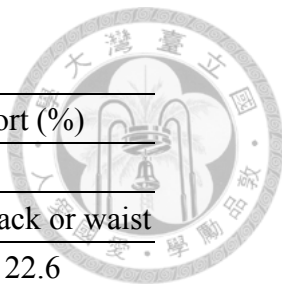
Consultancy Services										
Architecture and Engineering										
Services; Technical Testing and Analysis Services	45	0	2.2	28.9	0	0	2.2	0	2.2	2.2
Research and Development Services										
Research and Development Services	43	0	0	16.3	0	2.3	4.7	0	2.3	2.3
Advertising and Market Research										
Advertising and Market Research	33	0	0	33.3	0	0	0	0	6.1	6.1
Specialized Design Services										
Specialized Design Services	34	0	0	26.5	0	2.9	0	0	8.8	8.8
Veterinary Services										
Veterinary Services	4	0	0	0	0	0	0	0	0	0
Other Professional, Scientific and Technical Services										
Other Professional, Scientific and Technical Services	23	0	0	17.4	0	4.3	8.7	0	4.3	4.3
Rental and Leasing										
Rental and Leasing	11	0	0	9.1	0	9.1	0	0	18.2	18.2
Employment Services										
Employment Services	19	0	0	26.3	0	0	0	15.8	0	0
Travel Agency										
Travel Agency	54	1.9	0	16.7	0	0	0	3.7	5.6	5.6
Security and Investigation Services										
Security and Investigation Services	11	0	0	27.3	0	0	0	0	0	0
Buildings and Greenery Services										
Buildings and Greenery Services	104	2.9	1.9	29.8	2.9	7.7	16.3	1.9	1	1
Business and Office Support Services										
Business and Office Support Services	23	0	0	43.5	4.3	4.3	4.3	4.3	0	0
Public Administration and Defence; Compulsory Social Security										
Public Administration and Defence; Compulsory Social Security	413	0	0.2	29.4	0.5	1.5	2.4	1	5.6	5.6
Extra-territorial Organizations and Bodies										
Extra-territorial Organizations and Bodies	0	0	0	0	0	0	0	0	0	0
Education										
Education	1009	0.3	0.4	20.2	0.3	1.1	3.8	0.2	3.1	3.1
Human Health Services										
Human Health Services	574	0.2	1.4	26.2	1.7	5.9	10.3	0.3	6.8	6.8
Residential Care Services										
Residential Care Services	64	1.6	1.6	17.2	3.1	14.1	9.4	0	6.3	6.3



Other Social Work Services	25	0	0	32	4	12	0	0	4
Creative and Performing Arts	9	0	0	44.4	0	0	0	0	0
Libraries, Archives, Museums and Similar Institutions	18	5.6	0	22.2	0	0	5.6	0	0
Gambling	7	0	0	28.6	0	0	0	0	0
Sports, Amusement and Recreation	78	1.3	1.3	19.2	1.3	5.1	6.4	0	7.7
Religious, Trade and Similar Organizations	104	0	0	13.5	0	1	2.9	0	1
Maintenance and Repair of Personal and Household Goods	52	3.8	1.9	26.9	1.9	5.8	9.6	3.8	1.9
Other Services Not Elsewhere Classified	422	0	2.1	28.5	1.4	1.4	9.5	0	1.4



Table 11. Self-reported musculoskeletal discomforts in different job divisions

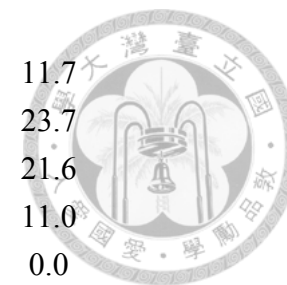


Job Division	Parts of the body occurring musculoskeletal discomfort (%)			
	Male		Female	
	Hands or wrists	Low back or waist	Hands or wrists	Low back or waist
Agriculture and Animal Husbandry	7.9	12.6	15.3	22.6
Forestry	7.7	30.8	16.7	0.0
Fishing	11.5	18.7	36.8	47.4
Mining and Quarrying	0.0	0.0	0.0	0.0
Crude Petroleum and Natural Gas Extraction	0.0	0.0	0.0	0.0
Sand, Stone and Clay Quarrying	16.7	5.6	0.0	0.0
Other Mining and Quarrying	0.0	0.0	0.0	0.0
Food Manufacturing	7.9	13.3	10.0	10.6
Beverages Manufacturing	13.3	20.0	18.2	27.3
Tobacco Manufacturing	0.0	0.0	0.0	0.0
Textiles Mills	11.0	12.9	17.2	14.2
Wearing Apparel and Clothing Accessories Manufacturing	14.8	13.0	15.5	13.1
Leather, Fur and Related Products Manufacturing	17.6	13.7	7.0	4.7
Wood and Bamboo Products Manufacturing	12.5	12.5	8.3	12.5
Pulp, Paper and Paper Products Manufacturing	8.3	10.7	20.0	13.3
Printing and Reproduction of Recorded Media	6.9	8.0	20.6	17.6
Petroleum and Coal Products Manufacturing	6.3	15.6	0.0	0.0
Chemical Material Manufacturing	8.6	12.9	16.7	16.7
Chemical Products Manufacturing	4.3	8.5	15.2	12.1

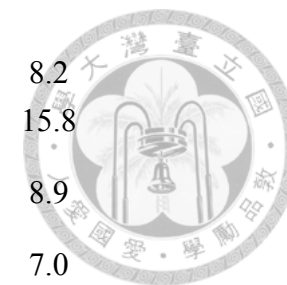
Medical Goods Manufacturing	0.0	3.7	17.8	8.7
Rubber Products Manufacturing	16.4	16.4	30.0	20.0
Plastic Products Manufacturing	8.0	11.1	11.0	11.0
Non-metallic Mineral Products Manufacturing	8.1	13.0	12.9	9.7
Basic Metal Manufacturing	10.4	8.5	10.3	3.4
Fabricated Metal Products Manufacturing	11.6	12.5	11.1	11.1
Electronic Parts and Components Manufacturing	6.7	7.9	13.0	12.3
Computers, Electronic and Optical Products Manufacturing	7.5	8.5	12.6	10.9
Electrical Equipment Manufacturing	8.3	10.3	13.6	15.5
Machinery and Equipment Manufacturing	8.5	10.2	14.5	17.1
Motor Vehicles and Parts Manufacturing	10.5	17.9	8.2	11.0
Other Transport Equipment Manufacturing	4.5	8.2	7.8	9.8
Furniture Manufacturing	14.1	15.4	27.3	18.2
Manufacturing Not Elsewhere Classified	13.3	9.2	18.9	11.1
Repair and Installation of Industrial Machinery and Equipment	8.2	13.4	0.0	0.0
Electricity and Gas Supply	3.3	7.7	0.0	0.0
Water Supply	0.0	5.9	0.0	0.0
Wastewater (Sewage) Treatment	4.8	0.0	20.0	0.0
Waste Collection, Treatment and Disposal; Materials Recovery	11.2	12.0	17.9	23.1
Buildings Construction	13.9	17.5	11.1	14.1
Civil Engineering	10.8	14.1	10.0	12.5



Specialized Construction	12.7	14.1	15.0	11.7
Wholesale Trade	12.6	19.5	20.5	23.7
Retail Trade	13.0	20.0	20.0	21.6
Land Transportation	10.1	15.6	4.1	11.0
Water Transportation	15.8	31.6	0.0	0.0
Air Transportation	0.0	0.0	25.0	8.3
Supporting Services to Transportation	11.8	15.2	3.8	13.5
Warehousing and Storage	5.9	5.9	11.1	11.1
Postal and Courier Services	5.4	9.5	12.5	7.5
Accommodation Services	6.7	8.0	7.5	7.4
Food and Beverage Services	11.4	8.9	13.7	10.9
Publishing	2.8	8.3	11.8	9.8
Motion Picture and Video Services, Sound Recording and Music Publishing	20.0	6.7	0.0	11.1
Broadcasting and Programming	14.8	7.4	7.7	11.5
Telecommunications	4.5	11.9	7.9	10.5
Computer Systems Design Services	3.4	3.5	10.5	0.0
Data Processing and Information Supply Services	25.0	25.0	0.0	16.7
Financial Intermediation	7.6	9.4	8.0	10.0
Insurance Carriers	0.7	3.7	5.4	12.3
Securities, Futures and Other Financing	0.0	2.1	4.1	5.5
Real Estate Development	0.0	0.0	0.0	16.7
Real Estate Operation and Relative Services	1.0	1.9	13.5	11.5



Legal and Accounting Services	3.8	1.9	8.2	8.2
Head Offices and Management Consultancy Services	0.0	5.6	5.3	15.8
Architecture and Engineering Services; Technical Testing and Analysis Services	4.1	7.2	6.7	8.9
Research and Development Services	1.9	0.0	4.8	7.0
Advertising and Market Research	8.3	8.3	18.2	15.2
Specialized Design Services	4.3	8.7	11.8	8.8
Veterinary Services	0.0	0.0	0.0	0.0
Other Professional, Scientific and Technical Services	3.6	7.1	0.0	0.0
Rental and Leasing	14.8	18.5	18.2	27.3
Employment Services	25.0	12.5	15.8	5.3
Travel Agency	4.8	9.5	7.4	9.3
Security and Investigation Services	3.5	8.1	0.0	0.0
Buildings and Greenery Services	20.3	27.0	19.2	22.1
Business and Office Support Services	9.7	9.7	13.0	13.0
Public Administration and Defence; Compulsory Social Security	5.2	8.1	8.2	7.5
Extra-territorial Organizations and Bodies	0.0	0.0	0.0	0.0
Education	6.4	8.4	8.1	8.8
Human Health Services	7.2	6.3	11.0	11.0
Residential Care Services	12.5	12.5	15.6	14.1
Other Social Work Services	0.0	12.5	4.0	8.0
Creative and Performing Arts	11.8	17.6	22.2	0.0



Libraries, Archives, Museums and Similar Institutions	0.0	15.4	16.7	16.7
Gambling	10.0	10.0	14.3	14.3
Sports, Amusement and Recreation	0.0	2.7	7.7	12.8
Religious, Trade and Similar Organizations	2.7	2.7	3.8	5.8
Maintenance and Repair of Personal and Household Goods	10.9	13.5	15.4	13.5
Other Services Not Elsewhere Classified	4.8	6.9	17.1	10.2

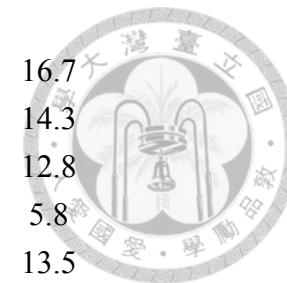


Table 12. Simple linear regression of log transformed SIR of CTS (case/yr/million workers) and workplace ergonomic factors (% reported +)

	Male		Female	
	β	95% CI	β	95% CI
Vibration from hand tools	0.035*	(0.016, 0.055)	0.124*	(0.063, 0.185)
Repetitive hand movements	0.036*	(0.020, 0.052)	0.001	(-0.009, 0.012)
Heavy tools used	0.027*	(0.006, 0.048)	0.047	(-0.004, 0.098)
Cold temperatures	-0.014	(-0.055, 0.028)	-0.026	(-0.063, 0.010)

* P<0.05

Table 13. Multiple linear regression of SIR in CTS and ergonomic risk factors

	Male ^a		Female	
	β	95% CI	β	95% CI
Repetitive hand movements	0.027*	(0.008, 0.046)	--	

a: Male CTS Log(SIR) Predicted P=0.0171 aR2=0.19

Table 14. Simple linear regression of log transformed SIR of HIVD (case/yr/million workers) and workplace ergonomic factors (% reported +)

	Male		Female	
	β	95% CI	β	95% CI
Whole body vibration	0.120*	(0.095, 0.144)	0.114*	(0.043, 0.184)
Heavy tools used	0.058*	(0.041, 0.075)	0.085*	(0.039, 0.131)
Heavy lifting	0.020*	(0.011, 0.029)	0.023*	(0.008, 0.038)
Awkward posture	0.053*	(0.033, 0.072)	0.038*	(0.016, 0.060)
Unacceptable desk	-0.032	(-0.145, 0.082)	-0.004	(-0.040, 0.031)

* P<0.05

Table 15. Multiple linear regression of SIR in HIVD and ergonomic risk factors

Ergonomic factors	Male ^a		Female ^b	
	β	95% CI	Ergonomic factors	β 95% CI
Whole body vibration	0.106	(0.082, 0.133)	Whole body vibration	0.086 (0.016, 0.157)
Heavy lifting	0.008	(0.001, 0.015)	Awkward posture	0.030 (0.008, 0.052)


a: Male HIVD Log(SIR) Predicted P<0.0001 aR2=0.55

b: Female HIVD Log(SIR) Predicted P=0.0002 aR2=0.17

Table 16. Level of groups and its included job divisions covering the percentage range and the groups in “vibration from hand tools”


Male			Female		
Exposure Level	Job Division	(%)	Exposure Level	Job Division	(%)
	Mining and Quarrying	0.0		Forestry	0.0
	Crude Petroleum and Natural Gas Extraction	0.0		Fishing	0.0
	Other Mining and Quarrying	0.0		Mining and Quarrying	0.0
	Tobacco Manufacturing	0.0		Crude Petroleum and Natural Gas Extraction	0.0
	Medical Goods Manufacturing	0.0		Sand, Stone and Clay Quarrying	0.0
	Wastewater (Sewage) Treatment	0.0		Other Mining and Quarrying	0.0
	Warehousing and Storage	0.0		Beverages Manufacturing	0.0
	Accommodation Services	0.0		Tobacco Manufacturing	0.0
	Publishing	0.0		Wood and Bamboo Products Manufacturing	0.0
	Motion Picture and Video Services, Sound Recording and Music Publishing	0.0		Pulp, Paper and Paper Products Manufacturing	0.0
Group1 (0%)	Data Processing and Information Supply Services	0.0	Group1 (0%)	Petroleum and Coal Products Manufacturing	0.0
	Financial Intermediation	0.0		Chemical Material Manufacturing	0.0
	Securities, Futures and Other Financing	0.0		Rubber Products Manufacturing	0.0
	Real Estate Development	0.0		Non-metallic Mineral Products Manufacturing	0.0
	Real Estate Operation and Relative Services	0.0		Furniture Manufacturing	0.0
	Legal and Accounting Services	0.0		Repair and Installation of Industrial Machinery and Equipment	0.0
	Head Offices and Management Consultancy Services	0.0		Electricity and Gas Supply	0.0
	Research and Development Services	0.0		Water Supply	0.0
	Veterinary Services	0.0		Wastewater (Sewage) Treatment	0.0

Other Professional, Scientific and Technical Services	0.0	Waste Collection, Treatment and Disposal; Materials Recovery	0.0
Travel Agency	0.0	Wholesale Trade	0.0
Extra-territorial Organizations and Bodies	0.0	Water Transportation	0.0
Residential Care Services	0.0	Air Transportation	0.0
Other Social Work Services	0.0	Supporting Services to Transportation	0.0
Libraries, Archives, Museums and Similar Institutions	0.0	Warehousing and Storage	0.0
Gambling	0.0	Postal and Courier Services	0.0
Sports, Amusement and Recreation	0.0	Publishing	0.0
Security and Investigation Services	0.6	Motion Picture and Video Services, Sound Recording and Music Publishing	0.0
Computer Systems Design Services	0.9	Computer Systems Design Services	0.0
Education	1.0	Data Processing and Information Supply Services	0.0
Public Administration and Defence; Compulsory Social Security	1.3	Financial Intermediation	0.0
Insurance Carriers	1.5	Insurance Carriers	0.0
Group2 (0-3%) Religious, Trade and Similar Organizations	1.8	Securities, Futures and Other Financing	0.0
Leather, Fur and Related Products Manufacturing	2.0	Real Estate Development	0.0
Architecture and Engineering Services; Technical Testing and Analysis Services	2.1	Real Estate Operation and Relative Services	0.0
Chemical Products Manufacturing	2.1	Legal and Accounting Services	0.0
Food and Beverage Services	2.3	Head Offices and Management Consultancy Services	0.0
Printing and Reproduction of Recorded Media	2.3	Research and Development Services	0.0
Computers, Electronic and	2.5	Advertising and Market Research	0.0



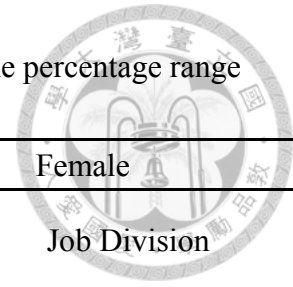
	Optical Products Manufacturing			
	Land Transportation	2.7	Specialized Design Services	0.0
	Postal and Courier Services	2.7	Veterinary Services	0.0
	Agriculture and Animal Husbandry	2.7	Other Professional, Scientific and Technical Services	0.0
	Other Services Not Elsewhere Classified	2.8	Rental and Leasing	0.0
	Electronic Parts and Components Manufacturing	3.0	Employment Services	0.0
	Telecommunications	3.0	Travel Agency	0.0
	Petroleum and Coal Products Manufacturing	3.1	Security and Investigation Services	0.0
	Waste Collection, Treatment and Disposal; Materials Recovery	3.2	Business and Office Support Services	0.0
	Business and Office Support Services	3.2	Extra-territorial Organizations and Bodies	0.0
	Food Manufacturing	3.4	Other Social Work Services	0.0
	Pulp, Paper and Paper Products Manufacturing	3.6	Creative and Performing Arts	0.0
	Broadcasting and Programming	3.7	Libraries, Archives, Museums and Similar Institutions	0.0
	Rental and Leasing	3.7	Gambling	0.0
Group3 (3-6.5%)	Specialized Design Services	4.3	Religious, Trade and Similar Organizations	0.0
	Electricity and Gas Supply	4.4	Public Administration and Defence; Compulsory Social Security	0.2
	Wholesale Trade	4.5	Education	0.4
	Human Health Services	4.9	Computers, Electronic and Optical Products Manufacturing	0.5
	Plastic Products Manufacturing	4.9	Textiles Mills	0.8
	Fishing	5.0	Accommodation Services	0.9
	Supporting Services to Transportation	5.4	Agriculture and Animal Husbandry	1.1
	Electrical Equipment Manufacturing	5.8	Sports, Amusement and Recreation	1.3
	Water Supply	5.9	Human Health Services	1.4

Air Transportation	5.9	Electronic Parts and Components Manufacturing	1.6
Creative and Performing Arts	5.9	Residential Care Services	1.6
Rubber Products Manufacturing	6.0	Food Manufacturing	1.7
Chemical Material Manufacturing	6.0	Food and Beverage Services	1.8
Textiles Mills	6.1	Retail Trade	1.8
Beverages Manufacturing	6.7	Buildings and Greenery Services	1.9
Retail Trade	6.7	Maintenance and Repair of Personal and Household Goods	1.9
Buildings and Greenery Services	6.8	Other Services Not Elsewhere Classified	2.1
Wearing Apparel and Clothing Accessories Manufacturing	7.4	Architecture and Engineering Services; Technical Testing and Analysis Services	2.2
Motor Vehicles and Parts Manufacturing	7.5	Leather, Fur and Related Products Manufacturing	2.3
Water Transportation	10.5	Telecommunications	2.6
Advertising and Market Research	10.6	Electrical Equipment Manufacturing	2.7
Sand, Stone and Clay Quarrying	11.1	Land Transportation	2.7
Other Transport Equipment Manufacturing	11.8	Machinery and Equipment Manufacturing	3.4
Employment Services	12.5	Group3 Broadcasting and Programming	3.7
Basic Metal Manufacturing	13.5	(>2%) Medical Goods Manufacturing	4.3
Non-metallic Mineral Products Manufacturing	13.8	Plastic Products Manufacturing	4.4
Forestry	15.4	Manufacturing Not Elsewhere Classified	4.4
Machinery and Equipment Manufacturing	15.9	Fabricated Metal Products Manufacturing	4.6
Manufacturing Not Elsewhere Classified	16.3	Civil Engineering	5.0
Repair and Installation of Industrial Machinery and Equipment	16.5	Specialized Construction	5.0
Buildings Construction	18.7	Printing and Reproduction of Recorded Media	5.9

