



UNIVERSITI PUTRA MALAYSIA

***RISK ASSESSMENT OF MANUAL HANDLING AMONG WORKERS IN
RETAIL STORE INDUSTRY***

**BY:
NUR AZREEN BINTI AZIZAN**

**Ip
FPSK4 2012 35**

ACKNOWLEDGEMENT

Praise be to Allah SWT for all His blessings and guidance this project could be completed. Thank you, I extend to Prof. Dr. Zailina Hashim as the supervisor of this project for all the advice, guidance and instruction was given and the project. Appreciation is also dedicated Lisa Putriku Diana binti Ab Kahar, Aqma Madiha Binti Mazelan and all minimarket workers at Cheras district who has given the necessary cooperation in this project. Special thanks also to my parents and friends for all the help, cooperation in succeeding in this project. Finally, an infinite gratitude I wish to all involved in this study, either directly or indirectly.

ABSTRACT

RISK ASSESSMENT OF MANUAL HANDLING AMONG WORKERS IN RETAIL STORE INDUSTRY

NUR AZREEN AZIZAN

Introduction: In this study, lifting and carrying score of minimarket worker as well as the musculoskeletal disorder risk assessment were determined among minimarket worker around Cheras district. There were 87 respondents involved in this study; consisting of cashier, storekeeper and meat cutter. **Objective:** This study was conducted for the purpose of determining the hazard and health problem of manual handling among workers in retail industry. **Method:** The Manual Handling Assessment Charts Method were used to evaluate the lifting and carrying procedure, Rapid Entire Body Assessment Method were used to evaluate the posture of workers while doing their daily work and Nordic Questionnaire were used to identify body area with pain or discomfort during the last 12 month and 7 days. **Result:** Result showed the scores of lifting and carrying for male and female cashier and female storekeeper were low. The male storekeeper and meat cutter had medium scores. The work posture scores for both male and female cashier and female storekeeper were low, while the male storekeeper and meat cutter had medium scores. There was a relationship between the carry distances of load with musculoskeletal disorder for male storekeeper at the hand and upper back region. There was a significant relationship between the hand distances to the low back while carrying load with musculoskeletal disorder among female storekeeper in the hand region. The risks of manual material handling by worker were between low and medium according to work type. **Conclusion:** In conclusion, the risks of manual handling among worker were still at acceptable limit but actions should be taken to reduce further risk.

Keywords: Manual Handling; Musculoskeletal disorder; Retail industry; Risk assessment.

ABSTRAK

PENILAIAN RISIKO PENGENDALIAN MANUAL KALANGAN PEKERJA
DALAM INDUSTRI PERUNCITAN

NUR AZREEN AZIZAN

Pengenalan: Dalam kajian ini, skor bagi mengangkat dan membawa dikalangan pekerja minimarket serta penilaian risiko masalah muskuloskeletal telah ditentukan di kalangan pekerja minimarket sekitar daerah Cheras. Terdapat 87 orang responden terlibat dalam kajian ini terdiri daripada juruwang, penjaga stor dan pemotong daging. **Objektif:** Kajian ini dijalankan bagi tujuan menentukan bahaya dan masalah kesihatan pengendalian manual di kalangan pekerja dalam industri peruncitan. **Kaedah:** Carta Kaedah Penilaian Pengendalian Manual telah digunakan untuk menilai mengangkat dan menjalankan prosedur, Kaedah Penilaian Seluruh Badan Rapid telah digunakan untuk menilai postur pekerja semasa melakukan kerja harian mereka dan Soal Selidik Nordic telah digunakan untuk mengenal pasti kawasan badan dengan kesakitan atau ketidakselesaan semasa 12 bulan yang lalu dan 7 hari. **Keputusan:** Keputusan menunjukkan skor mengangkat dan membawa untuk juruwang lelaki dan perempuan dan penjaga stor wanita adalah rendah. Penjaga stor lelaki dan pemotong daging mempunyai skor yang sederhana. Skor postur kerja untuk juruwang kedua-dua lelaki dan perempuan dan penjaga stor wanita adalah rendah, manakala penjaga stor lelaki dan pemotong daging mempunyai skor yang sederhana. Terdapat hubungan antara jarak pembawa beban dengan gangguan muskuloskeletal untuk penjaga stor lelaki di kawasan tangan dan bahagian atas belakang. Terdapat hubungan yang signifikan antara jarak tangan ke belakang rendah sambil membawa beban dengan gangguan muskuloskeletal di kalangan penjaga stor wanita di kawasan tangan. Risiko pengendalian bahan manual oleh pekerja adalah di antara rendah dan sederhana mengikut jenis pekerjaan. **Kesimpulan:** Kesimpulannya, risiko pengendalian manual di kalangan pekerja masih pada had yang boleh diterima tetapi tindakan perlu diambil untuk mengurangkan risiko tersebut.

Kata Kunci: Manual Pengendalian, gangguan Muskuloskeletal; industri peruncitan, penilaian risiko.

CONTENT

	PAGES
Declaration	i
Approval	ii
Acknowledgement	iii
Abstract	iv
Abstrak	v
Content	vi
List of Tables	xiii
List of Figures	xv
List of Appendices	xvi
List of Abbreviations	xvii
1.0 CHAPTER 1: INTRODUCTION	
1.1 Background	1
1.2 Problem Statement	6
1.3 Study Justification	7

1.4	Conceptual Framework	8
1.5	Objective	10
1.5.1	General Objective	10
1.5.2	Specific Objective	10
1.6	Hypothesis	11
1.7	Definition of Variable	11
1.7.1	Conceptual definition	12
1.7.2	Operational Definition	14

2.0 CHAPTER 2: LITERATURE REVIEW

2.1	Manual Handling Activities in Retail Industry	16
2.2	Hazard of Manual Handling in Different Types of Works	17
2.3	Relationship between Musculoskeletal Disorders with Carry Distance	20
2.4	Relationship between Musculoskeletal Disorder with Hand Distance from Low Back While Carry Load.	21
2.5	Relationship between Musculoskeletal Disorders with Body Posture	22

2.6	Various contributing factors that effecting musculoskeletal disorder	23
-----	--	----

3.0 CHAPTER 3: METHODOLOGY

3.1	Study location	25
3.2	Study Design	26
3.3	Study Population	26
3.4	Study Sample	27
3.5	Sample Frame	27
3.6	Sampling Method	27
3.7	Sample Size	29
3.8	Instrumentation	30
3.8.1	Questionnaire	30
3.8.2	REBA (Rapid Entire Body Assessment)	30
3.8.3	Standardized Nordic Questionnaire (SNQ)	35
3.9	Data Collection and Measurement	36
3.9.1	Questionnaire on risk factors	36
3.10	Data Analysis	37
3.10.1	SPSS	37
3.10.2	Risk Assessment	37
3.11	Quality Control	43