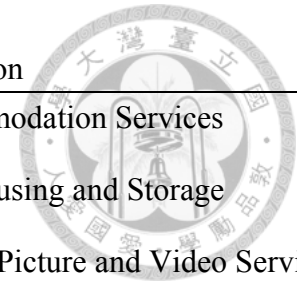


Civil Engineering	18.9	Other Transport Equipment Manufacturing	5.9
Maintenance and Repair of Personal and Household Goods	19.4	Chemical Products Manufacturing	6.1
Fabricated Metal Products Manufacturing	19.7	Buildings Construction	6.1
Specialized Construction	23.1	Motor Vehicles and Parts Manufacturing	6.8
Furniture Manufacturing	25.6	Basic Metal Manufacturing	6.9
Wood and Bamboo Products Manufacturing	30.0	Wearing Apparel and Clothing Accessories Manufacturing	7.1

Table 17. Level of groups and its included job divisions covering the percentage range and the groups in “repetitive hand movements”



Male			Female		
Exposure Level	Job Division	(%)	Exposure Level	Job Division	(%)
	Mining and Quarrying	0.0		Mining and Quarrying	0.0
	Other Mining and Quarrying	0.0		Crude Petroleum and Natural Gas Extraction	0.0
	Veterinary Services	0.0		Other Mining and Quarrying	0.0
	Extra-territorial Organizations and Bodies	0.0		Tobacco Manufacturing	0.0
	Other Social Work Services	0.0		Veterinary Services	0.0
	Security and Investigation Services	2.9		Extra-territorial Organizations and Bodies	0.0
	Legal and Accounting Services	3.9		Rental and Leasing	9.1
	Wastewater (Sewage) Treatment	4.8		Insurance Carriers	11.5
	Religious, Trade and Similar Organizations	5.5		Electricity and Gas Supply	13.3
	Air Transportation	5.9		Religious, Trade and Similar Organizations	13.5
Group1 (<15%)	Residential Care Services	6.3	Group1 (>20.7%)	Repair and Installation of Industrial Machinery and Equipment	14.3
	Accommodation Services	6.7		Real Estate Operation and Relative Services	15.4
	Motion Picture and Video Services, Sound Recording and Music Publishing	6.7		Head Offices and Management Consultancy Services	15.8
	Real Estate Operation and Relative Services	6.7		Research and Development Services	16.3
	Insurance Carriers	8.9		Forestry	16.7
	Travel Agency	9.5		Travel Agency	16.7
	Sports, Amusement and Recreation	10.7		Residential Care Services	17.2
	Research and Development Services	11.3		Other Professional, Scientific and Technical Services	17.4
	Employment Services	12.5		Sports, Amusement and Recreation	19.2
	Public Administration and Defence; Compulsory Social Security	12.7		Publishing	19.6
	Rental and Leasing	14.8		Wastewater (Sewage) Treatment	20.0



Forestry	15.4	Education	20.2
Electricity and Gas Supply	15.4	Accommodation Services	21.3
Libraries, Archives, Museums and Similar Institutions	15.4	Warehousing and Storage	22.2
Petroleum and Coal Products		Motion Picture and Video Services, Sound Recording and Music Publishing	22.2
Manufacturing	15.6	Libraries, Archives, Museums and Similar Institutions	22.2
Head Offices and Management Consultancy Services	16.7	Water Supply	25.0
Education	17.5	Water Transportation	25.0
Other Services Not Elsewhere Classified	17.9	Air Transportation	25.0
Chemical Material Manufacturing	18.1	Human Health Services	26.2
Medical Goods Manufacturing	18.5	Employment Services	26.3
Chemical Products Manufacturing	19.1	Specialized Design Services	26.5
Agriculture and Animal Husbandry	19.6	Specialized Construction	26.7
Crude Petroleum and Natural Gas	20.0	Maintenance and Repair of Personal and Household Goods	26.9
Group2 Extraction (15-23%)	20.0	Security and Investigation Services	27.3
Real Estate Development	20.0	Legal and Accounting Services	28.2
Gambling	20.0	Other Services Not Elsewhere Classified	28.5
Telecommunications	20.9	Gambling	28.6
Other Professional, Scientific and Technical Services	21.4	Architecture and Engineering Services; Technical Testing and Analysis Services	28.9
Human Health Services	21.5	Non-metallic Mineral Products Manufacturing	29.0
Architecture and Engineering Services; Technical Testing and Analysis Services	21.6	Food and Beverage Services	29.1
Supporting Services to Transportation	21.7	Public Administration and Defence; Compulsory Social Security	29.4
Specialized Design Services	21.7	Financial Intermediation	29.6
Publishing	22.2	Buildings and Greenery Services	29.8
Financial Intermediation	22.2	Group3 Land Transportation (30-40%)	30.1
Civil Engineering	22.7	Other Social Work Services	32.0
Securities, Futures and Other Financing	22.9		
Group3 Computers, Electronic and Optical	23.5		



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(23-30%)	Products Manufacturing		
	Leather, Fur and Related Products Manufacturing	23.5	Civil Engineering
	Repair and Installation of Industrial Machinery and Equipment	23.7	Supporting Services to Transportation
	Fishing	23.7	Securities, Futures and Other Financing
	Pulp, Paper and Paper Products Manufacturing	23.8	Chemical Material Manufacturing
	Buildings and Greenery Services	24.7	Data Processing and Information Supply Services
	Advertising and Market Research	25.0	Real Estate Development
	Textiles Mills	25.9	Advertising and Market Research
	Broadcasting and Programming	25.9	Agriculture and Animal Husbandry
	Basic Metal Manufacturing	26.4	Buildings Construction
	Wholesale Trade	27.0	Beverages Manufacturing
	Electronic Parts and Components Manufacturing	27.4	Computer Systems Design Services
	Electrical Equipment Manufacturing	27.6	Motor Vehicles and Parts Manufacturing
	Sand, Stone and Clay Quarrying	27.8	Leather, Fur and Related Products Manufacturing
	Wearing Apparel and Clothing Accessories Manufacturing	28.3	Machinery and Equipment Manufacturing
	Computer Systems Design Services	28.4	Textiles Mills
	Food Manufacturing	28.6	Medical Goods Manufacturing
	Maintenance and Repair of Personal and Household Goods	29.5	Retail Trade
	Machinery and Equipment Manufacturing	29.8	Fabricated Metal Products Manufacturing
	Beverages Manufacturing	30.0	Postal and Courier Services
	Non-metallic Mineral Products Manufacturing	30.1	Broadcasting and Programming
Group4 (>30%)	Waste Collection, Treatment and Disposal; Materials Recovery	30.7	Group4 (>40%) Food Manufacturing
	Plastic Products Manufacturing	30.9	Computers, Electronic and Optical Products Manufacturing

Postal and Courier Services	31.1	Wholesale Trade	41.0
Land Transportation	31.3	Business and Office Support Services	43.5
Water Transportation	31.6	Waste Collection, Treatment and Disposal; Materials Recovery	43.6
Food and Beverage Services	31.7	Plastic Products Manufacturing	44.0
Printing and Reproduction of Recorded Media	32.2	Creative and Performing Arts	44.4
Motor Vehicles and Parts Manufacturing	32.3	Basic Metal Manufacturing	44.8
Specialized Construction	33.0	Rubber Products Manufacturing	45.0
Fabricated Metal Products Manufacturing	33.1	Pulp, Paper and Paper Products Manufacturing	45.5
Tobacco Manufacturing	33.3	Furniture Manufacturing	45.5
Buildings Construction	34.4	Printing and Reproduction of Recorded Media	47.1
Water Supply	35.3	Other Transport Equipment Manufacturing	47.1
Warehousing and Storage	35.3	Chemical Products Manufacturing	48.5
Creative and Performing Arts	35.3	Electronic Parts and Components Manufacturing	48.8
Wood and Bamboo Products Manufacturing	37.5	Sand, Stone and Clay Quarrying	50.0
Retail Trade	38.1	Petroleum and Coal Products Manufacturing	50.0
Rubber Products Manufacturing	38.8	Manufacturing Not Elsewhere Classified	51.1
Furniture Manufacturing	39.7	Wearing Apparel and Clothing Accessories Manufacturing	51.5
Other Transport Equipment Manufacturing	40.0	Fishing	52.6
Business and Office Support Services	41.9	Telecommunications	52.6
Manufacturing Not Elsewhere Classified	48.0	Wood and Bamboo Products Manufacturing	54.2
Data Processing and Information Supply Services	50.0	Electrical Equipment Manufacturing	60.0

Table 18. Level of groups and its included job divisions covering the percentage range and the groups in “heavy tools used”

Male			Female		
Exposure Level	Job Division	(%)	Exposure Level	Job Division	(%)
	Mining and Quarrying	0.0		Forestry	0.0
	Crude Petroleum and Natural Gas Extraction	0.0		Mining and Quarrying	0.0
	Other Mining and Quarrying	0.0		Crude Petroleum and Natural Gas Extraction	0.0
	Tobacco Manufacturing	0.0		Sand, Stone and Clay Quarrying	0.0
	Petroleum and Coal Products Manufacturing	0.0		Other Mining and Quarrying	0.0
	Medical Goods Manufacturing	0.0		Tobacco Manufacturing	0.0
	Water Supply	0.0		Leather, Fur and Related Products Manufacturing	0.0
	Wastewater (Sewage) Treatment	0.0		Pulp, Paper and Paper Products Manufacturing	0.0
	Warehousing and Storage	0.0		Petroleum and Coal Products Manufacturing	0.0
Group1 (0%)	Motion Picture and Video Services, Sound Recording and Music Publishing	0.0		Medical Goods Manufacturing	0.0
	Data Processing and Information Supply Services	0.0		Rubber Products Manufacturing	0.0
	Financial Intermediation	0.0		Non-metallic Mineral Products Manufacturing	0.0
	Securities, Futures and Other Financing	0.0		Computers, Electronic and Optical Products Manufacturing	0.0
	Real Estate Development	0.0		Repair and Installation of Industrial Machinery and Equipment	0.0
	Real Estate Operation and Relative Services	0.0		Electricity and Gas Supply	0.0
	Legal and Accounting Services	0.0		Water Supply	0.0
	Head Offices and Management Consultancy Services	0.0		Wastewater (Sewage) Treatment	0.0
	Research and Development Services	0.0	Group1 (0%)	Water Transportation	0.0




Specialized Design Services	0.0	Air Transportation	0.0
Veterinary Services	0.0	Supporting Services to Transportation	0.0
Employment Services	0.0	Warehousing and Storage	0.0
Business and Office Support Services	0.0	Accommodation Services	0.0
Extra-territorial Organizations and Bodies	0.0	Publishing	0.0
Residential Care Services	0.0	Motion Picture and Video Services, Sound Recording and Music Publishing	0.0
Other Social Work Services	0.0	Broadcasting and Programming	0.0
Libraries, Archives, Museums and Similar Institutions	0.0	Computer Systems Design Services	0.0
Gambling	0.0	Data Processing and Information Supply Services	0.0
Sports, Amusement and Recreation	0.0	Insurance Carriers	0.0
Education	0.4	Securities, Futures and Other Financing	0.0
Human Health Services	0.4	Real Estate Development	0.0
Security and Investigation Services	0.6	Real Estate Operation and Relative Services	0.0
Computers, Electronic and Optical Products Manufacturing	0.7	Legal and Accounting Services	0.0
Insurance Carriers	0.7	Head Offices and Management Consultancy Services	0.0
Religious, Trade and Similar Organizations	0.9	Architecture and Engineering Services; Technical Testing and Analysis Services	0.0
Telecommunications	1.5	Research and Development Services	0.0
Computer Systems Design Services	1.7	Advertising and Market Research	0.0
Leather, Fur and Related Products Manufacturing	2.0	Specialized Design Services	0.0
Architecture and Engineering Services; Technical Testing and Analysis Services	2.1	Veterinary Services	0.0
Other Services Not Elsewhere Classified	2.1	Other Professional, Scientific and Technical Services	0.0

Printing and Reproduction of Recorded Media	2.3	Rental and Leasing	0.0
Travel Agency	2.4	Employment Services	0.0
Accommodation Services	2.7	Travel Agency	0.0
Publishing	2.8	Security and Investigation Services	0.0
Electronic Parts and Components Manufacturing	2.8	Extra-territorial Organizations and Bodies	0.0
Public Administration and Defence; Compulsory Social Security	2.9	Creative and Performing Arts	0.0
<hr/>		Libraries, Archives, Museums and Similar Institutions	0.0
Beverages Manufacturing	3.3	Gambling	0.0
Other Professional, Scientific and Technical Services	3.6	Religious, Trade and Similar Organizations	0.0
Food and Beverage Services	4.0	<hr/>	
Postal and Courier Services	4.1	Education	0.3
Chemical Material Manufacturing	4.3	Financial Intermediation	0.4
Food Manufacturing	4.4	Public Administration and Defence; Compulsory Social Security	0.5
Advertising and Market Research	4.4	Food Manufacturing	0.6
Waste Collection, Treatment and Disposal; Materials Recovery	4.7	Textiles Mills	0.8
Group3 (2.9-8.6%) Plastic Products Manufacturing	4.9	Sports, Amusement and Recreation	1.3
Supporting Services to Transportation	5.4	Wholesale Trade	1.3
Wearing Apparel and Clothing Accessories Manufacturing	5.6	Land Transportation	1.4
Electrical Equipment Manufacturing	5.8	Other Services Not Elsewhere Classified	1.4
Land Transportation	5.8	Human Health Services	1.7
Air Transportation	5.9	Wearing Apparel and Clothing Accessories Manufacturing	1.8
Chemical Products Manufacturing	6.4	Maintenance and Repair of Personal and Household Goods	1.9
Electricity and Gas Supply	6.6	Food and Beverage Services	2.0
Textiles Mills	6.8	Group2 (0-2.8%) Electronic Parts and Components Manufacturing	2.2



Manufacturing Not Elsewhere Classified	7.1	Plastic Products Manufacturing	2.2
Broadcasting and Programming	7.4	Machinery and Equipment Manufacturing	2.6
Forestry	7.7	Waste Collection, Treatment and Disposal; Materials Recovery	2.6
Pulp, Paper and Paper Products Manufacturing	8.3	Telecommunications	2.6
Retail Trade	8.5	Chemical Material Manufacturing	2.8
Wholesale Trade	8.6	Group2 (>2.8%) Buildings and Greenery Services	2.9
Motor Vehicles and Parts Manufacturing	9.0	Chemical Products Manufacturing	3.0
Agriculture and Animal Husbandry	9.7	Residential Care Services	3.1
Water Transportation	10.5	Basic Metal Manufacturing	3.4
Non-metallic Mineral Products Manufacturing	10.7	Retail Trade	3.9
Sand, Stone and Clay Quarrying	11.1	Other Transport Equipment Manufacturing	3.9
Rental and Leasing	11.1	Other Social Work Services	4.0
Creative and Performing Arts	11.8	Business and Office Support Services	4.3
Group4 (>8.6%) Rubber Products Manufacturing	11.9	Manufacturing Not Elsewhere Classified	4.4
Machinery and Equipment Manufacturing	12.3	Electrical Equipment Manufacturing	4.5
Other Transport Equipment Manufacturing	12.7	Furniture Manufacturing	4.5
Maintenance and Repair of Personal and Household Goods	15.8	Specialized Construction	5.0
Fishing	15.9	Postal and Courier Services	5.1
Basic Metal Manufacturing	16.0	Motor Vehicles and Parts Manufacturing	5.5
Buildings and Greenery Services	16.2	Fabricated Metal Products Manufacturing	5.5
Fabricated Metal Products Manufacturing	16.6	Agriculture and Animal Husbandry	6.3

Wood and Bamboo Products Manufacturing	17.5
Furniture Manufacturing	17.9
Specialized Construction	19.0
Repair and Installation of Industrial Machinery and Equipment	19.6
Civil Engineering	20.5
Buildings Construction	27.4



Civil Engineering	7.5
Wood and Bamboo Products Manufacturing	8.3
Printing and Reproduction of Recorded Media	8.8
Beverages Manufacturing	9.1
Fishing	10.5
Buildings Construction	12.1

Table 19. Level of groups and its included job divisions covering the percentage range and the groups in “whole body vibration”

Male			Female		
Exposure Level	Job Division	Exposure (%)	Exposure Level	Job Division	Exposure (%)
Group1 (0%)	Mining and Quarrying	0.0	Group1 (0%)	Forestry	0.0
	Other Mining and Quarrying	0.0		Fishing	0.0
	Tobacco Manufacturing	0.0		Mining and Quarrying	0.0
	Petroleum and Coal Products Manufacturing	0.0		Crude Petroleum and Natural Gas Extraction	0.0
	Chemical Products Manufacturing	0.0		Sand, Stone and Clay Quarrying	0.0
	Medical Goods Manufacturing	0.0		Other Mining and Quarrying	0.0
	Water Supply	0.0		Food Manufacturing	0.0
	Wastewater (Sewage) Treatment	0.0		Beverages Manufacturing	0.0
	Air Transportation	0.0		Tobacco Manufacturing	0.0
	Warehousing and Storage	0.0		Leather, Fur and Related Products Manufacturing	0.0
	Publishing	0.0		Pulp, Paper and Paper Products Manufacturing	0.0
	Motion Picture and Video Services, Sound Recording and Music Publishing	0.0		Petroleum and Coal Products Manufacturing	0.0
	Broadcasting and Programming	0.0		Chemical Material Manufacturing	0.0
	Telecommunications	0.0		Chemical Products Manufacturing	0.0
	Computer Systems Design Services	0.0		Medical Goods Manufacturing	0.0
	Data Processing and Information Supply Services	0.0		Rubber Products Manufacturing	0.0
	Securities, Futures and Other Financing	0.0		Non-metallic Mineral Products Manufacturing	0.0
	Real Estate Development	0.0		Electronic Parts and Components Manufacturing	0.0
	Head Offices and Management Consultancy Services	0.0		Computers, Electronic and Optical Products Manufacturing	0.0
	Research and Development Services	0.0		Other Transport Equipment Manufacturing	0.0
	Veterinary Services	0.0		Manufacturing Not Elsewhere Classified	0.0
	Other Professional, Scientific and	0.0		Repair and Installation of Industrial	0.0

Technical Services		Machinery and Equipment	
Rental and Leasing	0.0	Electricity and Gas Supply	0.0
Employment Services	0.0	Water Supply	0.0
Security and Investigation Services	0.0	Wastewater (Sewage) Treatment	0.0
Extra-territorial Organizations and Bodies	0.0	Land Transportation	0.0
Human Health Services	0.0	Water Transportation	0.0
Other Social Work Services	0.0	Warehousing and Storage	0.0
Creative and Performing Arts	0.0	Publishing	0.0
Libraries, Archives, Museums and Similar Institutions	0.0	Motion Picture and Video Services, Sound Recording and Music Publishing	0.0
Gambling	0.0	Broadcasting and Programming	0.0
Other Services Not Elsewhere Classified	0.0	Telecommunications	0.0
Computers, Electronic and Optical Products Manufacturing	0.4	Computer Systems Design Services	0.0
Financial Intermediation	0.6	Data Processing and Information Supply Services	0.0
Food and Beverage Services	0.8	Financial Intermediation	0.0
Real Estate Operation and Relative Services	1.0	Insurance Carriers	0.0
Public Administration and Defence; Compulsory Social Security	1.2	Securities, Futures and Other Financing	0.0
Accommodation Services	1.3	Real Estate Development	0.0
Sports, Amusement and Recreation	1.3	Legal and Accounting Services	0.0
Electronic Parts and Components Manufacturing	1.3	Head Offices and Management Consultancy Services	0.0
Education	1.4	Architecture and Engineering Services; Technical Testing and Analysis Services	0.0
Food Manufacturing	1.5	Research and Development Services	0.0
Legal and Accounting Services	1.9	Advertising and Market Research	0.0
Agriculture and Animal Husbandry	1.9	Specialized Design Services	0.0
Retail Trade	2.1	Veterinary Services	0.0
Architecture and Engineering Services; Technical Testing and Analysis Services	2.1	Other Professional, Scientific and Technical Services	0.0
Insurance Carriers	2.2	Rental and Leasing	0.0

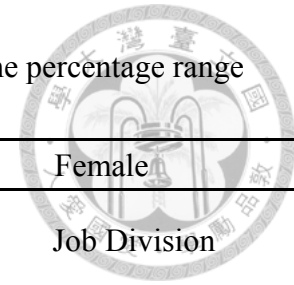


Pulp, Paper and Paper Products Manufacturing	2.4	Employment Services	0.0
Travel Agency	2.4	Security and Investigation Services	0.0
Plastic Products Manufacturing	3.1	Business and Office Support Services	0.0
Electrical Equipment Manufacturing	3.2	Public Administration and Defence; Compulsory Social Security	0.0
Beverages Manufacturing	3.3	Extra-territorial Organizations and Bodies	0.0
Textiles Mills	3.4	Other Social Work Services	0.0
Printing and Reproduction of Recorded Media	3.4	Creative and Performing Arts	0.0
Religious, Trade and Similar Organizations	3.6	Gambling	0.0
Motor Vehicles and Parts Manufacturing	3.7	Religious, Trade and Similar Organizations	0.0
Buildings and Greenery Services	4.1	Other Services Not Elsewhere Classified	0.0
Manufacturing Not Elsewhere Classified	4.1	Human Health Services	0.2
Advertising and Market Research	4.3	Education	0.3
Supporting Services to Transportation	4.3	Agriculture and Animal Husbandry	0.5
Chemical Material Manufacturing	4.3	Food and Beverage Services	0.8
Specialized Design Services	4.3	Textiles Mills	0.8
Electricity and Gas Supply	4.4	Group2 Electrical Equipment Manufacturing	0.9
Wholesale Trade	5.3	(0-1.5%) Accommodation Services	0.9
Wearing Apparel and Clothing Accessories Manufacturing	5.6	Wholesale Trade	0.9
Machinery and Equipment Manufacturing	5.7	Plastic Products Manufacturing	1.1
Fishing	5.8	Sports, Amusement and Recreation	1.3
Leather, Fur and Related Products Manufacturing	5.9	Residential Care Services	1.6
Rubber Products Manufacturing	6.0	Specialized Construction	1.7
Maintenance and Repair of Personal and Household Goods	6.0	Group3 Travel Agency	1.9
Group4 Basic Metal Manufacturing	6.2	(>1.5%) Supporting Services to Transportation	1.9
(>6%) Residential Care Services	6.3	Retail Trade	2.1

Other Transport Equipment Manufacturing	6.4	Civil Engineering	2.5
Business and Office Support Services	6.5	Machinery and Equipment Manufacturing	2.6
Repair and Installation of Industrial Machinery and Equipment	7.2	Motor Vehicles and Parts Manufacturing	2.7
Forestry	7.7	Buildings and Greenery Services	2.9
Postal and Courier Services	8.1	Wearing Apparel and Clothing Accessories Manufacturing	3.0
Fabricated Metal Products Manufacturing	8.7	Fabricated Metal Products Manufacturing	3.2
Furniture Manufacturing	9.0	Real Estate Operation and Relative Services	3.8
Specialized Construction	9.7	Maintenance and Repair of Personal and Household Goods	3.8
Buildings Construction	9.9	Buildings Construction	4.0
Waste Collection, Treatment and Disposal; Materials Recovery	10.2	Wood and Bamboo Products Manufacturing	4.2
Water Transportation	10.5	Libraries, Archives, Museums and Similar Institutions	5.6
Non-metallic Mineral Products Manufacturing	11.4	Printing and Reproduction of Recorded Media	5.9
Wood and Bamboo Products Manufacturing	12.5	Basic Metal Manufacturing	6.9
Civil Engineering	15.2	Postal and Courier Services	7.5
Land Transportation	15.9	Waste Collection, Treatment and Disposal; Materials Recovery	7.7
Crude Petroleum and Natural Gas Extraction	20.0	Air Transportation	8.3
Sand, Stone and Clay Quarrying	38.9	Furniture Manufacturing	9.1



Table 20. Level of groups and its included job divisions covering the percentage range and the groups in “heavy lifting”



Male			Female		
Exposure Level	Job Division	(%)	Exposure Level	Job Division	(%)
	Mining and Quarrying	0.0		Forestry	0.0
	Crude Petroleum and Natural Gas Extraction	0.0		Mining and Quarrying	0.0
	Other Mining and Quarrying	0.0		Crude Petroleum and Natural Gas Extraction	0.0
	Medical Goods Manufacturing	0.0		Sand, Stone and Clay Quarrying	0.0
	Water Supply	0.0		Other Mining and Quarrying	0.0
	Wastewater (Sewage) Treatment	0.0		Tobacco Manufacturing	0.0
	Motion Picture and Video Services, Sound Recording and Music Publishing	0.0		Leather, Fur and Related Products Manufacturing	0.0
	Telecommunications	0.0		Petroleum and Coal Products Manufacturing	0.0
	Data Processing and Information Supply Services	0.0		Repair and Installation of Industrial Machinery and Equipment	0.0
	Insurance Carriers	0.0		Electricity and Gas Supply	0.0
Group1 (<2%)	Securities, Futures and Other Financing	0.0	Group1 (0%)	Water Supply	0.0
	Real Estate Development	0.0		Wastewater (Sewage) Treatment	0.0
	Legal and Accounting Services	0.0		Water Transportation	0.0
	Research and Development Services	0.0		Supporting Services to Transportation	0.0
	Veterinary Services	0.0		Warehousing and Storage	0.0
	Other Professional, Scientific and Technical Services	0.0		Motion Picture and Video Services, Sound Recording and Music Publishing	0.0
	Extra-territorial Organizations and Bodies	0.0		Telecommunications	0.0
	Libraries, Archives, Museums and Similar Institutions	0.0		Computer Systems Design Services	0.0
	Gambling	0.0		Data Processing and Information Supply Services	0.0
	Education	0.4		Financial Intermediation	0.0
	Financial Intermediation	1.2		Insurance Carriers	0.0
	Computer Systems Design Services	1.7		Real Estate Development	0.0



Security and Investigation Services	1.7	Head Offices and Management Consultancy Services	0.0
Real Estate Operation and Relative Services	1.9	Architecture and Engineering Services; Technical Testing and Analysis Services	0.0
Human Health Services	2.2	Advertising and Market Research	0.0
Sports, Amusement and Recreation	2.7	Veterinary Services	0.0
Other Services Not Elsewhere Classified	3.4	Employment Services	0.0
Computers, Electronic and Optical Products Manufacturing	3.6	Travel Agency	0.0
Public Administration and Defence; Compulsory Social Security	4.1	Security and Investigation Services	0.0
Architecture and Engineering Services; Technical Testing and Analysis Services	4.1	Extra-territorial Organizations and Bodies	0.0
Religious, Trade and Similar Organizations	4.5	Creative and Performing Arts	0.0
Electricity and Gas Supply	5.5	Libraries, Archives, Museums and Similar Institutions	0.0
Head Offices and Management Consultancy Services	5.6	Gambling	0.0
Air Transportation	5.9	Legal and Accounting Services	0.9
Group2 Residential Care Services (2-10%)	6.3	Religious, Trade and Similar Organizations	1.0
Travel Agency	7.1	Education	1.1
Electronic Parts and Components Manufacturing	7.2	Securities, Futures and Other Financing	1.4
Forestry	7.7	Other Services Not Elsewhere Classified	1.4
Accommodation Services	8.0	Group2 Public Administration and Defence; Compulsory Social Security (0-3%)	1.5
Specialized Design Services	8.7	Real Estate Operation and Relative Services	1.9
Wearing Apparel and Clothing Accessories Manufacturing	9.3	Publishing	2.0
Petroleum and Coal Products Manufacturing	9.4	Medical Goods Manufacturing	2.2
Beverages Manufacturing	10.0	Research and Development	2.3

		Services		
	Chemical Material Manufacturing	10.3	Postal and Courier Services	2.5
	Food and Beverage Services	10.5	Land Transportation	2.7
	Supporting Services to Transportation	10.8	Accommodation Services	2.8
	Sand, Stone and Clay Quarrying	11.1	Specialized Design Services	2.9
	Publishing	11.1	Wearing Apparel and Clothing	3.6
	Employment Services	12.5	Accessories Manufacturing	3.7
	Other Social Work Services	12.5	Broadcasting and Programming	3.7
	Business and Office Support Services	12.9	Other Professional, Scientific and Technical Services	4.3
	Electrical Equipment Manufacturing	13.5	Business and Office Support Services	4.3
	Manufacturing Not Elsewhere Classified	14.3	Sports, Amusement and Recreation	5.1
	Water Transportation	15.8	Computers, Electronic and Optical Products Manufacturing	5.5
	Advertising and Market Research	16.7	Maintenance and Repair of Personal and Household Goods	5.8
Group3 (10-25%)	Chemical Products Manufacturing	17.0	Human Health Services	5.9
	Plastic Products Manufacturing	17.3	Group3 (3-9%) Electronic Parts and Components Manufacturing	6.2
	Repair and Installation of Industrial Machinery and Equipment	17.5	Food and Beverage Services	6.6
	Maintenance and Repair of Personal and Household Goods	18.1	Machinery and Equipment Manufacturing	6.8
	Broadcasting and Programming	18.5	Motor Vehicles and Parts Manufacturing	6.8
	Machinery and Equipment Manufacturing	19.5	Buildings and Greenery Services	7.7
	Leather, Fur and Related Products Manufacturing	19.6	Textiles Mills	8.2
	Basic Metal Manufacturing	19.6	Wholesale Trade	8.3
	Textiles Mills	19.7	Food Manufacturing	8.3
	Non-metallic Mineral Products Manufacturing	20.3	Chemical Material Manufacturing	8.3
	Motor Vehicles and Parts Manufacturing	20.9	Air Transportation	8.3
	Other Transport Equipment Manufacturing	22.7	Electrical Equipment	9.1
	Warehousing and Storage	23.5	Group4 (>9%) Manufacturing	9.1
			Rental and Leasing	9.1
			Non-metallic Mineral Products	9.7

Creative and Performing Arts	23.5	Manufacturing	10.0
Land Transportation	23.9	Beverages Manufacturing	10.0
Civil Engineering	24.9	Rubber Products Manufacturing	10.0
Waste Collection, Treatment and Disposal; Materials Recovery	25.2	Manufacturing Not Elsewhere Classified	10.0
Agriculture and Animal Husbandry	25.4	Civil Engineering	10.0
Postal and Courier Services	25.7	Specialized Construction	10.0
Buildings and Greenery Services	25.7	Basic Metal Manufacturing	10.3
Rental and Leasing	25.9	Printing and Reproduction of Recorded Media	11.8
Food Manufacturing	26.0	Other Social Work Services	12.0
Printing and Reproduction of Recorded Media	26.4	Fabricated Metal Products Manufacturing	12.9
Pulp, Paper and Paper Products Manufacturing	27.4	Furniture Manufacturing	13.6
Group4 Specialized Construction	29.2	Residential Care Services	14.1
(>25%) Fabricated Metal Products Manufacturing	29.5	Plastic Products Manufacturing	14.3
Wood and Bamboo Products Manufacturing	32.5	Other Transport Equipment Manufacturing	15.7
Tobacco Manufacturing	33.3	Fishing	15.8
Rubber Products Manufacturing	34.3	Pulp, Paper and Paper Products Manufacturing	15.9
Furniture Manufacturing	34.6	Buildings Construction	16.2
Buildings Construction	43.4	Agriculture and Animal Husbandry	16.8
Retail Trade	44.0	Waste Collection, Treatment and Disposal; Materials Recovery	17.9
Fishing	48.2	Chemical Products Manufacturing	18.2
Wholesale Trade	50.0	Retail Trade	20.2
		Wood and Bamboo Products Manufacturing	25.0

Table 21. Level of groups and its included job divisions covering the percentage range and the groups in “awkward posture”

Male			Female		
Exposure Level	Job Division	(%)	Exposure Level	Job Division	(%)
Group1 (<2.1%)	Forestry	0.0	Group1 (0%)	Forestry	0.0
	Mining and Quarrying	0.0		Mining and Quarrying	0.0
	Crude Petroleum and Natural Gas Extraction	0.0		Crude Petroleum and Natural Gas Extraction	0.0
	Other Mining and Quarrying	0.0		Sand, Stone and Clay Quarrying	0.0
	Medical Goods Manufacturing	0.0		Other Mining and Quarrying	0.0
	Wastewater (Sewage) Treatment	0.0		Beverages Manufacturing	0.0
	Warehousing and Storage	0.0		Tobacco Manufacturing	0.0
	Motion Picture and Video Services, Sound Recording and Music Publishing	0.0		Petroleum and Coal Products Manufacturing	0.0
	Real Estate Development	0.0		Repair and Installation of Industrial Machinery and Equipment	0.0
	Legal and Accounting Services	0.0		Electricity and Gas Supply	0.0
	Head Offices and Management	0.0		Water Supply	0.0
	Consultancy Services	0.0		Wastewater (Sewage) Treatment	0.0
	Specialized Design Services	0.0		Water Transportation	0.0
	Veterinary Services	0.0		Publishing	0.0
	Employment Services	0.0		Data Processing and Information Supply Services	0.0
	Extra-territorial Organizations and Bodies	0.0		Insurance Carriers	0.0
	Residential Care Services	0.0		Real Estate Development	0.0
	Other Social Work Services	0.0		Legal and Accounting Services	0.0
	Gambling	0.0		Head Offices and Management	0.0
	Financial Intermediation	0.6		Consultancy Services	0.0
	Insurance Carriers	0.7		Advertising and Market Research	0.0
Research and Development Services	1.9	Specialized Design Services	0.0		
Securities, Futures and Other Financing	2.1	Veterinary Services	0.0		
Architecture and Engineering Services; Technical Testing and Analysis Services	2.1	Rental and Leasing	0.0		
Group2	Computer Systems Design Services	2.6	Employment Services	0.0	

(2.1-7.4%) Computers, Electronic and Optical Products Manufacturing	2.8	Travel Agency	0.0
Real Estate Operation and Relative Services	2.9	Security and Investigation Services	0.0
Security and Investigation Services	2.9	Extra-territorial Organizations and Bodies	0.0
Petroleum and Coal Products Manufacturing	3.1	Other Social Work Services	0.0
Supporting Services to Transportation	3.2	Creative and Performing Arts	0.0
Electricity and Gas Supply	3.3	Gambling	0.0
Other Professional, Scientific and Technical Services	3.6	Securities, Futures and Other Financing	1.4
Education	3.6	Real Estate Operation and Relative Services	1.9
Religious, Trade and Similar Organizations	3.6	Medical Goods Manufacturing	2.2
Accommodation Services	4.0	Architecture and Engineering Services; Technical Testing and Analysis Services	2.2
Electronic Parts and Components Manufacturing	4.6	Public Administration and Defence; Compulsory Social Security	2.4
Travel Agency	4.8	Group2 Civil Engineering	2.5
Public Administration and Defence; Compulsory Social Security	5.0	(0-4.3%) Telecommunications	2.6
Sand, Stone and Clay Quarrying	5.6	Land Transportation	2.7
Publishing	5.6	Chemical Material Manufacturing	2.8
Creative and Performing Arts	5.9	Accommodation Services	2.8
Chemical Material Manufacturing	6.0	Religious, Trade and Similar Organizations	2.9
Chemical Products Manufacturing	6.4	Printing and Reproduction of Recorded Media	2.9
Advertising and Market Research	6.4	Education	3.8
Postal and Courier Services	6.8	Motor Vehicles and Parts Manufacturing	4.1
Group3 Plastic Products Manufacturing	7.4	Group3 Business and Office Support Services	4.3
(7.4-10.1%)		(4.3-8.7%)	

Broadcasting and Programming	7.4	Furniture Manufacturing	4.5
Motor Vehicles and Parts Manufacturing	7.5	Research and Development Services	4.7
Other Services Not Elsewhere Classified	7.6	Financial Intermediation	4.8
Food and Beverage Services	7.6	Specialized Construction	5.0
Human Health Services	7.6	Computer Systems Design Services	5.3
Libraries, Archives, Museums and Similar Institutions	7.7	Electrical Equipment Manufacturing	5.5
Sports, Amusement and Recreation	8.0	Wholesale Trade	5.5
Printing and Reproduction of Recorded Media	8.0	Libraries, Archives, Museums and Similar Institutions	5.6
Textiles Mills	8.2	Supporting Services to Transportation	5.8
Manufacturing Not Elsewhere Classified	8.2	Other Transport Equipment Manufacturing	5.9
Machinery and Equipment Manufacturing	8.7	Computers, Electronic and Optical Products Manufacturing	6.0
Rubber Products Manufacturing	9.0	Fabricated Metal Products Manufacturing	6.0
Telecommunications	9.0	Sports, Amusement and Recreation	6.4
Wearing Apparel and Clothing Accessories Manufacturing	9.3	Basic Metal Manufacturing	6.9
Food Manufacturing	9.3	Food and Beverage Services	7.0
Pulp, Paper and Paper Products Manufacturing	9.5	Food Manufacturing	7.2
Business and Office Support Services	9.7	Broadcasting and Programming	7.4
Non-metallic Mineral Products Manufacturing	9.8	Electronic Parts and Components Manufacturing	7.6
Leather, Fur and Related Products Manufacturing	9.8	Machinery and Equipment Manufacturing	7.7
Beverages Manufacturing	10.0	Textiles Mills	8.2
Fishing	10.1	Wood and Bamboo Products Manufacturing	8.3
Civil Engineering	10.3	Other Professional, Scientific and Technical Services	8.7