3.12	Study Limitation	43
3.13	Ethical Approval	44

4.0 CHAPTER 4: RESULT

4.1	Socio-demographic Data of Respondents	45
4.2	Manual Handling Assessment Chart Score	48
4.3	Posture assessment of worker during performing manual handling task	49
4.4	Correlation between carry distances of load with musculoskeletal disorder among worker	51
4.5	Correlation between hand distance from low back while carry load with musculoskeletal disorder among worker	55
4.6	Correlation between body postures with musculoskeletal disorder among worker	59
4.7	Contributing factors influencing musculoskeletal disorder among worker at various body region	60
4.7.1	Contributing factors influencing musculoskeletal disorder among worker at neck region.	60

4.7.2	Contributing factors influencing musculoskeletal disorder among worker at shoulders region	61
4.7.3	Contributing factors influencing musculoskeletal disorder among worker at elbows region	62
4.7.4	Contributing factors influencing musculoskeletal disorder among worker at wrists/hands region	62
4.7.5	Contributing factors influencing musculoskeletal disorder among worker at upper back region	63
4.7.6	Contributing factors influencing musculoskeletal disorder among worker at lower back region	65
4.7.7	Contributing factors influencing musculoskeletal disorder among worker at thighs/hips region	67
4.7.8	Contributing factors influencing musculoskeletal disorder among worker at knees region	67
4.7.9	Contributing factors influencing musculoskeletal disorder among at ankles/feet region.	70

5.0 CHAPTER 5: DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 DISCUSSION

5.1.1	Socio-demographic of respondents	72
5.1.2	Respondents job description	74

5.1.3	Manual Handling Assessment Chart Score	76
5.1.4	Posture assessment of worker during performing manual handling task	80
5.1.5	Correlation between carry distances of load with musculoskeletal disorder among worker	81
5.1.6	Correlation between hand distance from low back while carry load with musculoskeletal disorder among worker	82
5.1.7	Correlation between body postures with musculoskeletal disorder among worker	83
5.1.8	Correlation between hand distance from low back while carry load with musculoskeletal disorder among worker.	84
5.1.9	Various contributing factors that influencing musculoskeletal disorder among worker	86
5.2	Conclusion	88
5.3	Limitation	90
5.3	Recommendation	90

REFERENCE	93
------------------	-----------

APPENDIXES	98
-------------------	-----------

LIST OF TABLES

	Page
Table 4.1: Socio-demographic distribution of respondents	47
Table 4.2: Work information	48
Table 4.3: MAC score for lifting and carrying task	49
Table 4.4: REBA score for posture assessment.	50
Table 4.5: The correlation between carrying distances of load among cashier with musculoskeletal disorder of respondent.	52
Table 4.6: The correlation between carrying distances of load among storekeeper with musculoskeletal disorder of respondent.	53
Table 4.7: The correlation between carrying distances of load among meat cutter with musculoskeletal disorder of respondent	54
Table 4.8: The correlation between hand distances from lower back while carrying load among cashier with musculoskeletal disorder of respondent.	56
Table 4.9: The correlation between hand distances from lower back while carrying load among storekeeper with musculoskeletal disorder of respondent	57

Table 4.10:	The correlation between hand distances from lower back while carrying load among meat cutter with musculoskeletal disorder of respondent.	58
Table 4.11:	Factors influencing the musculoskeletal disorder among worker at upper back region.	63
Table 4.12:	Factors influencing the musculoskeletal disorder among worker at lower back region.	65
Table 4.13:	Factors influencing the musculoskeletal disorder among worker at knees region.	68
Table 4.14:	Factors influencing the musculoskeletal disorder among worker at ankles/feet region.	70

LIST OF FIGURES

	Page
Figure 1.1: Conseptual Framework	9
Figure 3.1: REBA : Trunk Score	32
Figure 3.2: REBA: Neck Score	32
Figure 3.3: REBA: Legs Score	33
Figure 3.4: REBA: Upper Arms	33
Figure 3.5: REBA: Lower Arms	34
Figure 3.6: REBA: Wrist	34
Figure 3.7: MAC score categories	40
Figure 3.8: Lifting assessment chart	41
Figure 3.9: Carrying assessment chart	42
Figure 5.1: A posture of wrists/hands region where arms were push outward	85

LIST OF APPENDICES

Appendix 1: Ethic Approval Letter

Appendix 2: Application Letter for the permission of Conducts the Research

Appendix 3: Information Sheet

Appendix 4: Concern Form

Appendix 5: Questionnaire

Appendix 6: Manual Handling Assessment Chart Instruction



LIST OF ABBREVIATIONS

CTD	Cumulative Trauma Disorder
DOSH	Department of Safety and Health
MAC	Manual Handling Assessment Chart
MMH	Manual Material Handling
MSD	Musculoskeletal Disorder
N/A	Negligible
REBA	Rapid Entire Body Assessment
RSI	Repetitive Stress Injuries
SD	Standard Deviation
SNQ	Standardize Nordic Questionnaire
SPSS	Statistical Package for Social Science

CHAPTER 1

INTRODUCTION

1.1 Background

Retail industry is a one of the commercial sector that has contributed significantly to Malaysia GDP. Retailing is directly refers to all activities related to the selling of small quantities of goods and services, at a profit, to the ultimate customers for personal consumption and non-business use (Straker, 2003; Mohd-Said, 1990). Retail trading comprise of wide variety of goods and services, which include from household items to food and accessories. (Straker, 2003; Ahmad et. al., 1996; Nik Yacob et. al., 1992; Cox, 1988) In Malaysia retail trade has separated into small-scale and large-scale establishments. The small-scale retailers include the single-propriety stores and non-store operators such as hawkers, peddlers and market stalls and the large-scale retailers

include superstore, discount store, department store, supermarket, hypermarket and shopping center. Four major categories of retailing can be found operating in all large cities in Malaysia that is included:

- The informal sector, which includes hawkers and peddlers selling fresh produce, cooked food and daily requirement in the designated morning market, wholesale market and enclosed market.
- The small-scale, single-proprietorship shops along major roads in town areas. These premises are usually double or three-storey pre-war shophouses with retail activities on the ground floor and dwelling units in the upper floors. Examples of such trading include jewellery, spices and religious paraphernalia, clothing apparel, handbags, personal items and medicinal herbs and coffee shops.
- The large-scale department stores and supermarkets built in the late 1970s and early 1980s, generally in modern architectural style.
- The super regional shopping centers built in the late 1980s and beyond, which feature several department stores and small-scale shops located under one roof. Such commercial complexes also provide for leisure and social activities along with shopping. The architectural styles of these modern shopping complexes, with glass frames, atrium and pitched roof, stood in contrast to the existing traditional architectural landscape in the immediate surrounding area.

Few minimarkets that have been established in Malaysia are 7-Eleven store, 99speedmart and KK store. Retail has been one of the most active sub-sectors in the Malaysian economy today and retail is the second biggest contributor to Malaysia GDP, its contributing RM31,081 million in 2000(Eighth Malaysia Plan, 2001). This sub-sector as a whole contributed 14.9% to the national income in 2000, rising from 11.1% in 1999. About 1.6 million people were employed in this sector in 2000 or 17.1% of total employment in Malaysia. This figure is estimated to increase to 1.9 million (17.3%) in 2005 (Eighth Malaysia Plan, 2001). By this standard it is anticipated that retail trade will continue to be a prominent economic activity in the country. Thus making the retail industry is important to look and the welfare of the worker that works in the industry is well provided.

Manual Handling involves more than just the lifting and/or carrying of weights. It can include any activity requiring the use of force exerted by a person to lift, push, pull, carry or otherwise move or restrain any moving or stationary object. Only a very small number of manual handling injuries are caused by lifting heavy weights. Often, seemingly simple activities such as repetitive reaching, twisting and bending, as well as poor sitting, standing and typing postures can contribute to an injury occurrence. Most manual task risk factors that present at supermarket work setting include:

- handling heavy, bulky or awkward loads
- holding loads/ arms away from trunk
- twisting back, neck or upper body
- reaching and load handling at low levels and above shoulder height
- repetitive movements
- strenuous lifting, lowering, carrying, pushing and pulling
- load handling on one side
- sustained and repetitive gripping
- inadequate task variety or breaks
- working under time pressures
- working in cold environments
- postural or movement constraints due to working in narrow or obstructed work areas

Many manual handling can cause many type of injury manual tasks include sprains and strains and most common at the muscles, ligaments and tendons supporting the shoulders, back and neck; hernias; and disc injuries to the spine. Such injuries are a major cause of lost time at work. Injuries can be the result of gradual wear and tear, or sudden damage due to a single lift of something very heavy or awkward to handle, or from an unexpected event that result in injury. In the 2008-2009 financial year, workers

compensation claims from injuries that resulted from “body stressing” made up 37.6% of all lost time claims in Western Australia, with an average lost time duration of 90.5 days. When manual task injury data is combined with slips, trips and falls injury data, the supermarket industry accounts for higher numbers of lost time injuries to sales assistants and store persons than any other industry in Western Australia.

A risk assessment is the process of determining whether there is a risk associated with an identified hazard, that is, whether there is any likelihood of injury or harm. The process should include consultation with people involved in the task, as well as consideration of the, experience and training of the operator, individual tasks to be performed and the length of time the operator is exposed to the identified hazards. This study will use the method to identify risk of manual handling among supermarket worker that involving this activity in their daily work task so that it can be assessed and control in the future.

1.2 Problem Statement

Manual handling is one of various work tasks that present in every day work procedure of a worker working in supermarket. The nature of manual handling if it is not performed in a proper way it will lead to health problem related to manual handling such as, musculoskeletal disorder, joint pain, fatigue, disc injury to the spine and stress. Other than that manual handling task such as lifting heavy load is not the only cause of injury. It may also be an outcome from dropping the load which can lead to physical injury such as laceration, crush injuries or fracture while doing manual handling. Manual materials handling (MMH) is the leading source of private sector workers' compensation claims (Murphy et al., 1996).

1.3 Study Justification

Due to the fact that manual handling are necessary task to be carried out by the worker and from doing the task the workers may contract a health problem, thus this assessment is appropriate to be conduct. So that the hazard present at the work place due to manual handling can be identified, assess and a proper solution to overcome the problem can be addressed.

1.4 Conceptual Framework

As showed in Figure 1.1 retail industry divide into four section and minimarket fall under small-scale shop. Cashier, storekeeper and meat cutter were among types of workers involve with manual handling and at risk in developing musculoskeletal disorder. Among health effect raised from manual handling activities related to musculoskeletal disorder was low back pain, upper limb disorder, neck and shoulder pain and wrist pain. To identify body region that were in pain Nordic questionnaire was used. Among influencing factors that look in this research were carrying distance, hand distance from lower back and body posture. Age, gender, previous health status and sport involvement among influencing factors that may contribute to musculoskeletal disorder development.