Wholesale Trade	10.3	Wearing Apparel and Clothing Accessories Manufacturing	8.9
Water Supply	11.8	Manufacturing Not Elsewhere Classified	8.9
Air Transportation	11.8	Buildings Construction	9.1
Other Transport Equipment Manufacturing	11.8	Residential Care Services	9.4
Basic Metal Manufacturing	12.3	Other Services Not Elsewhere Classified	9.5
Waste Collection, Treatment and Disposal; Materials Recovery	12.6	Maintenance and Repair of Personal and Household Goods	9.6
Electrical Equipment Manufacturing	13.5	Plastic Products Manufacturing	9.9
Fabricated Metal Products Manufacturing	13.8	Rubber Products Manufacturing	10.0
Furniture Manufacturing	14.1	Postal and Courier Services	10.0
Retail Trade	14.2	Waste Collection, Treatment and Disposal; Materials Recovery	10.3
Land Transportation	14.3	Human Health Services	10.3
Agriculture and Animal Husbandry	14.6	Warehousing and Storage	11.1
Group4 (>10.3%) Repair and Installation of Industrial Machinery and Equipment	16.5	Group4 (>8.7%) Motion Picture and Video Services, Sound Recording and Music Publishing	11.1
Rental and Leasing	18.5	Leather, Fur and Related Products Manufacturing	11.6
Buildings and Greenery Services	18.9	Chemical Products Manufacturing	12.1
Wood and Bamboo Products Manufacturing	20.0	Retail Trade	12.7
Water Transportation	21.1	Pulp, Paper and Paper Products Manufacturing	15.6
Specialized Construction	22.2	Fishing	15.8
Buildings Construction	24.0	Non-metallic Mineral Products Manufacturing	16.1
Data Processing and Information Supply Services	25.0	Buildings and Greenery Services	16.3
Maintenance and Repair of Personal and Household Goods	26.1	Air Transportation	16.7
Tobacco Manufacturing	33.3	Agriculture and Animal Husbandry	22.6

Table 22. Relationship between SIR of HIVD and combination of ergonomic factors,

Male			
Whole body vibration	Heavy lifting	Male ^a	
		Estimate	95% CI
-	-	Reference (0)	-
+	-	0.132	(-0.144,0.407)
-	+	0.174*	(0.011, 0.337)
+	+	0.532*	(0.403, 0.661)

*:P-value < 0.05

a: Predicted P<.0001 aR²=0.45

Table 23. Relationship between SIR of HIVD and combination of ergonomic factors,

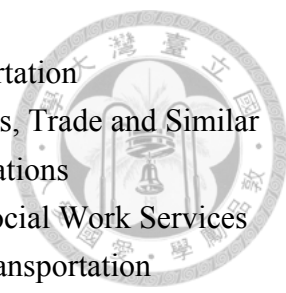
Female			
Whole body vibration	Awkward posture	Female ^a	
		Estimate	95% CI
-	-	Reference (0)	-
+	-	0.171*	(0.002, 0.341)
-	+	0.191*	(0.043, 0.339)
+	+	0.334*	(0.204, 0.465)

*:P-value < 0.05

a: Predicted P <.0001 aR²=0.23

Table 24. Level of groups and its included job divisions covering the percentage range and the groups in “hands or wrists musculoskeletal discomfort”

Male			Female		
Exposure Level	Job Division	(%)	Exposure Level	Job Division	(%)
	Mining and Quarrying	0.0		Mining and Quarrying	0.0
	Crude Petroleum and Natural Gas Extraction	0.0		Crude Petroleum and Natural Gas Extraction	0.0
	Other Mining and Quarrying	0.0		Sand, Stone and Clay Quarrying	0.0
	Tobacco Manufacturing	0.0		Other Mining and Quarrying	0.0
	Medical Goods Manufacturing	0.0		Tobacco Manufacturing	0.0
	Water Supply	0.0		Petroleum and Coal Products Manufacturing	0.0
	Air Transportation	0.0		Repair and Installation of Industrial Machinery and Equipment	0.0
	Securities, Futures and Other Financing	0.0		Electricity and Gas Supply	0.0
	Real Estate Development	0.0		Water Supply	0.0
Group1 (0-3.5%)	Head Offices and Management	0.0	Group1 (0-4.5%)	Water Transportation	0.0
	Consultancy Services	0.0		Motion Picture and Video Services, Sound Recording and Music Publishing	0.0
	Veterinary Services	0.0		Data Processing and Information Supply Services	0.0
	Extra-territorial Organizations and Bodies	0.0		Real Estate Development	0.0
	Other Social Work Services	0.0		Veterinary Services	0.0
	Libraries, Archives, Museums and Similar Institutions	0.0		Other Professional, Scientific and Technical Services	0.0
	Sports, Amusement and Recreation	0.0		Security and Investigation Services	0.0
	Insurance Carriers	0.7		Extra-territorial Organizations and Bodies	0.0
	Real Estate Operation and Relative Services	1.0		Supporting Services to	3.8
	Research and Development	1.9			



Services		Transportation	
Religious, Trade and Similar Organizations	2.7	Religious, Trade and Similar Organizations	3.8
Publishing	2.8	Other Social Work Services	4.0
Electricity and Gas Supply	3.3	Land Transportation	4.1
Computer Systems Design Services	3.4	Securities, Futures and Other Financing	4.1
Security and Investigation Services	3.5	Research and Development Services	4.8
Other Professional, Scientific and Technical Services	3.6	Head Offices and Management Consultancy Services	5.3
Legal and Accounting Services	3.8	Insurance Carriers	5.4
Architecture and Engineering Services; Technical Testing and Analysis Services	4.1	Architecture and Engineering Services; Technical Testing and Analysis Services	6.7
Chemical Products Manufacturing	4.3	Leather, Fur and Related Products Manufacturing	7.0
Specialized Design Services	4.3	Travel Agency	7.4
Telecommunications	4.5	Accommodation Services	7.5
Other Transport Equipment Manufacturing	4.5	Broadcasting and Programming	7.7
Group2 (3.5-7.5%) Wastewater (Sewage) Treatment	4.8	Group2 (4.5-11%) Sports, Amusement and Recreation	7.7
Travel Agency	4.8	Other Transport Equipment Manufacturing	7.8
Other Services Not Elsewhere Classified	4.8	Telecommunications	7.9
Public Administration and Defence; Compulsory Social Security	5.2	Financial Intermediation	8.0
Postal and Courier Services	5.4	Education	8.1
Warehousing and Storage	5.9	Legal and Accounting Services	8.2
Petroleum and Coal Products Manufacturing	6.3	Motor Vehicles and Parts Manufacturing	8.2
Education	6.4	Public Administration and	8.2

			Defence; Compulsory Social Security	
			Wood and Bamboo Products Manufacturing	8.3
Accommodation Services	6.7		Food Manufacturing	10.0
Electronic Parts and Components Manufacturing	6.7		Civil Engineering	10.0
Printing and Reproduction of Recorded Media	6.9		Basic Metal Manufacturing	10.3
Human Health Services	7.2		Computer Systems Design Services	10.5
Computers, Electronic and Optical Products Manufacturing	7.5		Human Health Services	11.0
Financial Intermediation	7.6		Plastic Products Manufacturing	11.0
Forestry	7.7		Fabricated Metal Products Manufacturing	11.1
Agriculture and Animal Husbandry	7.9		Buildings Construction	11.1
Food Manufacturing	7.9		Warehousing and Storage	11.1
Plastic Products Manufacturing	8.0		Publishing	11.8
Non-metallic Mineral Products Manufacturing	8.1		Specialized Design Services	11.8
Repair and Installation of Industrial Machinery and Equipment	8.2		Postal and Courier Services	12.5
Group3 (7.5-11.5%) Pulp, Paper and Paper Products Manufacturing	8.3	Group3 (11-16%)	Computers, Electronic and Optical Products Manufacturing	12.6
Electrical Equipment Manufacturing	8.3		Non-metallic Mineral Products Manufacturing	12.9
Advertising and Market Research	8.3		Electronic Parts and Components Manufacturing	13.0
Machinery and Equipment Manufacturing	8.5		Business and Office Support Services	13.0
Chemical Material Manufacturing	8.6		Real Estate Operation and Relative Services	13.5
Business and Office Support Services	9.7		Electrical Equipment	13.6
Gambling	10.0			

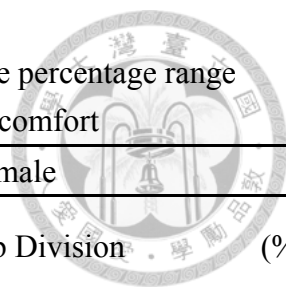


		Manufacturing	
	Land Transportation	10.1	Food and Beverage Services 13.7
	Basic Metal Manufacturing	10.4	Gambling 14.3
	Motor Vehicles and Parts Manufacturing	10.5	Machinery and Equipment Manufacturing 14.5
	Civil Engineering	10.8	Specialized Construction 15.0
	Maintenance and Repair of Personal and Household Goods	10.9	Chemical Products Manufacturing 15.2
	Textiles Mills	11.0	Agriculture and Animal Husbandry 15.3
	Waste Collection, Treatment and Disposal; Materials Recovery	11.2	Maintenance and Repair of Personal and Household Goods 15.4
	Food and Beverage Services	11.4	Wearing Apparel and Clothing Accessories Manufacturing 15.5
Group4 (>11.5%)	Fishing	11.5	Residential Care Services 15.6
	Fabricated Metal Products Manufacturing	11.6	Employment Services 15.8
	Creative and Performing Arts	11.8	Group4 (>16%) Forestry 16.7
	Supporting Services to Transportation	11.8	Chemical Material Manufacturing 16.7
	Wood and Bamboo Products Manufacturing	12.5	Libraries, Archives, Museums and Similar Institutions 16.7
	Residential Care Services	12.5	Other Services Not Elsewhere Classified 17.1
	Wholesale Trade	12.6	Textiles Mills 17.2
	Specialized Construction	12.7	Medical Goods Manufacturing 17.8
	Retail Trade	13.0	Waste Collection, Treatment and Disposal; Materials Recovery 17.9
	Manufacturing Not Elsewhere Classified	13.3	Beverages Manufacturing 18.2



Beverages Manufacturing	13.3	Advertising and Market Research	18.2
Buildings Construction	13.9	Rental and Leasing	18.2
Furniture Manufacturing	14.1	Manufacturing Not Elsewhere Classified	18.9
Wearing Apparel and Clothing Accessories Manufacturing	14.8	Buildings and Greenery Services	19.2
Broadcasting and Programming	14.8	Pulp, Paper and Paper Products Manufacturing	20.0
Rental and Leasing	14.8	Wastewater (Sewage) Treatment	20.0
Water Transportation	15.8	Retail Trade	20.0
Rubber Products Manufacturing	16.4	Wholesale Trade	20.5
Sand, Stone and Clay Quarrying	16.7	Printing and Reproduction of Recorded Media	20.6
Leather, Fur and Related Products Manufacturing	17.6	Creative and Performing Arts	22.2
Motion Picture and Video Services, Sound Recording and Music Publishing	20.0	Air Transportation	25.0
Buildings and Greenery Services	20.3	Furniture Manufacturing	27.3
Data Processing and Information Supply Services	25.0	Rubber Products Manufacturing	30.0
Employment Services	25.0	Fishing	36.8

Table 25. Level of groups and its included job divisions covering the percentage range and the groups in “low back or waist musculoskeletal discomfort”



Male			Female		
Exposure Level	Job Division	(%)	Exposure Level	Job Division	(%)
	Mining and Quarrying	0.0		Forestry	0.0
	Crude Petroleum and Natural Gas Extraction	0.0		Mining and Quarrying	0.0
	Other Mining and Quarrying	0.0		Crude Petroleum and Natural Gas Extraction	0.0
	Tobacco Manufacturing	0.0		Sand, Stone and Clay Quarrying	0.0
	Wastewater (Sewage) Treatment	0.0		Other Mining and Quarrying	0.0
	Air Transportation	0.0		Tobacco Manufacturing	0.0
	Real Estate Development	0.0		Petroleum and Coal Products Manufacturing	0.0
	Research and Development Services	0.0		Repair and Installation of Industrial Machinery and Equipment	0.0
	Veterinary Services	0.0		Electricity and Gas Supply	0.0
Group1 (<6%)	Extra-territorial Organizations and Bodies	0.0	Group1 (<6%)	Water Supply	0.0
	Real Estate Operation and Relative Services	1.9		Wastewater (Sewage) Treatment	0.0
	Legal and Accounting Services	1.9		Water Transportation	0.0
	Securities, Futures and Other Financing	2.1		Computer Systems Design Services	0.0
	Sports, Amusement and Recreation	2.7		Veterinary Services	0.0
	Religious, Trade and Similar Organizations	2.7		Other Professional, Scientific and Technical Services	0.0
	Computer Systems Design Services	3.5		Security and Investigation Services	0.0
	Medical Goods Manufacturing	3.7		Extra-territorial Organizations and Bodies	0.0
	Insurance Carriers	3.7		Creative and Performing Arts	0.0
	Sand, Stone and Clay Quarrying	5.6		Basic Metal Manufacturing	3.4
	Head Offices and Management	5.6		Leather, Fur and Related	4.7

Consultancy Services		Products Manufacturing	
Water Supply	5.9	Employment Services	5.3
Warehousing and Storage	5.9	Securities, Futures and Other Financing	5.5
Human Health Services	6.3	Religious, Trade and Similar Organizations	5.8
Motion Picture and Video Services, Sound Recording and Music Publishing	6.7	Research and Development Services	7.0
Other Services Not Elsewhere Classified	6.9	Accommodation Services	7.4
Other Professional, Scientific and Technical Services	7.1	Postal and Courier Services	7.5
Architecture and Engineering Services; Technical Testing and Analysis Services	7.2	Public Administration and Defence; Compulsory Social Security	7.5
Broadcasting and Programming	7.4	Other Social Work Services	8.0
Electricity and Gas Supply	7.7	Legal and Accounting Services	8.2
Electronic Parts and Components Manufacturing	7.9	Air Transportation	8.3
Group2 (6-10%) Accommodation Services	8.0	Group2 (6-10%) Medical Goods Manufacturing	8.7
Printing and Reproduction of Recorded Media	8.0	Education	8.8
Public Administration and Defence; Compulsory Social Security	8.1	Specialized Design Services	8.8
Security and Investigation Services	8.1	Architecture and Engineering Services; Technical Testing and Analysis Services	8.9
Other Transport Equipment Manufacturing	8.2	Travel Agency	9.3
Publishing	8.3	Non-metallic Mineral Products Manufacturing	9.7
Advertising and Market Research	8.3	Other Transport Equipment Manufacturing	9.8
Education	8.4	Publishing	9.8
Chemical Products Manufacturing	8.5	Financial Intermediation	10.0
Basic Metal Manufacturing	8.5	Group3 Other Services Not Elsewhere	10.2



(10-14%) Classified

Computers, Electronic and Optical Products Manufacturing	8.5	Telecommunications	10.5
Specialized Design Services	8.7	Food Manufacturing	10.6
Food and Beverage Services	8.9	Food and Beverage Services	10.9
Manufacturing Not Elsewhere Classified	9.2	Computers, Electronic and Optical Products Manufacturing	10.9
Financial Intermediation	9.4	Motor Vehicles and Parts Manufacturing	11.0
Postal and Courier Services	9.5	Land Transportation	11.0
Travel Agency	9.5	Human Health Services	11.0
Business and Office Support Services	9.7	Plastic Products Manufacturing	11.0
Gambling	10.0	Fabricated Metal Products Manufacturing	11.1
Machinery and Equipment Manufacturing	10.2	Manufacturing Not Elsewhere Classified	11.1
Electrical Equipment Manufacturing	10.3	Warehousing and Storage	11.1
Pulp, Paper and Paper Products Manufacturing	10.7	Motion Picture and Video Services, Sound Recording and Music Publishing	11.1
Plastic Products Manufacturing	11.1	Broadcasting and Programming	11.5
Telecommunications	11.9	Real Estate Operation and Relative Services	11.5
Group3 (10-14%) Waste Collection, Treatment and Disposal; Materials Recovery	12.0	Specialized Construction	11.7
Wood and Bamboo Products Manufacturing	12.5	Chemical Products Manufacturing	12.1
Fabricated Metal Products Manufacturing	12.5	Insurance Carriers	12.3
Employment Services	12.5	Electronic Parts and Components Manufacturing	12.3
Residential Care Services	12.5	Wood and Bamboo Products Manufacturing	12.5
Other Social Work Services	12.5	Civil Engineering	12.5

	Agriculture and Animal Husbandry	12.6		Sports, Amusement and Recreation	12.8
	Textiles Mills	12.9		Business and Office Support Services	13.0
	Chemical Material Manufacturing	12.9		Wearing Apparel and Clothing Accessories Manufacturing	13.1
	Wearing Apparel and Clothing Accessories Manufacturing	13.0		Pulp, Paper and Paper Products Manufacturing	13.3
	Non-metallic Mineral Products Manufacturing	13.0		Supporting Services to Transportation	13.5
	Food Manufacturing	13.3		Maintenance and Repair of Personal and Household Goods	13.5
	Repair and Installation of Industrial Machinery and Equipment	13.4		Residential Care Services	14.1
	Maintenance and Repair of Personal and Household Goods	13.5		Buildings Construction	14.1
	Leather, Fur and Related Products Manufacturing	13.7		Textiles Mills	14.2
	Civil Engineering	14.1		Gambling	14.3
	Specialized Construction	14.1		Advertising and Market Research	15.2
	Supporting Services to Transportation	15.2		Electrical Equipment Manufacturing	15.5
	Furniture Manufacturing	15.4	Group4 (>14%)	Head Offices and Management Consultancy Services	15.8
Group4 (>14%)	Libraries, Archives, Museums and Similar Institutions	15.4		Chemical Material Manufacturing	16.7
	Petroleum and Coal Products Manufacturing	15.6		Data Processing and Information Supply Services	16.7
	Land Transportation	15.6		Real Estate Development	16.7
	Rubber Products Manufacturing	16.4		Libraries, Archives, Museums and Similar Institutions	16.7
	Buildings Construction	17.5		Machinery and Equipment Manufacturing	17.1
	Creative and Performing Arts	17.6		Printing and Reproduction of Recorded Media	17.6
	Motor Vehicles and Parts	17.9		Furniture Manufacturing	18.2

Manufacturing		Rubber Products	20.0
Rental and Leasing	18.5	Manufacturing	21.6
Fishing	18.7	Retail Trade	22.1
Wholesale Trade	19.5	Buildings and Greenery Services	22.6
Retail Trade	20.0	Agriculture and Animal Husbandry	23.1
Beverages Manufacturing	20.0	Waste Collection, Treatment and Disposal; Materials Recovery	23.7
Data Processing and Information Supply Services	25.0	Wholesale Trade	27.3
Buildings and Greenery Services	27.0	Beverages Manufacturing	27.3
Forestry	30.8	Rental and Leasing	47.4
Water Transportation	31.6	Fishing	



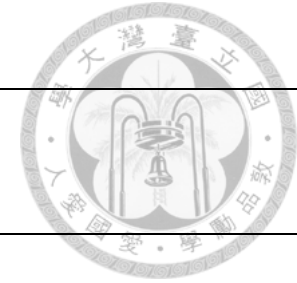
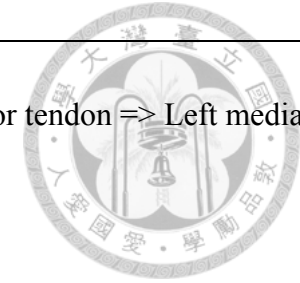
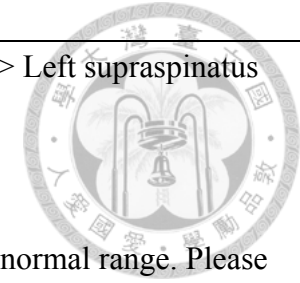