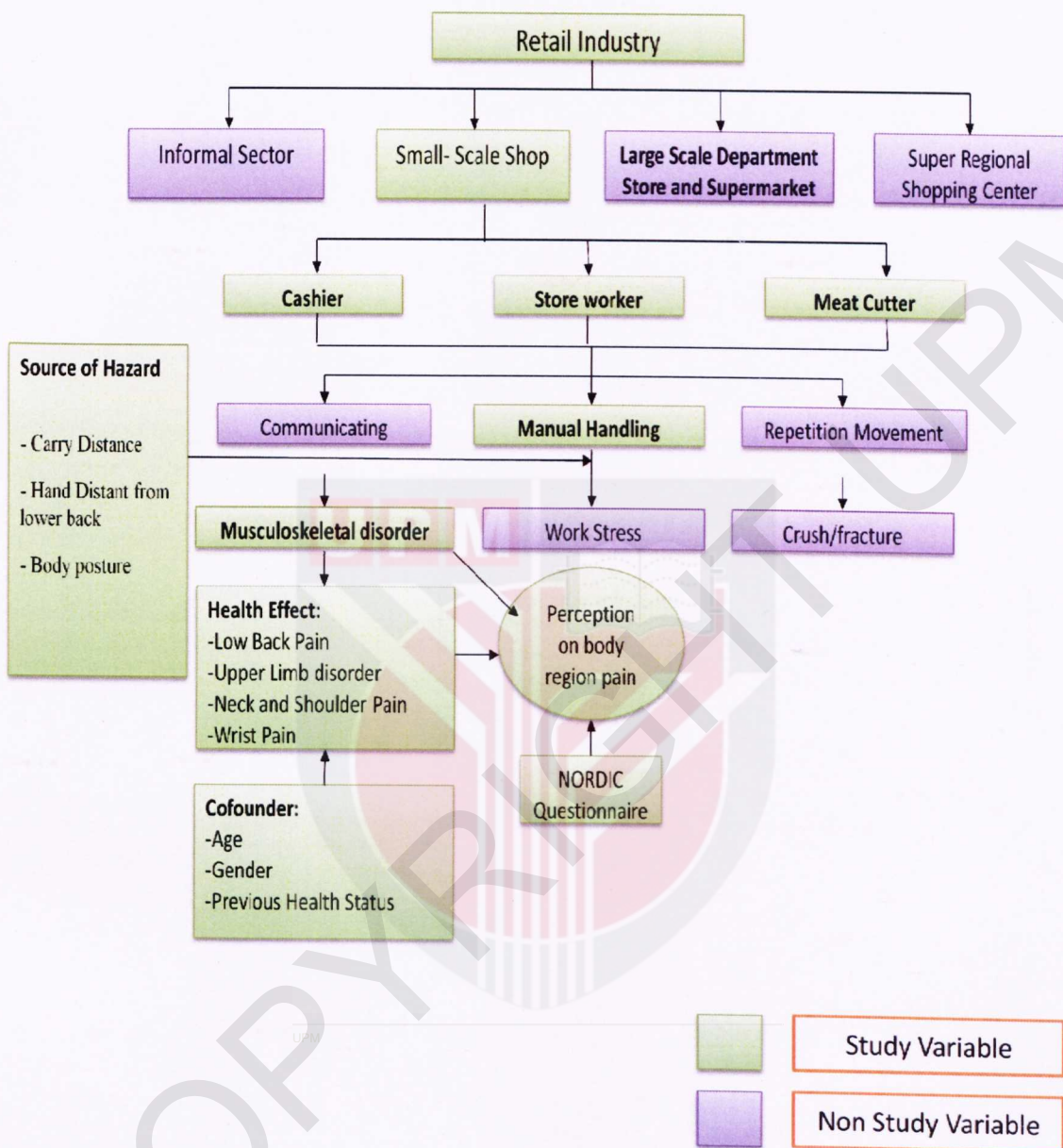


Figure 1.1: Conceptual Framework

1.5 Objective

1.5.1 General Objective

To determine the hazard and health problem of manual handling among workers in retail industry.

1.5.2 Specific Objective

- i. To identify hazards of manual handling among various types of minimarket workers
- ii. To identify the posture of worker while conducting manual handling.
- iii. To determine the correlation between musculoskeletal disorder with carry distance of load.
- iv. To determine the correlation between musculoskeletal disorder with hand distance from low back while carry load.
- v. To determine the correlation between musculoskeletal disorder with body posture.

- vi. To determine the risk factors influencing the musculoskeletal disorder in various body regions.

1.6 Hypothesis

- i. There is correlation between musculoskeletal disorder with carry distance of load.
- ii. There is correlation between musculoskeletal disorder with hand distance from low back while carry load.
- iii. There is correlation between musculoskeletal disorders with body posture.
- iv. Age and gender are the factors influencing the musculoskeletal disorder in various body regions.

1.7 Definition of Variable

1.7.1 Conceptual definition

Risk Assessment

The process of evaluating the risks of safety and health submerses from hazards at work. Risk means a combination of the likelihood of an occurrence of a hazardous event with specified period or in specified circumstances and the severity of injury or damage to the health of people, property, environment or any combination of these caused by the event (DOSH 2008). Manual handling hazards identification can be determine using Manual handling assessment charts.

Manual Handling

Manual tasks refer to any activity that requires a person to use their physical body (musculoskeletal system) to perform work. It includes manual handling (the use of force in lifting, lowering, pushing, pulling, carrying or otherwise moving, holding or restraining any person, animal or thing); repetitive actions; adopting awkward or sustained postures and tasks that expose workers to vibration.

Retail Industry

Retailing is directly refers to all activities related to the selling of small quantities of goods and services, at a profit, to the ultimate customers for personal consumption and non-business use (Lim, 2003).

1.7.2 Operational Definition

Risk Assessment

The Manual Handling Assessment Charts (MAC) is designed to assess the most common risk factors in lifting (and lowering), carrying and team handling operations. By using the assessment guide and flow chart the level of risk for each risk factor can be determine.

Manual Handling

Manual tasks been done via worker at minimarket that need them to use their physical body to perform work. It includes the use of force in lifting, lowering, carrying or otherwise moving, holding or restraining any person. It also looks at repetitive actions and adopting awkward or sustained postures and tasks that expose workers to vibration. And if any of this action are present in one work cycle in eight hour working time it consider that the work task are at risk due to manual handling.

Retail Industry

The study directly looks into only minimarket industry. Retailing is directly refers to activities related to the selling of grocery item such as can food, vegetable, raw meat and dairy items. In this study the warehouse superstore part of the network of retail stores will be look into to conduct this assessment.



CHAPTER 2

LITERATURE REVIEW

2.0 Literature Review

2.1 Manual Handling Activities in Retail Industry

Manual handling is common within the retail industries and may involve specific tasks such as using power tools above shoulder level or laying boxes on high surfaces (Darren *et al*, 2010). The service and retail sectors offer a broad range of jobs and tasks. Retail means the handling and/or processing of food and its storage at the point of sale

or delivery to the final consumer (European Agency for Safety and Health at Work, 2002).

It is well known that manual materials handling is a hazardous activity, particularly for the low back (Kumar, 1994). Service and retail workers are particularly at risk from back and upper limb disorders, including muscle strains and back injuries, tendonitis, carpal tunnel syndrome, rotator cuff injuries, epicondylitis and trigger finger. Many activities in service and retail work put workers at risk from developing MSDs. The most important risk factors are biomechanical and environmental (European Agency for Safety and Health at Work, 2002).

2.2 Hazard of Manual Handling in Different Types of Works

Superstore sector is a potentially hazardous sector due to its widespread handling activities, particularly for stockers and receivers. The job of stocker consisting of placing merchandise in the store to make it accessible to the customers was targeted because it involves mostly handling activities. Description of the merchandising sections includes household maintenance products and sanitary products, canned goods and nonperishable food products, Juice and beverages, automobile and hardware, fruits and vegetables and freezer (St-Vincent *et al*, 2004).

In 2000, in the province of Quebec, the incidence rate for compensated back disorders in the retail grocery industry (CAEQ 6012 [8]) was 19.6 per 1000 full-time equivalent (FTE) workers, compared with 14.6 per 1000 FTE workers for all industries combined (16,68). For compensated musculoskeletal disorders of the limbs, for the same year in the same industry, the incidence rate was 4.9 per 1000 FTE workers, compared with 4.5 per 1000 FTE workers for all industries.

However, within these statistics for the retail grocery industry (for 1998 to 2000), cashiers accounted for only 16% of the compensated back disorders (409 cases out of 2,507) and only 24% (174 out of 713) of the compensated limb disorders. Statistics for 1995 to 1997 and for 1992 to 1994 revealed the same pattern. Cashiers do not account for the majority of compensation cases, yet most research conducted in supermarkets focuses on cashiers and leaves other types of workers in the shadows (Forcier *et al*, 2008).

Thus this indicates that manual handling among worker that work at supermarket may have also contributed to this figure. Moreover, the role of cumulative trauma disorders (CTDs), repetitive stress injuries (RSIs) and musculoskeletal disorders (MSDs) in everyday occupations has garnered increased attention in the last few years (Shinnar *et al.*, 2004).