Table 26. Results of physical examination and ultrasound examination

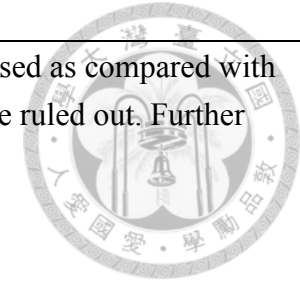
No	Diagnosis*	Other diagnosis or finding	Body part be done the ultrasound Examination	Results of the ultrasound Examination
1	4	R/O cervical radiculopathy Suspect		
2	Nil	osteoarthritis over left knee		
3	4			
4	4,5		L't Shoulder	Bulging of the left AC joint => Left AC joint [#] distention
5	4,5,10		Lt shoulder, Rt shoulder, Rt wrist	1. Right AC distention 2. Right wrist ganglion cyst 3. Right 4th finger tenosynovitis
6	5,9		Lt shoulder, Lt wrist	1. The sonographical images of right shoulder are within normal limit. Myofascial pain syndrome cannot be ruled out. 2. Irregularity of bony cortex of left wrist is found, favoring degenerative change. Please correlate with the clinical presentations.
7	4,6,7,10		Lt elbow, Rt elbow, Rt wrist	1. Bilateral lateral epicondylitis 2. Right de Quervain's tenosynovitis
8	4,5		right shoulder	Right supraspinatus tendonitis
9	Nil			
10	5,6,8		Rt shoulder, rt	1. The sonographical images of left shoulder are within normal limit. Myofascial pain



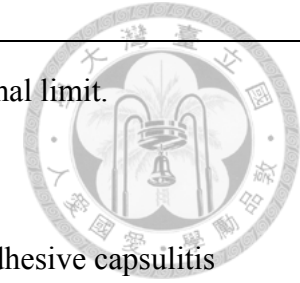
			elbow	<p>syndrome cannot be ruled out.</p> <p>2. Hypoechoic swelling over the insertion of left common flexor tendon => Left medial epicondylitis</p>
11	Nil	Myofascial pain over left shoulder		
12	4	Suspect R't 2nd DIP osteoarthritis	Rt index finger	Myofascial pain syndrome cannot be ruled out. Please correlate with the clinical presentations.
13	Nil			
14	5		Rt shoulder	<p>1. Bulging of the right AC joint => Right AC joint distention</p> <p>2. Diffuse swelling with heterogeneous hypoechoic appearance over the right supraspinatus tendon => Right supraspinatus tendinosis</p>
15	10		Rt wrist	Right de Quervain's tenosynovitis
16	Nil	Myofascial pain over right shoulder		
17	Nil			
18	10,11		Lt wrist	Left de Quervain's tenosynovitis
19	Nil	Myofascial pain over left shoulder		
20		Myofascial pain over right shoulder		
21	4,5		Lt shoulder	<p>1. Joint effusion around the left biceps, long head tendon => Left biceps long head peritendineal effusion</p> <p>2. Bulging of the left AC joint => Left AC distention</p>



				3. Hypoechoic appearance over the left supraspinatus tendon => Left supraspinatus tendinosis
22	4			
23	Nil			
24	10,11	Suspect CTS	Lt wrist, Rt wrist	The cross-sectional areas of bilateral median nerves are within normal range. Please correlate with clinical presentations. Further electrophysiological study is suggested.
25	4,5,6,8,10,11		Rt should, Lt elbow, Rt elbow, Lt wrist, Rt wrist	<ol style="list-style-type: none"> 1. Right AC joint distention 2. Right supraspinatus tendon full-thickness tear (anterior part) 3. Right posterior olecranon effusion 4. Left Lateral epicondylitis 5. Bilateral de Quervain's tenosynovitis
26	4,10		Lt wrist, Rt wrist	Hypoechoic swelling over bilateral abductor pollicis longus and extensor pollicis brevis tendons with hypoechoic thickening of the tendon sheath => Bilateral DeQuervain's disease
27	5,10		Rt shoulder, Rt wrist	<ol style="list-style-type: none"> 1. Right supraspinatus diffuse tendinosis 2. Right wrist common extensor digitorum tenosynovitis
28	Nil			
29	5		Rt shoulder	The sonographical images of the right shoulder are within normal limit. Myofascial pain syndrome cannot be ruled out. Please correlate with the clinical presentations.
30	5,11	NCV wrist	Lt shoulder, Lt wrist, Rt wrist	<ol style="list-style-type: none"> 1. Bulging of the left AC joint => Left AC joint distention 2. Incomplete motion of the left shoulder during examination => Left adhesive capsulitis



				3. The cross-sectional area of right median nerve is mild increased as compared with that of left median nerve. Right carpal tunnel syndrome can't be ruled out. Further electrophysiological study is suggested.
31	Others	Suspect left lateral epicondylitis	Lt elbow	
32	10,11	Hand NCV	Lt wrist, Rt wrist	The cross-sectional area and the flattening ratio of right median nerve are increased. Right carpal tunnel syndrome is impressed.
33	4,7,10,11,12		Rt wrist	Increased cross-sectional area over the right ulnar nerve at Guyon's canal. Right ulnar neuropathy was favoured. Please correlate with the clinical presentations.
34	Nil			
35	10		Rt wrist	1. Hypoechoic swelling of the right EBP and APL tendons à Right Quervain's tenosynovitis 2. Cortex irregularity over multiple DIP joints of both hands à Osteoarthritis of both hands
36	11	NCV	Lt wrist, Rt wrist	There are increased cross-sectional areas and flattening ratio of bilateral median nerves. => Bilateral carpal tunnel syndrome
37	Nil	History of trigger finger, Lt		
38	4,5,10		Rt shoulder, Rt wrist	1. Right AC joint distention 2. Right supraspinatus calcific tendinosis 3. Hypoechoic swelling of the right abductor pollicis longus tendon with hypoechoic thickening of the tendon sheath à Right de Quervain's tenosynovitis
39	Nil	History of HIVD		



40	4,5	R/Ocervical radiculopathy	right shoulder	The sonographical images of the right shoulder are within normal limit.
41	4,5			
42	5		Lt shoulder	1. Left biceps brachii, long head peritendineal effusion 2. Incomplete motion during examination, compatible to left adhesive capsulitis
43	4,5		right shoulder, Lt shoulder	No structure abnormality was found over the bilateral biceps, subscapularis, supraspinatus, infraspinatus tendons, and AC joint.
44	4,5		right shoulder, Lt shoulder	No significant structure abnormality was found over the bilateral biceps, subscapularis, supraspinatus, infraspinatus tendons, and AC joints.
45		r/o right index figure flexor		1. No significant tendon swelling of right index finger flexor tendon comparing to left side 2. No significant tendon swelling of right index finger extensor tendon
46	4,11		Lt wrist, Rt wrist	1. No significant thickening of right common extensor tendon over lateral epicondyle 2. Bilateral median nerve CSA at pisiform level are within normal limit. Suggest NCS study. 3. No significant tendon swelling or effusion over bilateral wrist extensor tendons
47	11,12		Lt wrist, Rt wrist	1. increased cross-sectional area of bilateral median nerves at pisiform level, compatible with bilateral carpal tunnel syndrome 2. cross-sectional areas of bilateral ulnar nerves at cubital tunnel are within normal limits 3. No effusion or significant tendon swelling was found at bilateral wrist extensor tendons.
48	10		Bilateral hand	No significant tendon swelling or effusion over right 1 MCP joint level APL /EPB



			tendon
49	11	Lt wrist, Rt wrist	Increased cross-sectional area of bilateral median nerves at pisiform level was found, compatible with bilateral CTS.
50	Nil		
51	4		
52	Nil		
53	Nil		
54	Nil		
55	4		
56	4,10	Right hand	

*: 4. Radiating neck complaints (suggested by physical examination)

5. Rotator cuff syndrome

6. Lateral-medial epicondylitis

7. Cubital tunnel syndrome

8. Radial tunnel syndrome

9. Flexor-extensor peritendinitis or tenosynovitis of forearm-wrist

10. Quervain's disease

11. Carpal tunnel syndrome

12. Guyon's canal syndrome

#:AC joint: acromioclavicular joint

Table 27. Distribution of demographics and working conditions of workers

	Self-reported musculoskeletal symptoms	
	No (N=283) N (%)	Yes (N=76) N (%)
Sex		
Male	198 (70.7)	48 (64.0)
Female	82 (29.3)	27 (36.0)
Age (years)		
Mean (SD)	39.0 (6.6)	39.6 (7.8)
<30	19 (6.8)	5 (6.8)
30-35	85 (30.6)	15 (20.3)
35-40	69 (24.8)	19 (25.7)
40-45	55 (19.8)	20 (27.0)
>45	50 (18.0)	15 (20.3)
Job tenure (years)		
Mean (SD)	12.4 (6.6)	12.8 (7.0)
1-5	35 (12.9)	10 (13.5)
5-10	69 (25.5)	17 (23.0)
10-15	76 (28.0)	18 (24.3)
>15	91 (33.6)	29 (39.2)
Body mass index (kg /m²)		
Mean (SD)	25.3 (3.8)	23.9 (4.4)
<18.5	8 (2.9)	0 (0.0)
18.5-24	122 (44.5)	28 (38.4)
≥24	144 (52.6)	45 (23.8)
Marital status		
Single	81 (28.7)	16 (21.1)
Married	195 (69.2)	59 (77.6)
Divorced/separated	5 (1.8)	1 (1.3)
Widow	1 (0.4)	0 (0.0)
Education level		
Primary school	3 (1.1)	0 (0.0)
Junior college	14 (5.0)	9 (11.8)
Professional school	109 (38.7)	23 (30.3)
College	141 (50.0)	39 (51.3)
Master or above	15 (5.3)	5 (6.6)
Job level		

Employee	244 (86.8)	70 (92.1)
Manager	37 (13.2)	6 (7.9)
Shift work*		
Yes	145 (51.4)	28 (36.8)
No	137 (48.5)	48 (63.2)
Repetitive hand movement*		
Yes	127 (45.0)	54 (71.1)
No	155 (55.0)	22 (28.9)
Awkward posture*		
Yes	126 (44.7)	45 (59.2)
No	156 (55.3)	31 (40.8)
Force*		
Yes	116 (41.1)	46 (60.5)
No	166 (58.9)	30 (39.5)

*: P<0.05

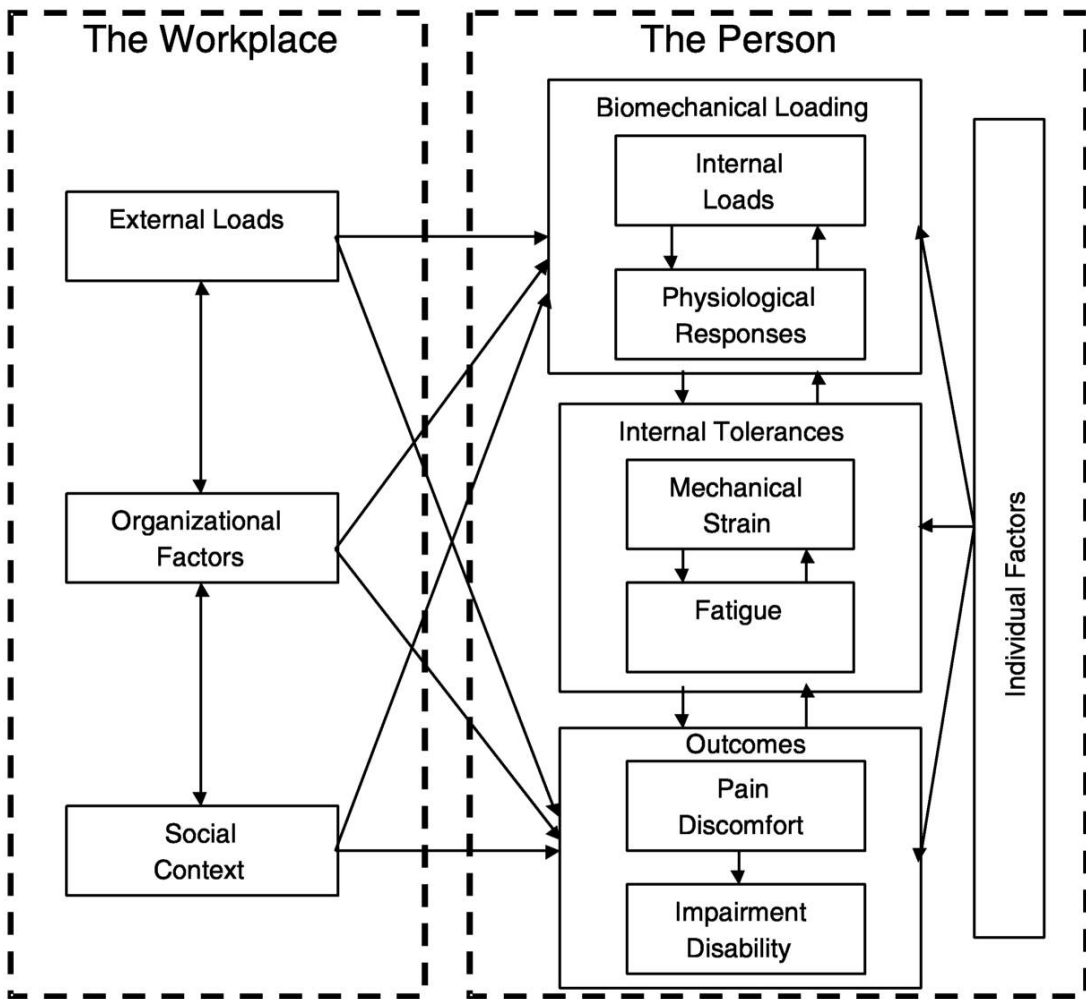



Figure 1. A conceptual model of the possible roles and influences that various factors may play in the development of musculoskeletal disorders [25].



Figure 2. The network for Occupational Disease and Injury Services in Taiwan



$$\begin{aligned}
 & \text{(Incidence rate)} && \text{(Standard population) (Expected numbers)} \\
 & \frac{\text{20-24 year-old case \#}}{\text{20-24 year-old total \#}} && \times \frac{\text{20-24 year-old total \#}}{\text{employed population}} = \text{20-24 year-old expected case \#} \\
 & \text{A Job section} && \text{national-wide of} \\
 & \text{employed population *4 years} && \\
 & \text{A Job section} && \\
 \\
 & \frac{\text{Sum of each aged stratification}}{\text{National-wide total \# of}} && * 10^6 = \text{Standardized Incidence Rates} \\
 & \text{expected case \#} && \text{employed population}
 \end{aligned}$$

(Case per 10⁶ population per year)

Figure 3. Calculated process of SIR

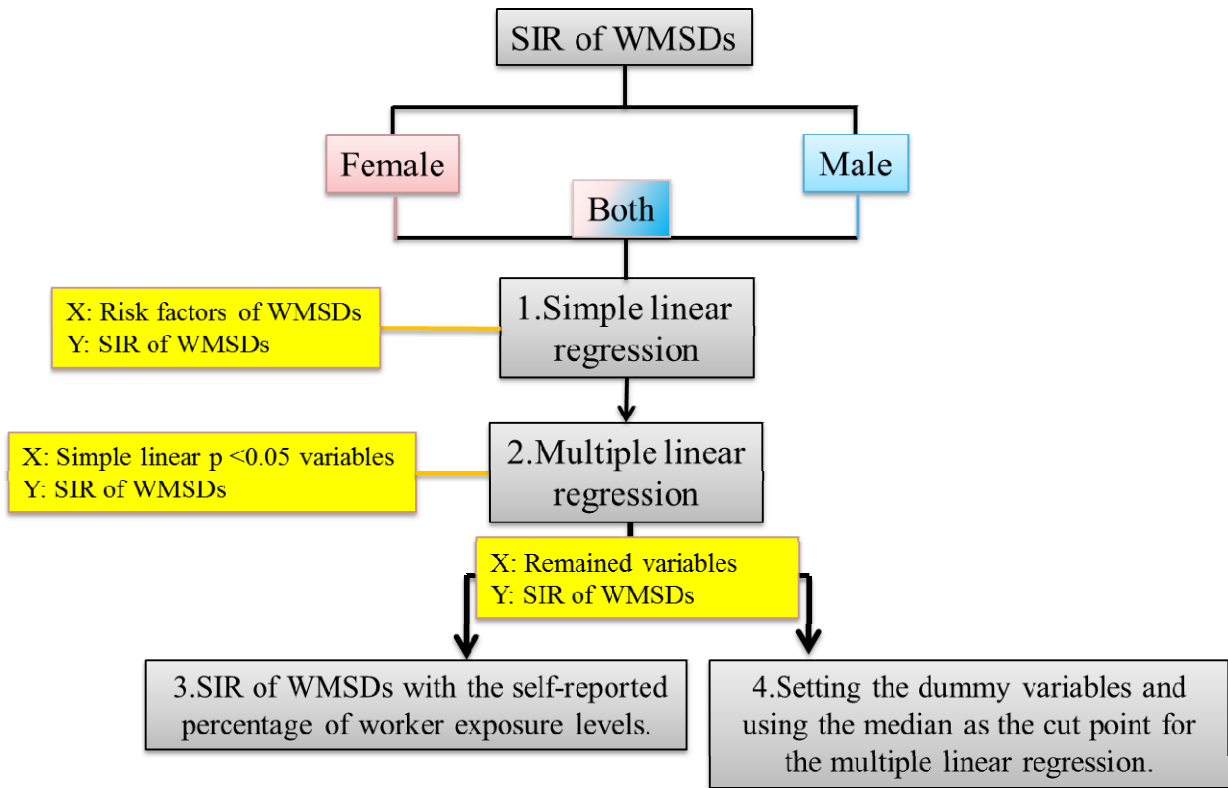


Figure 4. Flow chart of statistical methods

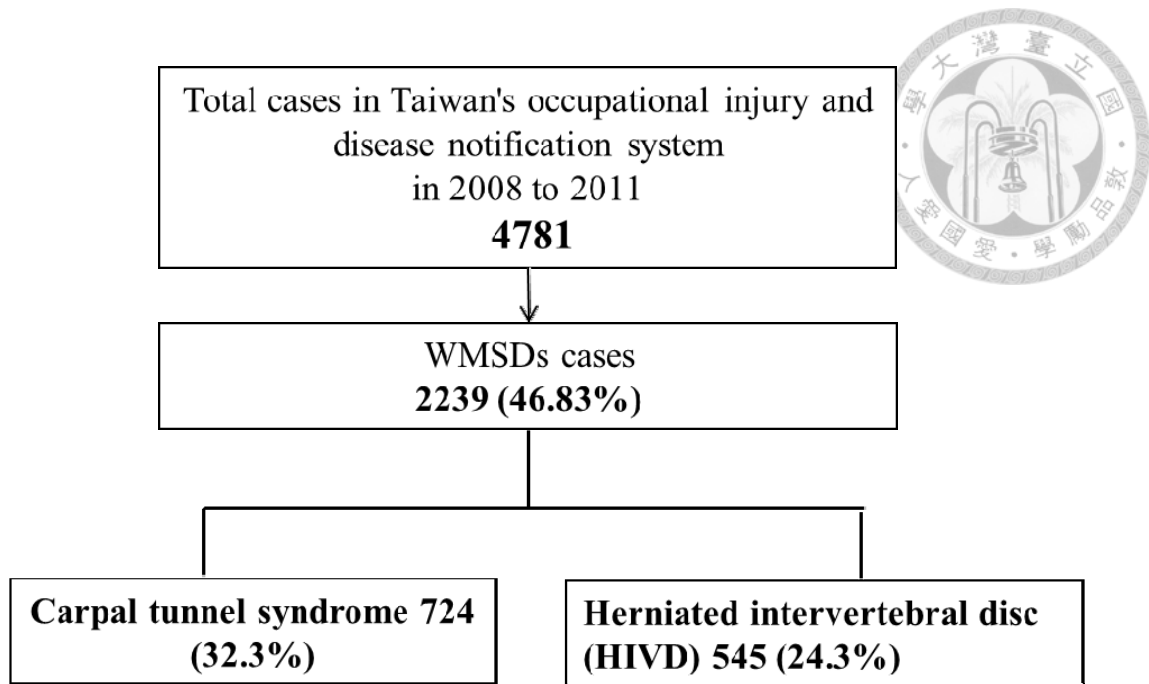


Figure 5. Results of selected and recognized the WMSDs

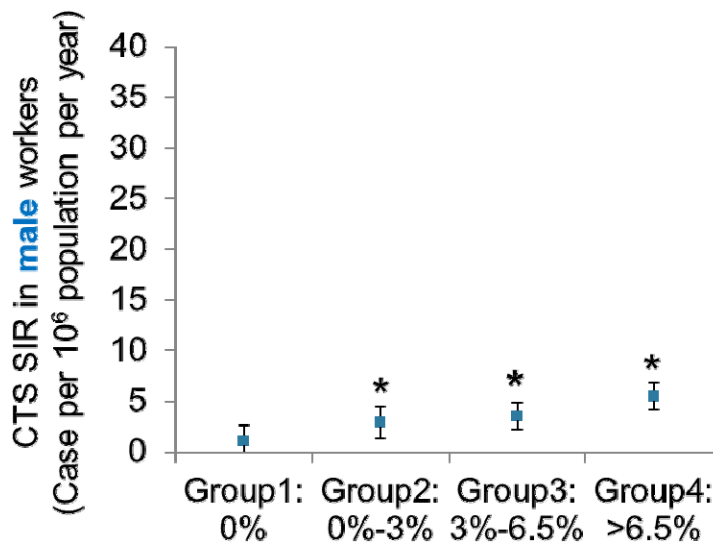


Figure 6. The SIR of CTS with the self-reported percentage of workers exposure to “vibration from hand tools” levels, Male

*: Significant difference from Group1; Self-reported percentage level of workers exposure to vibration from hand tools: group 1: <25th percentile, group 2: 25th–50th percentile, group 3: 50th to 75th percentile, group 4: >75th percentile.