In a 1989 study of supermarket departments (Ryan, 1989), the checkout area had the highest rate of symptoms for all areas of the body, significantly for neck, upper back, shoulder and hand related disorders such as sprains of the forearm muscles and wrist tendons.

Among the biggest factors in the retail and service sectors are awkward and static postures, lifting and pushing, repetition, vibration and the cold. As well as physical factors, organisational factors such as low job satisfaction and individual factors such as medical history, physical capacity and age are also significant. The Bureau of Labor and Statistics in a report issued in 2001 for OSHA found that sales clerks/cashiers have the second highest rate of MSDs of all grocery store employees at 3440 (OSHA, 2004).

Light weight of the products that did not require a large effort of the operators, who performed the task predominantly using their upper limbs. The use of small number of muscles may be interpreted as a strategy to reduce the fatigue that would be imposed over the large muscles of the back if subjects predominantly used the trunk to perform the task. Handling light products may not constitute a risk for the spine as the range of movements are similar to that employed in the erect posture, although activation of the back muscles for stabilisation and repeated movements in long-term activities is said to be a key factor for the development of back pain (Rodacki, 2005).

2.3 Relationship between Musculoskeletal Disorders with Carry Distance

Carrying was a task that required workers to lift heavy objects and carried manually for long distances (European Agency for Safety and Health at Work, 2002). Most manual handling injuries are classified as being caused by lifting and carrying objects or other handling of objects (Straker, 1999). Large number of manual handling work performed during the working day may be problematic for other structures of the body. In fact, the high incidence of musculoskeletal problems in upper limbs—hands, wrists, elbows, shoulders and neck (Lehman, 2001).

A study has shown that work-cycles with short durations movement for more than half working day significantly increased the risk of hand and wrist joint injuries and other musculoskeletal problems (Rodacki, 2006). According to British HSE (2002) if the carrying distances below 4 meters it indicate that the carrying task severity was low. Most of carrying was done by the male worker and the carrying distance was between 4 meters to 10 meters which was medium risk according to British HSE (2002).

2.4 Relationship between Musculoskeletal Disorder with Hand Distance from Low Back While Carry Load.

Lifting is a task required a heavy lifting done with one hand or without the assistance of mechanical devices, heavy lifting while bending over, reaching above shoulder height, or twisting, holding objects with a pinch grasp and lifting items rather than sliding them over the scanner (European Agency for Safety and Health at Work, 2002).

Most manual handling injuries are classified as being caused by lifting and carrying objects or other handling of objects (Straker, 1999). In particular, the effect on worker musculoskeletal caused by product of different weight ranging from light, moderate and heavy (Rodacki, 2006). The load constant for the NIOSH equation is 23kg and 6 lifts per minutes (Ceriello, 1999).

The combination of weight lifted, lift origin region and lift asymmetry were intended to represent the range of lift exertion variable combinations expected of a worker. In lift origin regions it would be expected to be the least stressful biomechanically and in the cases of both compression and A/P shear, the largest

difference in loading occurred in the shoulder lift origin region followed by the waist lift origin region (Marras, 2004).

2.5 Relationship between Musculoskeletal Disorders with Body Posture

The very nature of the job in many vocations like manufacturing, food service, aviation, and health care industries require a person to adopt a standing position as a major part of their daily activity (Zander *et al.*, 2004). Awkward and static postures included bending or twisting torso while lifting or holding heavy items , lifting out or putting objects into cramped spaces, frequent tasks involving (leaning, bending forward, kneeling or squatting , working with wrists in a bent or twisted position , the use of hands below the waist or above the shoulders, operations done behind (pushing items to bagging) or to the sides of the body), standing or sitting for most of a shift and working with arms or hands in the same position for long periods of time without changing position or resting (European Agency for Safety and Health at Work, 2002). Abnormal ergonomic features including the high frequency of trunk twisting, bending and extension, and weight lifting were found to increase risks of musculoskeletal disorder (Meksawi, 2011). It has been reported that stationary standing decreases the blood flow

to the muscles, accelerates the onset of fatigue, and causes pain in the leg, back and neck muscles (Quiros, 2001).

2.6 Various contributing factors that effecting musculoskeletal disorder

Low back pain is common. A survey in Denmark revealed that the lifetime prevalence rates of low back pain were 62.5% for men and 77.1% for women over a period of 60 years. Therefore, it is very important to prevent low back pain. There are various causes of low back pain. Among the frequent causes is load lifting. According to Glover, among 50 people suffering from low back pain in the work environment, lifting tasks were the cause in 38. On the other hand, age can affect the geometries and biomechanical properties of structures such as vertebral bodies, intervertebral discs and intervertebral ligaments, and the very integrity of these structures can be compromised under given loads. Therefore, aging can increase the risk of low back pain during lifting. The elderly show increased incidences of pathological conditions that can lead to long postural response latencies (Sakata, 2010).

According to (Widarnako, 2005) females reported a statistically significantly higher prevalence of symptoms in the neck, shoulders, wrist/hands, upper back and

hips/thighs/buttocks regions compared with males. However, males had a higher prevalence than females for symptoms in the elbows, low back and knees. Individuals with a lifetime history of chronic back pain were significantly more likely to smoke cigarettes daily than those without lifetime chronic back pain or arthritis (Zvolensky, 2010).

Previous study showed that 20 percent of athletes have an acute or chronic injury related to their sport (Heere, 1988). Previous research showed that age finding is not surprising given the generally higher occurrence of back pain. Older patients have accumulated more spinal damage over their working lives and are exposed to repeated microtrauma to the spine which might account for increased susceptibility to recurrent injury outcomes found in the literature for older patients (Evans, 2001). According to a study by Widamako (2005) there were no statistically significant differences in prevalence between age groups for all body regions for males, females, and the whole population. However according to Grimby (1999) stated that nearly two thirds of the elderly age above 75 years old reported with pain on musculoskeletal.

CHAPTER 3

METHODOLOGY

3.1 Study location

The study location was the area around Cheras district area which was a part of Selangor. Minimarket around Cheras district was the study location. Minimarket around Cheras district have been selected because it meets the study criteria of a minimarket that was composed of a worker that involve in retail industry and done manual handling in their everyday work tasks.

3.2 Study Design

This study was a cross sectional study to determine the hazard of manual handling in supermarket industry that included 87 workers. The study was a cross sectional study because the studies involved data collected at a defined time and used to assess about the causes of disease. Which means that the measurement of manual handling health risk only concern on the time the measurement taken and not what the state of health status of the worker in the past or upcoming future.

3.3 Study Population

Study population was workers that work at minimarket that involved with manual handling while doing their daily work.

3.4 Study Sample

As this was a cross-sectional study, the study sample was selected without making reference to exposure or disease. The study sample for this research were workers that work at minimarket involved with manual handling while doing their daily work.

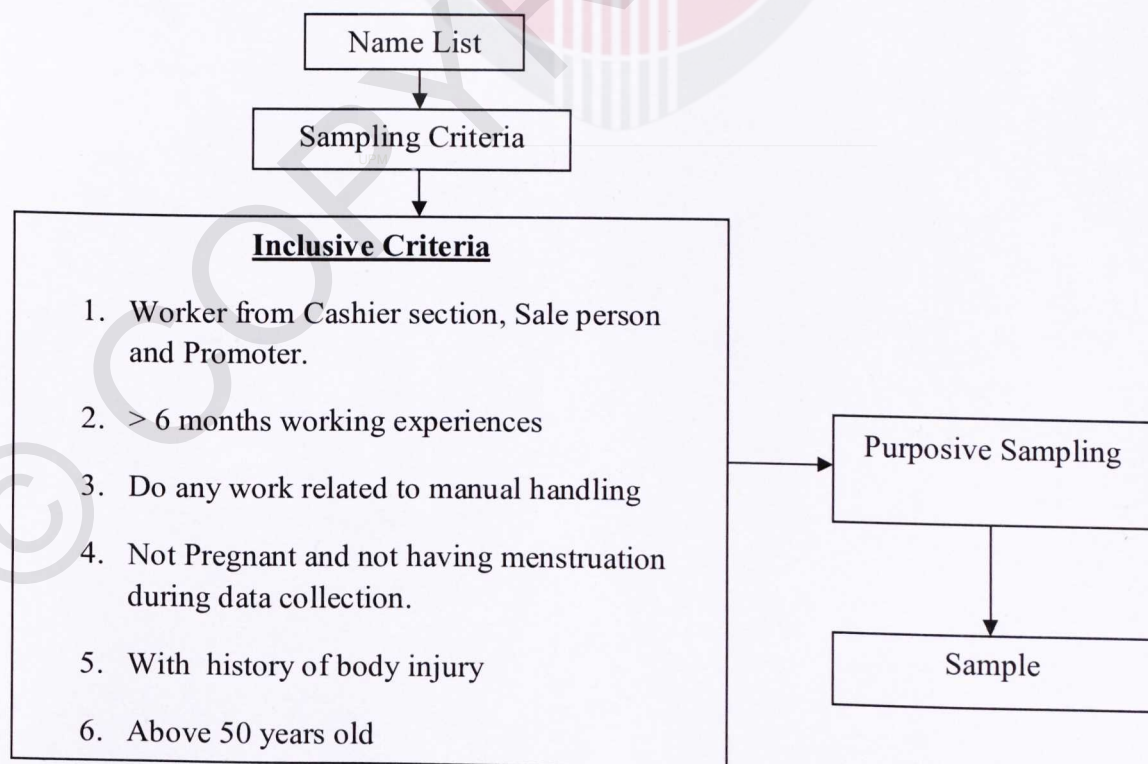
3.5 Sample Frame

The sample frame was the name list of workers that work in the minimarket. The name list was obtained from the minimarket owner and it only include worker who had worked for at least 6 months.

3.6 Sampling Method

Among all three work activities include in this study were cashier, store keeper and meat cutter. Epidemiological studies reported that 57.6% of minimarket operators

presented back discomfort and pain at some point (Beardmore, 1998). (Mackay *et al.* 1998) which high incidence of musculoskeletal disorder among minimarket operators (Rodacki *et al.*, 2006). Thus it is necessary to include cashier and other minimarket workers in the study in order to determine the manual handling hazard. Sampling method used is purposive sampling because specific criteria are put forward and it is critical to state the condition to make this study more relevant. Only those that involve with manual handling task in supermarket work setting will be included in this study. Even thou there was bias in this type of study method but it was essential to put the criteria for this study. Exclusion factor in this study was the respondent would not be above 55 years old as old people have higher tendency to get musculoskeletal related disorder due to their age. The respondents have been employed for more than 6 months in the related work activity. As for female respondent they should not have their monthly menstruation or being pregnant during the data collection.



3.7 Sample Size

Sample size determination was calculated using Kirkwood and Sterne (2009), formula; with the equation:

$$N = \frac{P(1-P)}{e^2}$$

N = sample size

P = prevalence

e = probability error

According to Aviva Shinnar et al. (2004), p: 70%

For a 95% of level of confidence, the margin error is ± 2 time the standard errors.

Therefore the error, $e = 0.05$.

The prevalence rate of worker with musculoskeletal disorder was 70% (Aviva Shinnar *et al.*, 2004). By substituting P with 0.70, the sample size will be:

Therefore;

$$N = \frac{0.70(1-0.70)}{(0.05)^2} = 84\%$$

Therefore, the total number of respondent is 84 respondents.

3.8 Instrumentation

3.8.1 Questionnaire

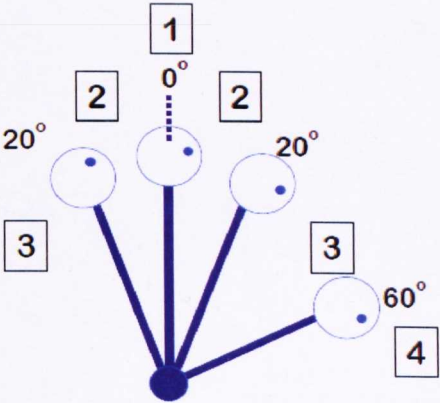
Questionnaire was used to obtain the socio-demographic and occupational information of the study population. The questionnaire was categorized into several parts which include subject background, socio economic status, health status including subject weight and height to calculate body mass index. The questionnaire was based on previous research and some adjustment was designed to make suits with this study.

3.8.2 REBA (Rapid Entire Body Assessment)

REBA was designed in UK to provide a quick and easy observational postural analysis for the whole body activities (Hignett2000, Hignett 2006, McAtamney 2005)). REBA was used when a position of individual body segment was observed. The more deviation from the natural posture, the higher are the scores of each body part given. Group A, of the REBA measurement includes the trunk and neck and leg region of body. For Group B included the assessment of arm, lower arm and wrist region of the body. These 2 groups were combined and the 144 posture combinations were transformed to a

general posture score. In addition, additional items observed and scored are load handled, coupling with load handle and physical activity. This score is summed up to one score for each observation. This score is compared to a table stating risk at five levels and action needed. REBA was designed to provide a quick gauge of the level of musculoskeletal risk present in the tasks being assessed. The use of REBA is beneficial in supporting manual handling risk assessments where a case is needed to fund equipment or changes in work practices (Coyle, 2005). The use of REBA was to made a postural analysis of musculoskeletal risks for a variety of tasks, in which the body was divided into segments of movement planes. Scores were provided for muscle activity caused by static, dynamic, rapid changing or unstable postures and not only focus on handling of loads that may not always be handled via the hands and an action level with an indication of urgency was given. The scoring was made as shown in Figure 3.1 to Figure 3.6 (Hignett, 1999).