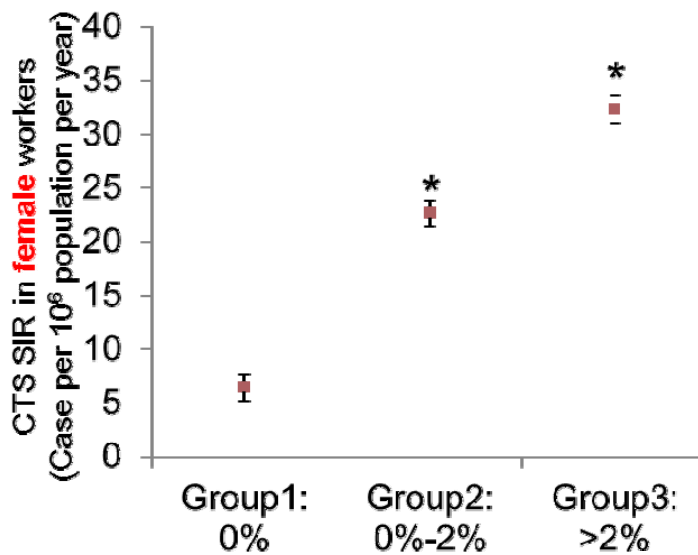


Figure 7. The SIR of CTS with the self-reported percentage of workers exposure to “vibration from hand tools” levels, Female

*: Significant difference from Group1; Self-reported percentage level of workers exposure to vibration from hand tools: group 1: <50th percentile, group 3: 50th to 75th percentile, group 4: >75th percentile.

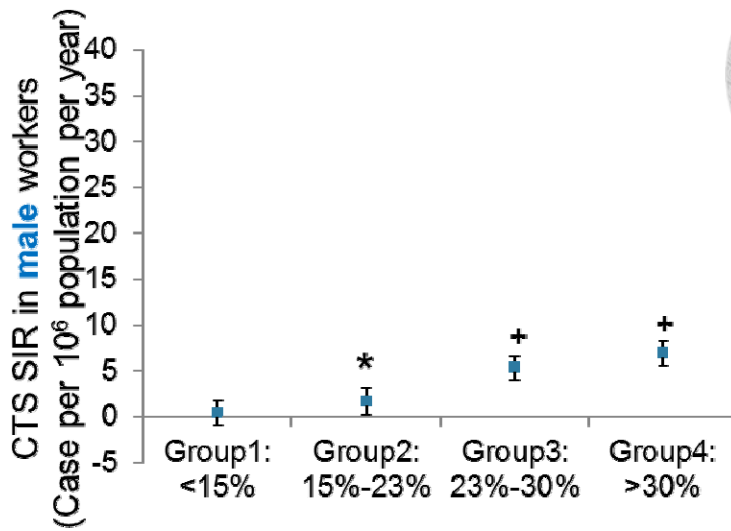


Figure 8. The SIR of CTS with the self-reported percentage of workers exposure to “repetitive hand movements” levels, Male

*: Significant difference from Group1 and Group3,4; +: Significant difference from Group1 and Group 2; Self-reported percentage level of workers exposure to repetitive hand movements: group 1: <25th percentile, group 2: 25th–50th percentile, group 3: 50th to 75th percentile, group 4: >75th percentile.

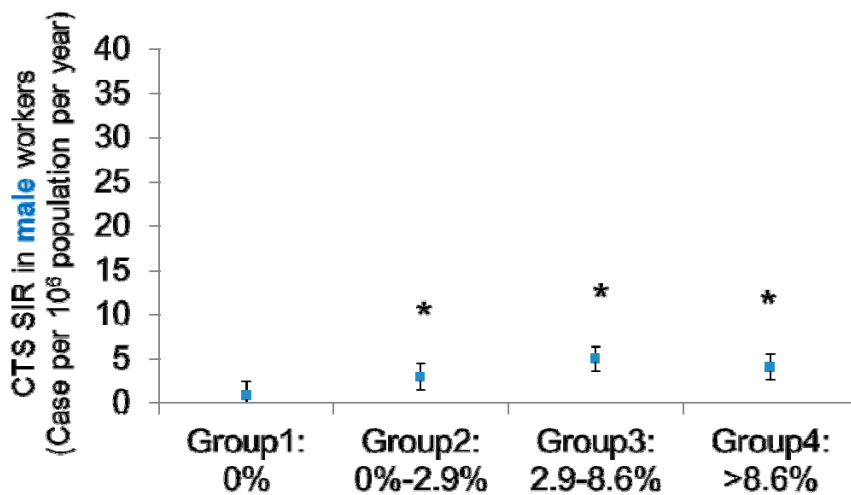


Figure 9. The SIR of CTS with the self-reported percentage of workers exposure to “heavy tools used” levels, male

*: Significant difference from Group1; Self-reported percentage level of workers exposure to heavy tools used: group 1: <50th percentile, group 3: 50th to 75th percentile, group 4: >75th percentile.

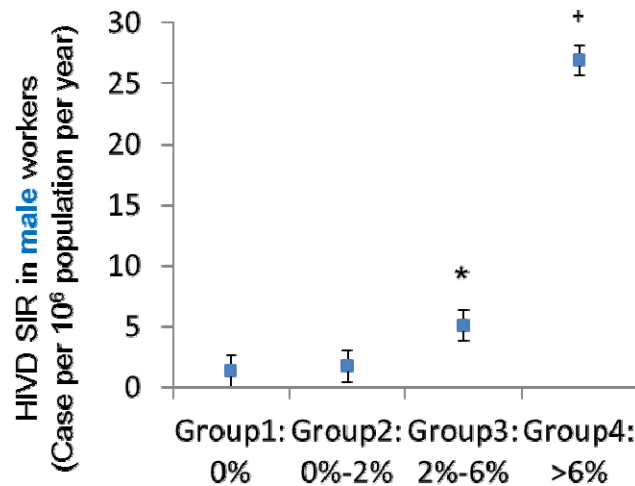


Figure 10. The SIR of HIVD with the self-reported percentage of workers exposure to “whole body vibration” levels, Male

*: Significant difference from Group1, Group2 and Group4

+: Significant difference from Group1, Group 2 and Group3; Self-reported percentage level of workers exposure to whole body vibration: group 1: <25th percentile, group 2: 25th–50th percentile, group 3: 50th to 75th percentile, group 4: >75th percentile.

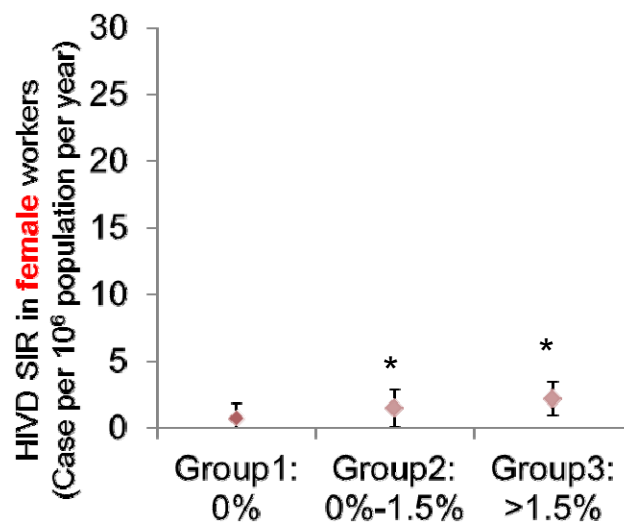


Figure 11. The SIR of HIVD with the self-reported percentage of workers exposure to “whole body vibration” levels, Female

*: Significant difference from Group1; Self-reported percentage level of workers exposure to whole body vibration: group 1: <50th percentile, group 2: 50th to 75th percentile, group 3: >75th percentile.

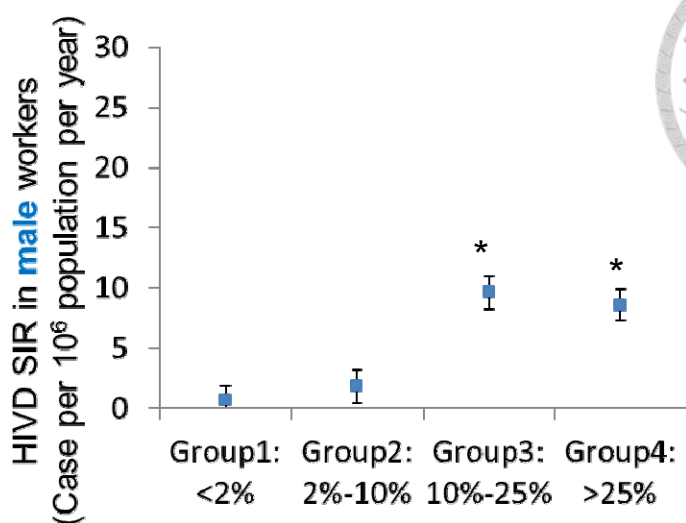


Figure 12. The SIR of HIVD with the self-reported percentage of workers exposure to “heavy lifting” levels, Male

*: Significant difference from Group1, Group2; Self-reported percentage level of workers exposure to heavy lifting: group 1: <25th percentile, group 2: 25th–50th percentile, group 3: 50th to 75th percentile, group 4: >75th percentile.

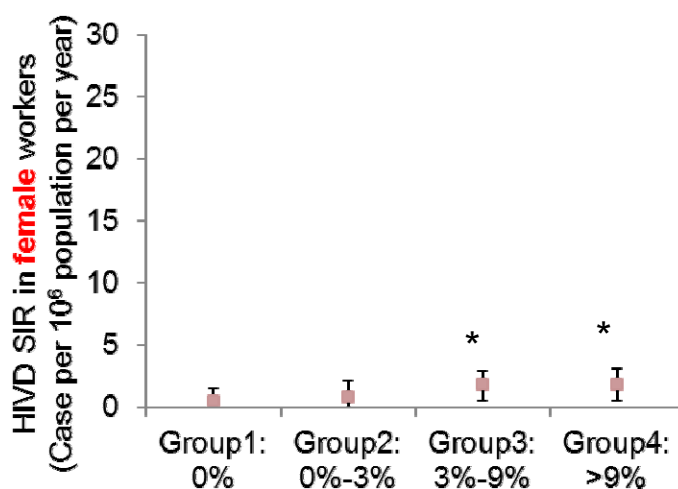


Figure 13. The SIR of HIVD with the self-reported percentage of workers exposure to “heavy lifting” levels, Female

*: Significant difference from Group1 and Group2; Self-reported percentage level of workers exposure to heavy lifting: group 1: <50th percentile, group 3: 50th to 75th percentile, group 4: >75th percentile.

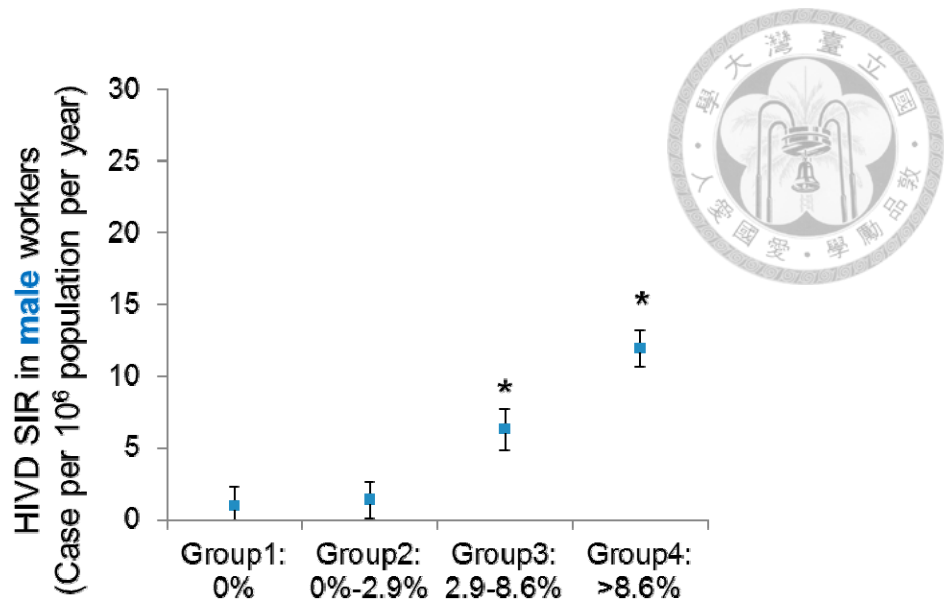


Figure 14. The SIR of HIVD with the self-reported percentage of workers exposure to “heavy tools used” levels, Male

*: Significant difference from Group1 and Group2; Self-reported percentage level of workers exposure to heavy tools used: group 1: <25th percentile, group 2: 25th–50th percentile, group 3: 50th to 75th percentile, group 4: >75th percentile.

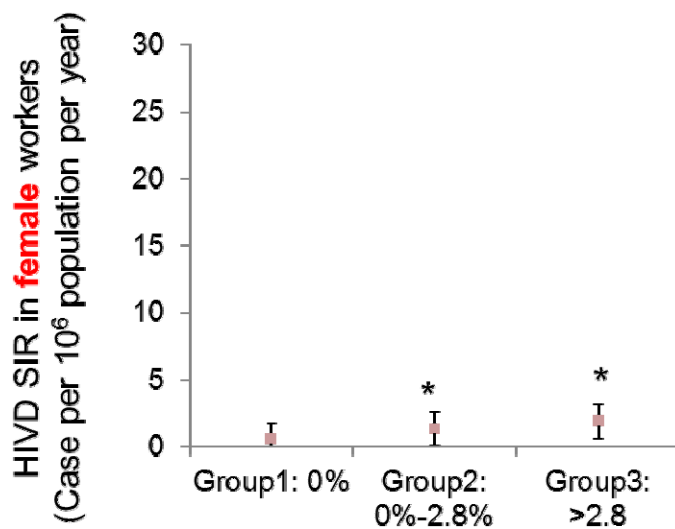


Figure 15. The SIR of HIVD with the self-reported percentage of workers exposure to “heavy tools used” levels, Female

*: Significant difference from Group1; Self-reported percentage level of workers exposure to heavy tools used: group 1: <50th percentile, group 3: 50th to 75th percentile, group 4: >75th percentile.

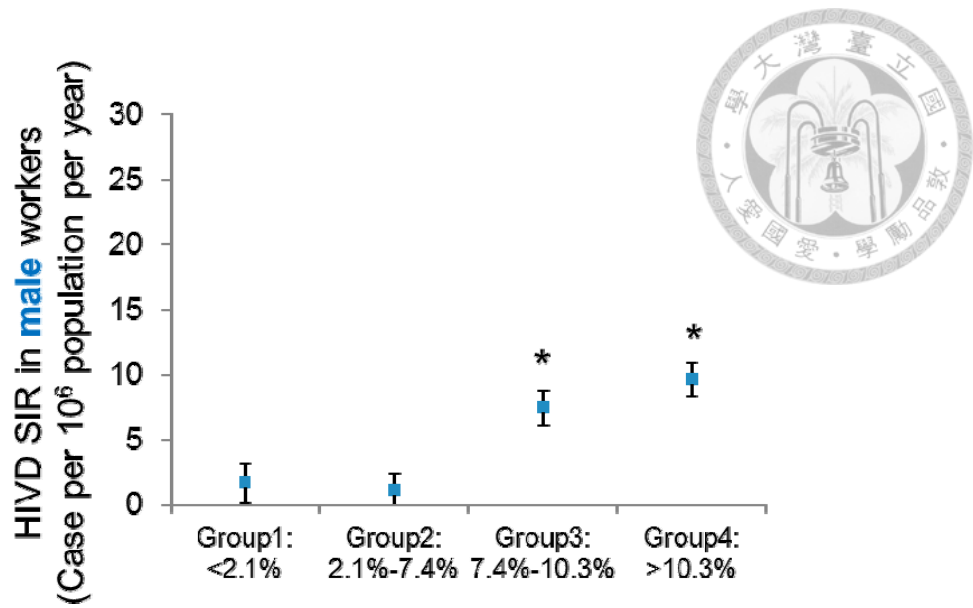


Figure 16. The SIR of HIVD with the self-reported percentage of workers exposure to “awkward posture” levels, Male

*: Significant difference from Group1 and Group2; Self-reported percentage level of workers exposure to awkward posture: group 1: <25th percentile, group 2:25th–50th percentile, group 3: 50th to 75th percentile, group 4: >75th percentile.

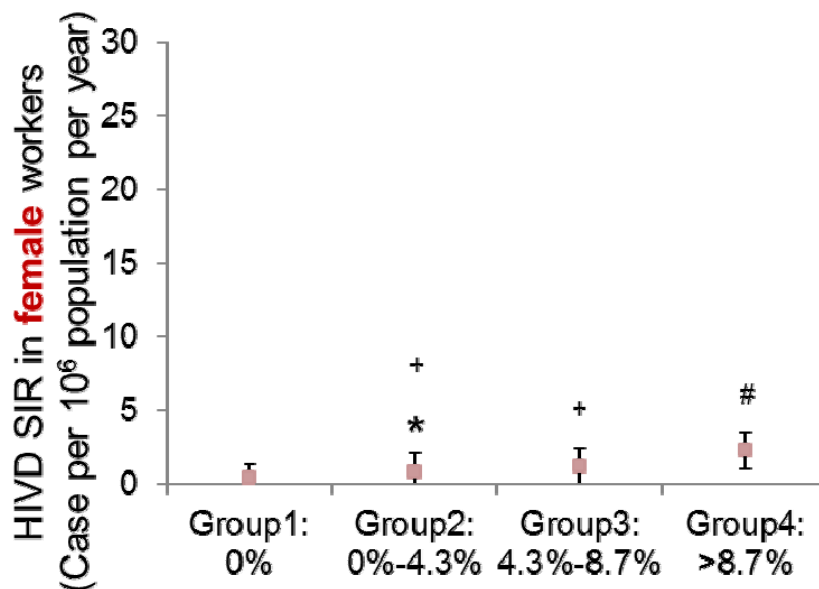


Figure 17. The SIR of HIVD with the self-reported percentage of workers exposure to “awkward posture” levels, Female

*: Significant difference from Group3 and Group4; +: Significant difference from Group1 and Group4; #: Significant difference from Group1-Group3; Self-reported percentage level of workers exposure to awkward posture: group 1: <25th percentile, group 2:25th–50th percentile, group 3: 50th to 75th percentile, group 4: >75th percentile.

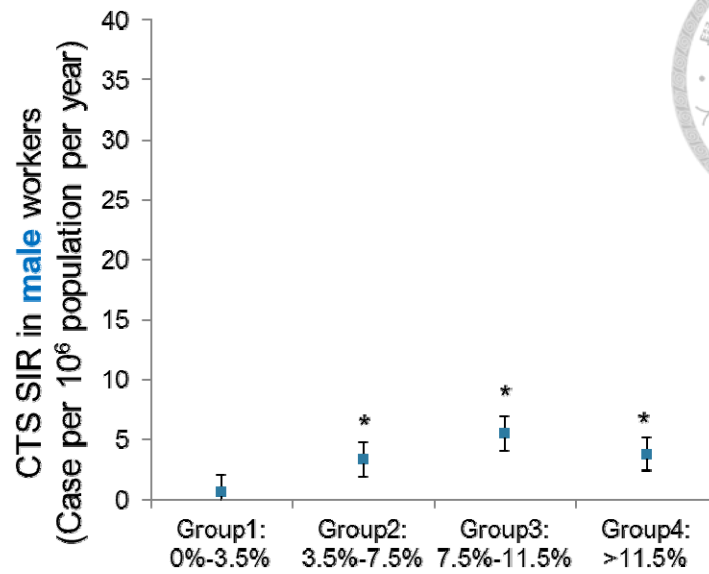


Figure 18. The SIR of CTS with the self-reported percentage of “hands or wrists musculoskeletal discomfort” levels, Male

*: Significant difference from Group1; Self-reported percentage level of hands or wrists musculoskeletal discomfort: group 1: <25th percentile, group 2:25th–50th percentile, group 3: 50th to 75th percentile, group 4: >75th percentile.

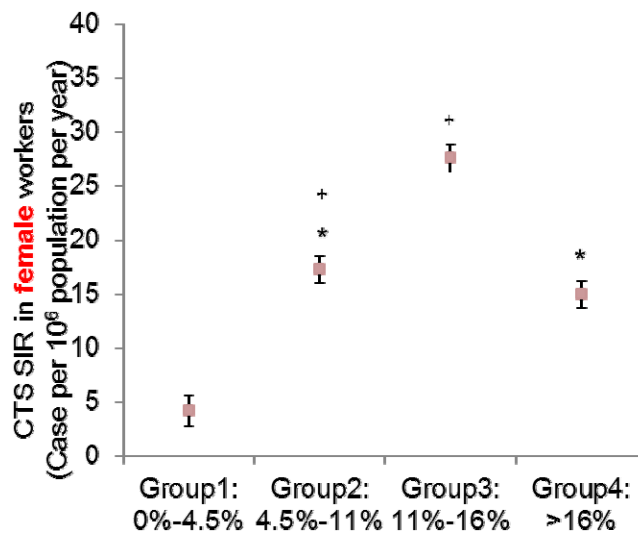


Figure 19. The SIR of CTS with the self-reported percentage of “hands or wrists musculoskeletal discomfort” levels, Female

*: Significant difference from Group1 and Group3; +: Significant difference from Group1 and Group4; Self-reported percentage level of hands or wrists musculoskeletal discomfort: group 1: <50th percentile, group 3: 50th to 75th percentile, group 4: >75th percentile.

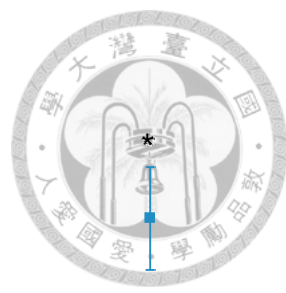
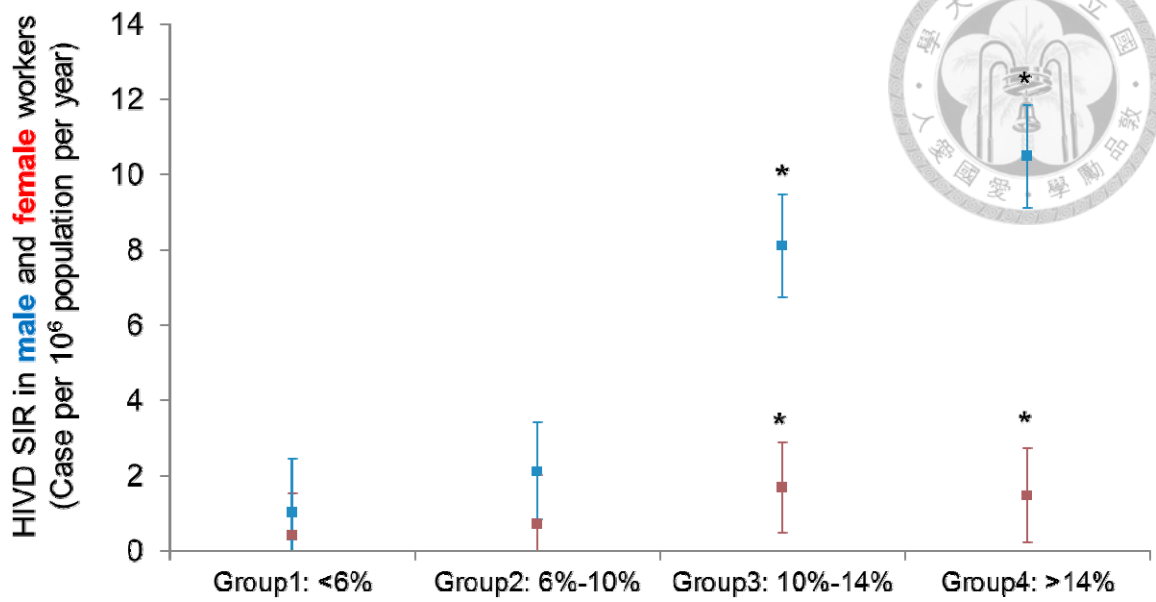


Figure 20. The SIR of HIVD with the self-reported percentage of “low back or waist musculoskeletal discomfort” levels, Male and Female

*: Significant difference from Group1 and Group2; Self-reported percentage level of low back or waist musculoskeletal discomfort: group 1: <25th percentile, group 2:25th–50th percentile, group 3: 50th to 75th percentile, group 4: >75th percentile.

部位	不適症狀(可複選)					症狀持續時間(單選)						症狀出現頻率(單選)					影響程度(單選)					
	1 酸	2 疼痛	3 麻木	4 活動困難	5 肌肉無力	1 一個月以下	2 一至三個月	3 三至六個月	4 半年至一年	5 一年至兩年	6 兩年以上	1 幾乎每天	2 一週約一次	3 一月約一次	4 約半年一次	5 半年以上一次	1 完全不影響	2 稍微降低工作能力	3 工作能力明顯降低	4 生活稍微受到影響	5 嚴重影響生活	6 完全不能動作
不適症狀(可複選)																						
上肢	A. 頸部																					
	B. 肩部(右)																					
	C. 肩部(左)																					
	D. 手肘(右)																					
	E. 手肘(左)																					
	F. 前臂(右)																					
	G. 前臂(左)																					
	H. 手腕(右)																					
	I. 手腕(左)																					
	J. 手掌與手指(右)																					
	K. 手掌與手指(左)																					

Figure 21. Case including criteria in the field study

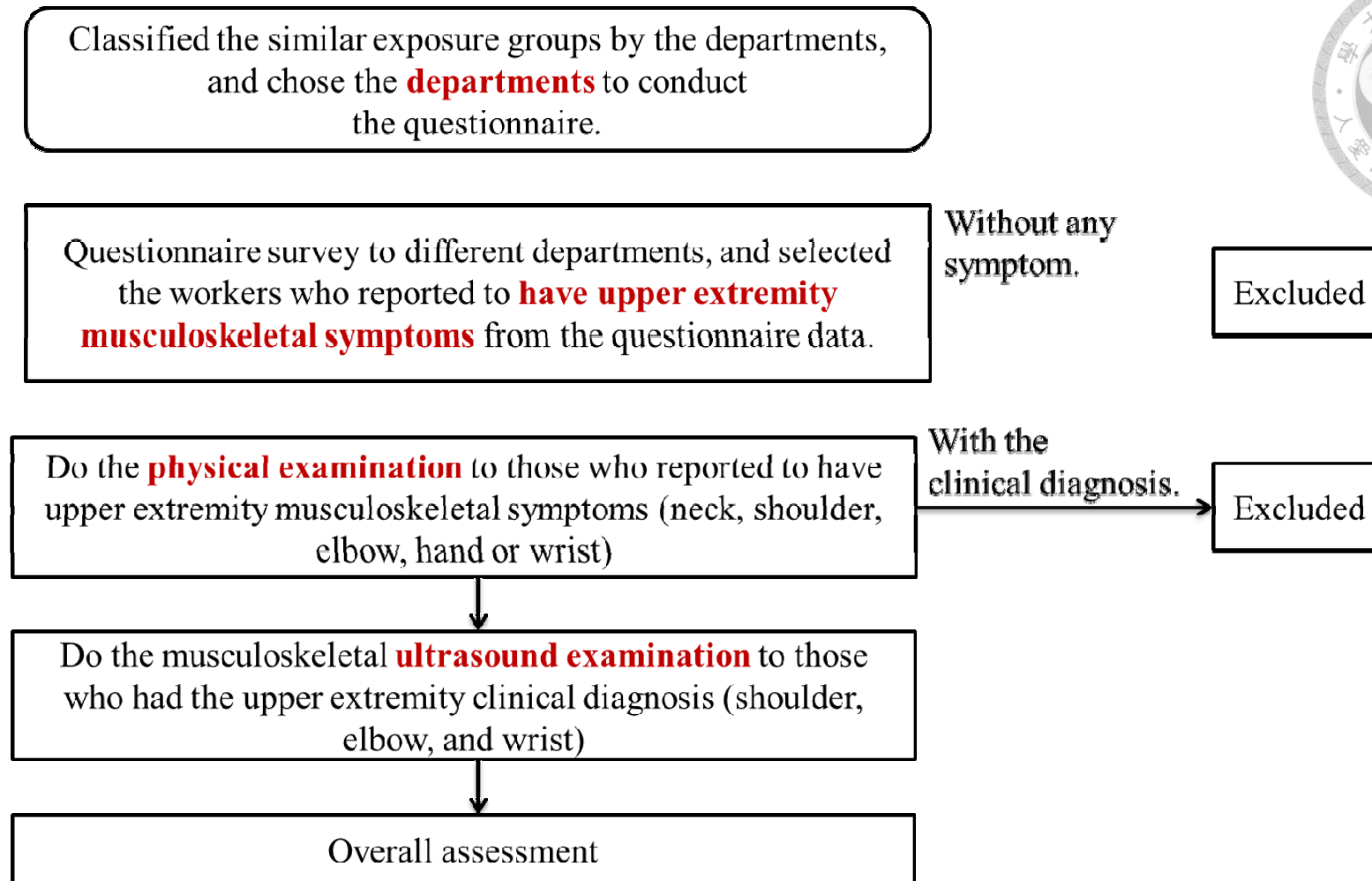


Figure 22. Flow chart of field study

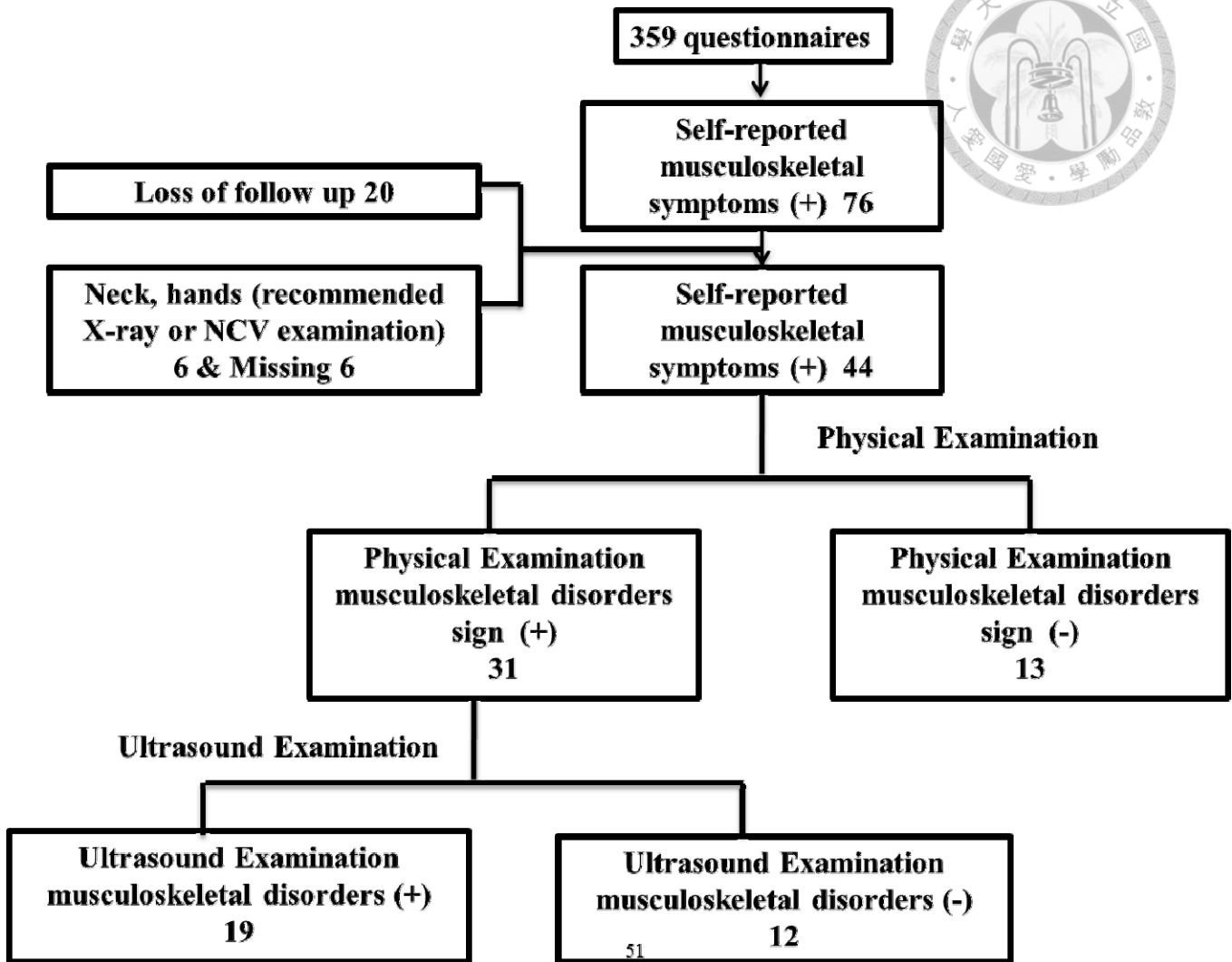
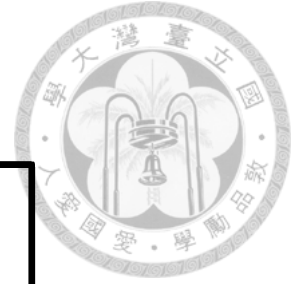


Figure 23. Flow chart of workers inclusion in field study

Appendix

1. Questionnaire of field study



四、請您依「最近一年內」肌肉骨骼任何不適的症狀勾選下表(可複選)：

無任何不適症	不適症狀 (可複選)	不適症狀 (可複選)					症狀持續時間 (單選)						症狀出現頻率 (單選)					影響程度 (單選)						
		1	2	3	4	5	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
	部位	酸	疼	麻	活	肌	一	一	三	半	一	兩	幾	一	一	約	半	完	稍	工	生	嚴	完	
		痛	痛	木	動	肉	個	至	至	年	年	年	乎	週	月	半	年	全	微	作	活	重	全	
					困	無	月	六	六	至	以		每	約	約	以		不	降	能	受	影	不	
					難	力	下	個	個	一	上		天	一	一	上		影	低	力	到	響	動	
								月	月	年				次	次	次		響	工	明	影	生	作	
																		能	作	顯	響	活	能	
																		力	力	降	低	活	力	
上肢	A. 頭部	1	2	3	4	5	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
	B. 肩部(右)	1	2	3	4	5	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
	C. 肩部(左)	1	2	3	4	5	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
	D. 手肘(右)	1	2	3	4	5	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
	E. 手肘(左)	1	2	3	4	5	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
	F. 前臂(右)	1	2	3	4	5	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
	G. 前臂(左)	1	2	3	4	5	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
	H. 手腕(右)	1	2	3	4	5	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
	I. 手腕(左)	1	2	3	4	5	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
	J. 手掌與手指(右)	1	2	3	4	5	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
	K. 手掌與手指(左)	1	2	3	4	5	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
背部 下肢	L. 上背	1	2	3	4	5	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
	M. 下背或腰部	1	2	3	4	5	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
	N. 臀部	1	2	3	4	5	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
	O. 大腿	1	2	3	4	5	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
	P. 膝蓋(右)	1	2	3	4	5	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
	Q. 膝蓋(左)	1	2	3	4	5	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
	R. 小腿(右)	1	2	3	4	5	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
	S. 小腿(左)	1	2	3	4	5	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
	T. 腳踝(右)	1	2	3	4	5	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
U. 腳踝(左)	1	2	3	4	5	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	
V. 其他:	1	2	3	4	5	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	

五、生活習慣

5.1 請問您過去一個月內是否有吸菸？ ① 從未吸菸

① 偶爾吸(不是天天)

② 已經戒菸，戒了 >>> 十位 0 1 2 3 4 5 6 7 8 9 年， 十位 0 1 2 3 4 5 6 7 8 9 個月。

③ (幾乎) 每天吸，平均每天吸 >>> 十位 0 1 2 3 4 5 6 7 8 9 支，

>>> 已吸菸 十位 0 1 2 3 4 5 6 7 8 9 年。

5.2 請問您過去一個月內是否有喝酒？ ① 從未喝酒

① 偶爾喝(不是天天)