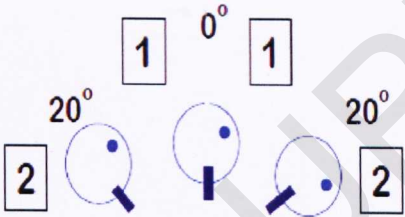
Movement	Score	Change Score
Upright	1	+1 if twisting or side flexed
0° - 20° flexion 0° - 20° extension	2	
20° - 60° flexion >20° extension	3	
> 60° flexion	4	



Suorce : Hignett, S., Mc Atamney, L., (2000) Applied Ergonomics. 31, 201-5

Figure 3.1: REBA : Trunk Score

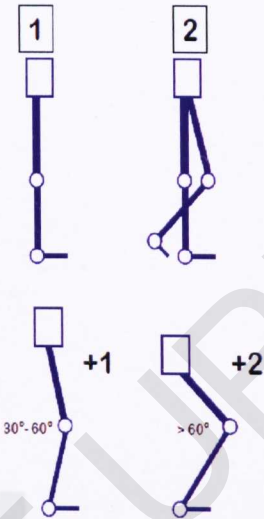
Movement	Score	Change score:
0° - 20° flexion	1	+1 if twisting or side flexed
>20° flexion or >20° extension	2	



Suorce : Hignett, S., Mc Atamney, L., (2000) Applied Ergonomics. 31, 201-5

Figure 3.2: REBA: Neck Score

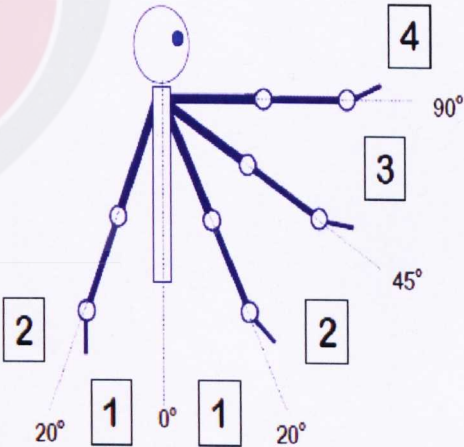
Position	Score	Change score
Bilateral weight bearing, walking or sitting	1	+1 if knees between 30° - 60° flexion
Unilateral weight bearing Feather weight bearing or an unstable posture	2	+2 if knees >60° flexion (n.b. Not for sitting)



Suorce : Hignett, S., Mc Atamney, L., (2000) Applied Ergonomics. 31, 201-5

Figure 3.3: REBA: Legs Score

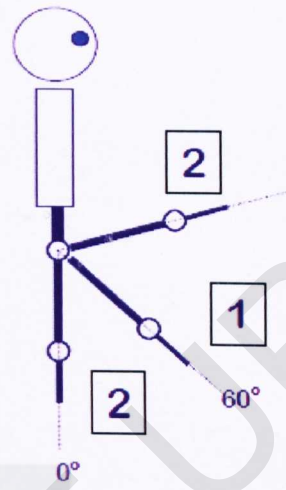
Position	Score	Change score
20° extension to 20° flexion	1	+1 if arm is abducted or rotated
>20° extension 20° - 45° flexion	2	
45° - 90° flexion	3	-1 if leaning, supporting weight of arm or if posture is gravity assisted
>90° flexion	4	



Suorce : Hignett, S., Mc Atamney, L., (2000) Applied Ergonomics. 31, 201-5

Figure 3.4: REBA: Upper Arms

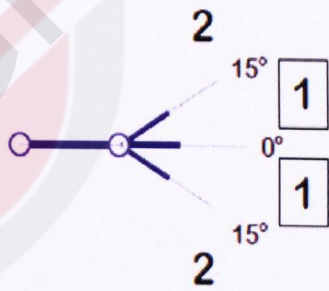
Movement	Score
60° - 100° flexion	1
<60° flexion or >100° flexion	2



Suorce : Hignett, S., Mc Atamney, L., (2000) Applied Ergonomics. 31, 201-5

Figure 3.5: REBA: Lower Arms

Movement	Score	Change score:
0° - 15° flexion or extension	1	
>15° flexion or > 15° extension	2	+1 if wrist is deviated or twisted



Suorce : Hignett, S., Mc Atamney, L., (2000) Applied Ergonomics. 31, 201-5

Figure 3.6: REBA: Wrist

3.8.3 Standardized Nordic Questionnaire (SNQ)

A standardized SNQ questionnaire consist of question which related to musculoskeletal disorders symptoms on eight body parts include neck, shoulder, elbow, arm/forearm, upper back, low back, thigh, and knee were used. This questionnaire also determines on the presence of pain in each area of body for last 12 month and 7 days. The measurements were made for 12 month and 7 days because it will show the present of musculoskeletal disorder among worker for the past one year as stated in the questionnaire. The question ask if the pain affected by the work of the worker. The questionnaire consists of structured and multiple choice variants and used as self administered questionnaires or in interviews. There are two types of questionnaires: a general questionnaire, and specific ones focusing on the low back and neck/shoulders. The purpose of the general questionnaire was to gather general information on respondents' musculoskeletal problems, while the specific ones permit a more detailed analysis. The purpose of this questionnaire was to screen the musculoskeletal disorders from the ergonomic perspective for future remediation measures and health care provisions. The questionnaire may be use to measure the outcome of epidemiological studies on musculoskeletal disorders but not meant to provide a basis for clinical diagnosis. (Kuorinka, 1987)

3.9 Data Collection and Measurement

Observational safety analysis

In the safety analysis (Johnson, 1980; Saarela, 1983; Suokas, 1988), the workplace was investigated systematically by observation and interviews.

3.9.1 Questionnaire on risk factors

This questionnaire was in English language. It included socio-demographic, selected job factors and musculoskeletal symptoms used to determine the major risk factors that contributed to the high prevalence of low back pain among these minimarket workers.

3.10 Data Analysis

3.10.1 SPSS

The statistical Package for Social Science (SPSS) was used to analyze data from questionnaire. The descriptive test was used to calculate mean, median, mode and standard deviation. Correlation were tested using Pearson correlation test with a significant value of $p < 0.05$. Logistic regression test used to analyzed multiple variables that may contribute to musculoskeletal disorder among workers.

3.10.2 Risk Assessment

In assessing the risk of manual handling Guideline for Hazard Identification, Risk Assessment and Risk Control that been made by Department of Occupational Safety and Health Ministry of Human Resources Malaysia 2008 are use. The purposes of HIRARC were as follows:-

- a) Identified factors that caused harm to employees and others (the hazards);

- b) Considered the chances were of that harm actually be falling anyone in the circumstances of a particular case and the possible severity that could come from it (the risks); and
- c) Enable employers to plan, introduce and monitor preventive measures to ensure that the risks were adequately controlled at all times.