② 已經戒酒，戒了 >>> 十位 0 1 2 3 4 5 6 7 8 9 年， 十位 0 1 2 3 4 5 6 7 8 9 個月。

③ (幾乎) 每天喝，平均每天喝 >>> 十位 0 1 2 3 4 5 6 7 8 9 次，

>>> 最常喝 酒，每次 十位 0 1 2 3 4 5 6 7 8 9 杯。

5.3 請問您過去三個月內是否有規律的運動習慣(每次達30分鐘以上)？

① 否 ② 每月1次 ③ 每月2~3次 ④ 每週約1~2次 ⑤ 每週約3~5次 ⑥ 幾乎天天

>>> 5.31 請問您規律運動的項目包括下列何者?(可複選)

① 無 ② 網球 ③ 羽毛球 ④ 桌球 ⑤ 棒球 ⑥ 壘球 ⑦ 籃球 ⑧ 排球 ⑨ 手球
⑩ 高爾夫球 ⑪ 游泳 ⑫ 跑步 ⑬ 健走 ⑭ 騎自行車 ⑮ 其他: _____

5.4 請問您過去六個月內平均一天須花多少時間做家事或照顧幼兒？

① 無 ② 小於2小時 ③ 2至4小時 ④ 4至6小時 ⑤ 大於6小時

六、壓力感受

6.1 請問您最近六個月內生活與工作中所感受的壓力程度如何？

- (1) 婚姻與家庭 → ① 無 ① 輕微 ② 中等 ③ 大 ④ 非常大
- (2) 情感議題 → ① 無 ① 輕微 ② 中等 ③ 大 ④ 非常大
- (3) 人際關係 → ① 無 ① 輕微 ② 中等 ③ 大 ④ 非常大
- (4) 財務經濟 → ① 無 ① 輕微 ② 中等 ③ 大 ④ 非常大
- (5) 工作 → ① 無 ① 輕微 ② 中等 ③ 大 ④ 非常大
- (6) 自我成長/生涯規劃 → ① 無 ① 輕微 ② 中等 ③ 大 ④ 非常大

6.2 整體而言，上述壓力來源對您工作的影響程度如何？

- ① 無 ① 輕微 ② 中等 ③ 大 ④ 非常大

6.3 整體而言，您對您現在的工作滿意程度為何？

- ① 非常不滿意 ② 有些不滿意 ③ 無意見 ④ 有些滿意 ⑤ 非常滿意

七、自覺症狀

7.1 您最近一個月是否常有下列症狀？(可複選)

- ① 咳嗽 ② 咳痰 ③ 呼吸困難 ④ 氣喘 ⑤ 呼吸疾病 ⑥ 胸痛 ⑦ 心悸 ⑧ 心血管疾病
- ⑨ 頭暈 ⑩ 耳鳴 ⑪ 頭痛或偏頭痛 ⑫ 過敏 ⑬ 倦怠 ⑭ 憂鬱、焦慮、或情緒障礙
- ⑮ 噁心 ⑯ 腹痛 ⑰ 便秘 ⑱ 腹瀉 ⑲ 腸胃疾病 ⑳ 血便 ㉑ 上背痛 ㉒ 下背痛
- ㉓ 其他背部或頸部疾病 ㉔ 手脚麻痛 ㉕ 關節炎或關節疼痛/僵硬 ㉖ 排尿不適
- ㉗ 多尿、頻尿 ㉘ 手脚肌肉無力 ㉙ 體重無故減輕3公斤以上
- ㉚ 其他症狀：_____ ㉛ 以上皆無

7.2 續上題- 7.1題回答『以上皆無』者免填，請跳至7.3題繼續作答。

	非常不同意	不同意	不確定	同意	非常同意
(1) 因為上述的健康狀況，我更難應付工作上的壓力。	①	②	③	④	⑤
(2) 儘管有上述的健康狀況，仍能完成工作中艱難的任務。	①	②	③	④	⑤
(3) 上述的健康狀況會分散工作中的樂趣。	①	②	③	④	⑤
(4) 儘管有上述的健康狀況，仍能專注於達成工作目標。	①	②	③	④	⑤
(5) 因為上述的健康狀況，我對某些工作項目之完成感到絕望。	①	②	③	④	⑤
(6) 儘管有上述的健康狀況，仍有足夠精力完成所有的工作。	①	②	③	④	⑤

7.3 您常覺得身體上體力透支(累到完全沒有力氣)嗎？

- ① 從未 ① 不常 ② 有時 ③ 常常 ④ 總是

7.4 您常覺得情緒上心力交瘁(心情上非常累)嗎？

- ① 從未 ① 不常 ② 有時 ③ 常常 ④ 總是

八、自主健康監控量表

◎請表達您「目前」或「現狀」

	非常不符合 ❖	不算很符合 ❖	偶爾不符合 ❖	偶爾符合 ❖	算是符合 ❖	非常符合 ❖
— (1) 我的日常生活有許多讓我感興趣和期待的事。	①	②	③	④	⑤	⑥
— (2) 家人最近常用不了解我的方式來照顧我和要求我。	①	②	③	④	⑤	⑥
— (3) 近來我起床時都很勉強，覺得沒有甚麼事情能吸引我的注意。	①	②	③	④	⑤	⑥
— (4) 遇到阻礙和情緒危機時，我不習慣求援或聲張，盡量自己默默承受。	①	②	③	④	⑤	⑥
— (5) 最近與我人生相關的許多重要事情，大多是由別人決定和操縱。	①	②	③	④	⑤	⑥
— (6) 最近我覺得要獲得家人或朋友的了解，是一件很不容易的事。	①	②	③	④	⑤	⑥
— (7) 目前我的生活和工作方式，讓我覺得已經失去了自我感。	①	②	③	④	⑤	⑥
— (8) 最近我的食慾和體重都頗穩定，不太會隨著突發的生活事件改變。	①	②	③	④	⑤	⑥
— (9) 社會上眾多既得利益者之作為，常引發我極高度的厭惡和憤怒。	①	②	③	④	⑤	⑥
— (10) 近來我的睡眠狀況不太理想，常覺得睡不安穩或睡不飽。	①	②	③	④	⑤	⑥
— (11) 從以往的經驗，我認為自己算是個很能以正面想法來應付壓力的人。	①	②	③	④	⑤	⑥
— (12) 即使沒有甚麼理由，我也常會想很多、覺得緊張、不能放鬆。	①	②	③	④	⑤	⑥
— (13) 和其他同年齡的人比起來，我覺得我目前的狀態還很不錯。	①	②	③	④	⑤	⑥
— (14) 我會看到一些別人看不到的東西，或聽到一些別人沒有聽到的聲音。	①	②	③	④	⑤	⑥
— (15) 我很在意最近常有別人胡亂批評我的缺點。	①	②	③	④	⑤	⑥
— (16) 最近我很討厭一些老是對別人表示善意的人，因為看起來很假惺惺。	①	②	③	④	⑤	⑥
— (17) 如果我現在遇到很大的挫折或困難，至少會有幾個朋友或家人可以幫忙。	①	②	③	④	⑤	⑥
— (18) 目前為止，我覺得自己活得還不錯，頗有趣味。	①	②	③	④	⑤	⑥

九、請評估您過去一星期內從事下列活動的能力，並塗圈適當的答案數字。

- (1) 打開緊閉或新的瓶罐。 ① 毫無困難 ② 有點困難 ③ 中等困難 ④ 非常困難 ⑤ 無法做到
- (2) 提購物袋或公事包。 ① 毫無困難 ② 有點困難 ③ 中等困難 ④ 非常困難 ⑤ 無法做到
- (3) 洗身體背部。 ① 毫無困難 ② 有點困難 ③ 中等困難 ④ 非常困難 ⑤ 無法做到
- (4) 用刀子切食物。 ① 毫無困難 ② 有點困難 ③ 中等困難 ④ 非常困難 ⑤ 無法做到
- (5) 從事費力的家務，如：清洗牆壁、地板。
① 毫無困難 ② 有點困難 ③ 中等困難 ④ 非常困難 ⑤ 無法做到
- (6) 從事手臂、肩膀或手部要用到一些力氣、或受到衝擊的休閒活動，如：打高爾夫、打網球等。
① 毫無困難 ② 有點困難 ③ 中等困難 ④ 非常困難 ⑤ 無法做到
- (7) 過去一星期，您手臂、肩膀、或手部的問題，對您與家人、朋友、鄰居、或團體等平常的社交活動，影響到什麼程度？
① 完全沒有影響 ② 有一點影響 ③ 中等程度影響 ④ 非常影響 ⑤ 極度影響
- (8) 過去一星期，是否由於手臂、肩膀、或手部的問題，而在工作或其他日常活動受限？
① 完全沒有限制 ② 有一點限制 ③ 中度限制 ④ 非常限制 ⑤ 無法做到
- (9) 過去一星期，手臂、肩膀、或手部感覺疼痛？
① 完全沒有 ② 有一點 ③ 中度程度 ④ 非常疼痛 ⑤ 極度疼痛
- (10) 過去一星期，手臂、肩膀、或手部感覺刺痛？
① 完全沒有 ② 有一點 ③ 中等程度 ④ 非常刺痛 ⑤ 極度刺痛
- (11) 過去一星期，由於手臂、肩膀、或手部的疼痛，您有多難入睡？
① 毫無困難 ② 有點困難 ③ 中等困難 ④ 非常困難 ⑤ 難到我睡不着



2. Scandinavian criteria of physical examination

肌肉骨骼系統理學檢查評估紀錄表

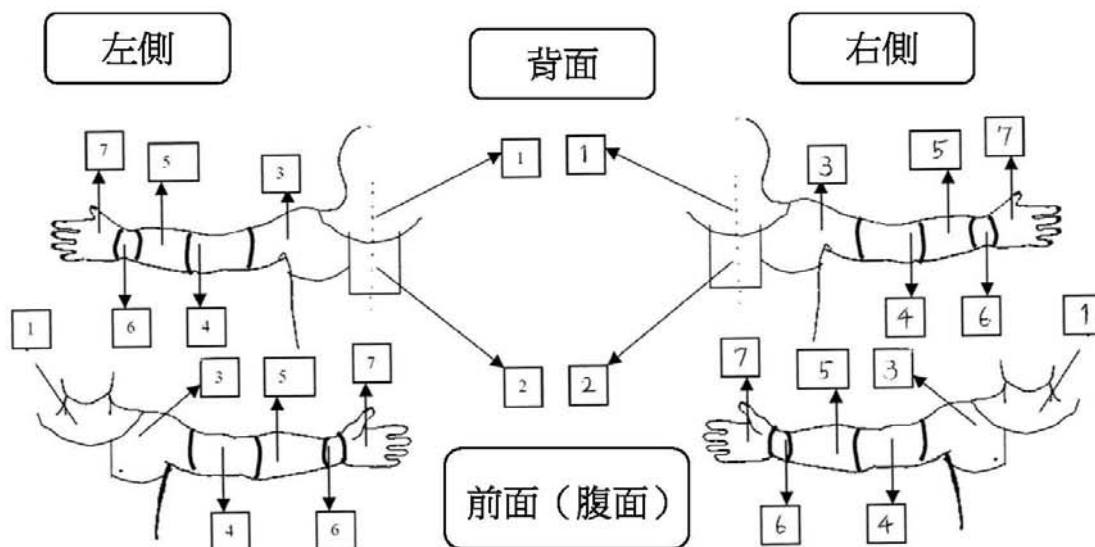
1. 基本資料：

1.1 姓名：_____ 1.2 工號：_____ 1.3 部門：_____

1.4 職稱：_____ 1.5 您到目前工作站的日期：民國____年____月____日

2. 上肢的不適部位：

2.1 請依據 您最近一星期內上肢不適的部位，於下圖數字上劃一個圈（可複選），若有大於一個不適的部位，請於「最不適或最困擾您」的部位劃多劃一個圈



2.2 請問您是否有？上肢關節上或關節旁的疼痛或僵硬症狀？ 否 是，若是，為何部位？

手指 腕關節 肘關節 其他，請說明：_____

-----以下由醫師填寫-----

3. 請醫師依據上述勾選之上肢不適的部位，於下表中「需評估的疾病名稱」前勾選（可複選）

需評估的疾病代號與名稱	身體部位				
	Neck region	Shoulder- upper arm region	Elbow region	Forearm region	Wrist-hand region
Specific UEMSD*					
11	Carpal tunnel syndrome				X (ventral)
12	Guyon's canal syndrome				X (ulnar)
10	Quervain's disease			X (radial)	X (radial)
9	Flexor-extensor peritendinitis or tenosynovitis of forearm-wrist			X	X
8	Radial tunnel syndrome		X (dorsal)	X (dorsal)	
6	Lateral-medial epicondylitis		X		
7	Cubital tunnel syndrome		X (ulnar)	X (ulnar)	X (ulnar)
5	Rotator cuff syndrome				
4	Radiating neck complaints	X			
Nonspecific UEMSD*					
		X	X	X	X

請醫師依據上述「需評估的疾病」來作相關之症狀詢問與理學檢查：

4. RADIATING NECK COMPLAINTS

- 4.1 At least intermittent pain or stiffness in the neck and pain or paresthesias in \geq One upper extremity regions in association with head movements Yes No
- 4.2 Yes No “Symptoms present now or on at least 4 days during the last 7 days”
- 4.3 Photo 1 (+)(-) 4.4 Photo 2 (+)(-)

5. ROTATOR CUFF SYNDROME

- 5.1 At least intermittent pain in the shoulder region without paresthesias Yes No
- 5.2 Worsened by active elevation movement of the upper arm, as in scratching the upper back Yes No
- 5.3 Yes No “Symptoms present now or on at least 4 days during the last 7 days”
- 5.4 Photo 3 (+)(-) 5.5 Photo 4-6 [Rt (+)(4,5,6)(-); Lt (+)(4,5,6)(-)]
- 5.6 Photo 7-10 [Rt (+)(7,8,9,10)(-); Lt (+)(7,8,9,10)(-)]

6. LATERAL AND MEDIAL EPICONDYLITIS

- 6.1 At least intermittent, activity dependent pain directly located around the lateral or medial epicondyle Yes No
- 6.2 Yes No “Symptoms present now or on at least 4 days during the last 7 days”
- 6.3 Photo 11 [Rt (+)(-); Lt (+)(-)] 6.4 Photo 12 [Rt (+)(-); Lt (+)(-)]

7. ULNAR NEUROPATHY AT THE ELBOW: CUBITAL TUNNEL SYNDROME

- 7.1 At least intermittent paresthesias in the 4th or 5th digit or both or on the ulnar border of forearm, wrist, or hand Yes No
- 7.2 Yes No “Symptoms present now or on at least 4 days during the last 7 days”
- 7.3 Photo 14 [Rt (+)(-); Lt (+)(-)]

8. RADIAL NERVE COMPRESSION

- 8.1 Pain in the lateral elbow region or forearm muscle mass of wrist extensors-supinator Yes No
- 8.2 Weakness on extending the wrist and fingers Yes No
- 8.3 Yes No “Symptoms present now or on at least 4 days during the last 7 days”
- 8.4 Tenderness in supinator area on palpation over the radial nerve, 4-7 cm distal to the lateral epicondyle Yes No
- 8.5 Photo 13 [Rt (+)(-); Lt (+)(-)] 8.6 Photo 15 [Rt (+)(-); Lt (+)(-)]
- 8.7 Photo 18 [Rt (+)(-); Lt (+)(-)]

9. FLEXOR-EXTENSOR PERITENDINITIS OR TENOSYNOVITIS

- 9.1 Intermittent pain-ache in the ventral or dorsal forearm or wrist region Yes No
- 9.2 Yes No “Symptoms present now or on at least 4 days during the last 7 days”
- 9.3 Yes No Reproduction of pain during palpation of the affected tendons or palpable crepitus under the symptom area or visible swelling of the dorsum wrist-forearm
- 9.4 Photo 16 [Rt (+)(-); Lt (+)(-)] 9.5 Photo 17 [Rt (+)(-); Lt (+)(-)]

10. DE QUERVAIN'S DISEASE

- 10.1 Intermittent pain or tenderness localized over the radial side of the wrist; either may radiate to the forearm or distally

to the thumb Yes No

10.2 Yes No “Symptoms present now or on at least 4 days during the last 7 days”

10.3 Photo 19 [Rt (+)(-); Lt (+)(-)] 10.4 Photo 20 [Rt (+)(-); Lt (+)(-)]

10.5 Photo 21 [Rt (+)(-); Lt (+)(-)]

10.6 Trigger finger

10.6.1 Intermittent pain over finger with/without locking; pain aggravated by motion or tenderness localized around the metacarpophalangeal area Yes No

10.6.2 Yes No “Symptoms present now or on at least 4 days during the last 7 days”

10.6.3 locking [Rt (+)(-); Lt (+)(-)];

tenderness localized around the metacarpophalangeal area [Rt (+)(-); Lt (+)(-)];

active finger flexion induce pain [Rt (+)(-); Lt (+)(-)]

11. CARPAL TUNNEL SYNDROME

11.1 Intermittent paresthesias or pain in at least 2 of digits I, II, or III;

either may be present at night as well Yes No

11.2 Yes No “Symptoms present now or on at least 4 days during the last 7 days”

11.3 Photo 20 [Rt (+)(-); Lt (+)(-)] 11.4 Photo 25 [Rt (+)(-); Lt (+)(-)]

11.5 Photo 26 [Rt (+)(-); Lt (+)(-)] 11.6 Photo 27 [Rt (+)(-); Lt (+)(-)]

11.7 Photo 28 [Rt (+)(-); Lt (+)(-)]

12. ULNAR NERVE COMPRESSION AT THE WRIST: GUYON'S CANAL SYNDROME

12.1 Intermittent paresthesias in the palmar ulnar nerve distribution of the hand, distal to the wrist Yes No

12.2 Pain in the palmar ulnar innervated area of the hand; pain may radiate to the forearm Yes No

12.3 Yes No “Symptoms present now or on at least 4 days during the last 7 days”

12.4 Photo 22 [Rt (+)(-); Lt (+)(-)] 12.5 Photo 23 [Rt (+)(-); Lt (+)(-)]

13. OSTEOARTHRITIS OF DISTAL JOINTS OF THE UPPER EXTREMITIES

13.1 Intermittent pain, locally or around the joint Yes No

13.2 Local stiffness after a rest period or specific movement related triggering cause Yes No

13.3 Yes No “Symptoms present now or on at least 4 days during the last 7 days”

13.4 Yes No “Symptoms present on at least 4 days during at least 1 week in the last 12 months”

13.5 Capsular pattern in restricted passive movements of the joints involved Yes No

理學檢查結果：

診斷為：_____

不做 ECHO 之診斷	建議作 ECHO 進一步檢查
<input type="checkbox"/> 4. RADIATING NECK COMPLAINTS 建議頸部 X 光檢查 <input type="checkbox"/> 8. RADIAL NERVE COMPRESSION 建議肌電圖檢查 <input type="checkbox"/> 13. OSTEOARTHRITIS 建議手部 X 光檢查	部位： <input type="checkbox"/> Lt Shoulder <input type="checkbox"/> Right shoulder <input type="checkbox"/> Lt elbow <input type="checkbox"/> Right elbow <input type="checkbox"/> Lt wrist <input type="checkbox"/> Right wrist <input type="checkbox"/> Other site, please specify: _____