Hazard control means the process of implementing measures to reduce the risk associated with a hazard.

Hierarchy of control means the established priority order for the types of measures to be used to control risks.

Hazard identification means the identification of undesired events that lead to the materialisation of the hazard and the mechanism by which those undesired events could occur.

3.10.3 The hazard identification and assessment methodology

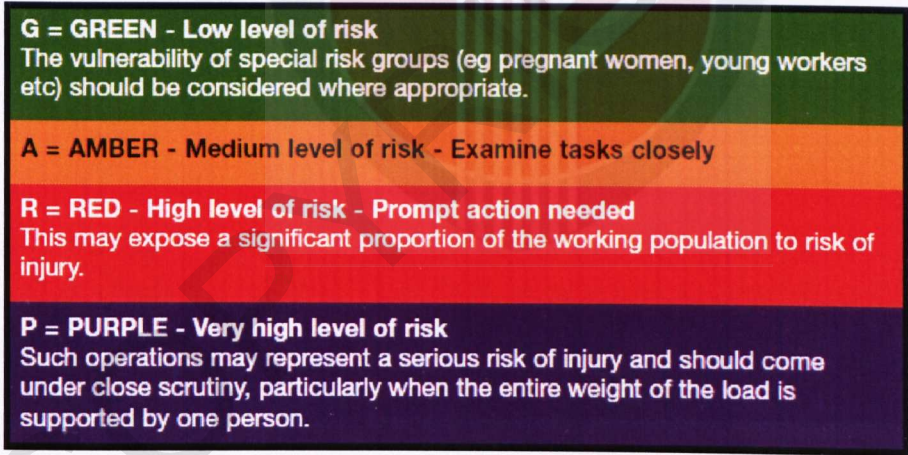
Manual Handling Assessment Charts (MAC)

The Manual Handling Assessment Charts (MAC) is a tool to help in the identification of common risk factors in lifting, carrying and team handling operations. The MAC used a numerical score to indicate the level of risk.

The MAC considers manual handling as 3 types of distinct operation includes single lifting operation, single carrying operation and team handling operation. These operations are divided into the different manual handling hazards and interpreted in a flow chart. The flow chart detail out the steps needed to identify the risk level, step-by-step, through each factor of the manual handling operation. The MAC discusses on the possible contributing factors affecting the manual handling task performance. To calculate the risk for the load and frequency of a lifting/carrying operation, a graph accompanies the flowchart. The purpose of the assessment is to identify and then manage the overall level of risk of the task (Health and Safety Executive, 2000).

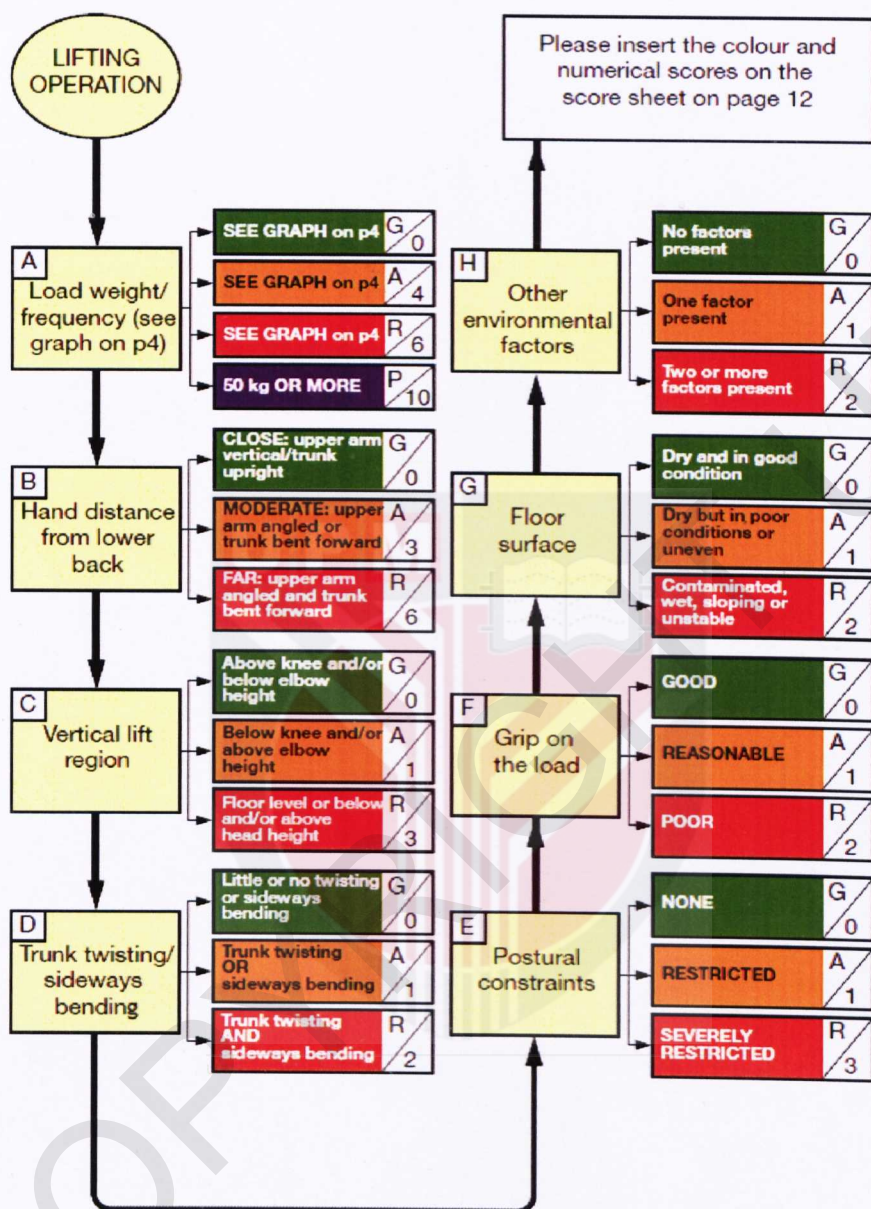
The workers were observed so that they represented the normal work task and procedure. During the assessment process it is important to consult employees and safety representatives. Details on work unit and insight info on the demands of the job from all workers' perspective were identified. The workers were videotape so that it can be viewed during assessment. Follow the flow chart as shown in Figure 3.8 and Figure 3.9 the level of risk for each risk factors were determined. Enter the colour band as shown in Figure 3.7 and corresponding numerical score on the score sheet. The total scores help priorities those tasks that need most urgent attention and help check the effectiveness of those improvements (Health and Safety Executive, 2000).

The levels of risk are classified as follow:



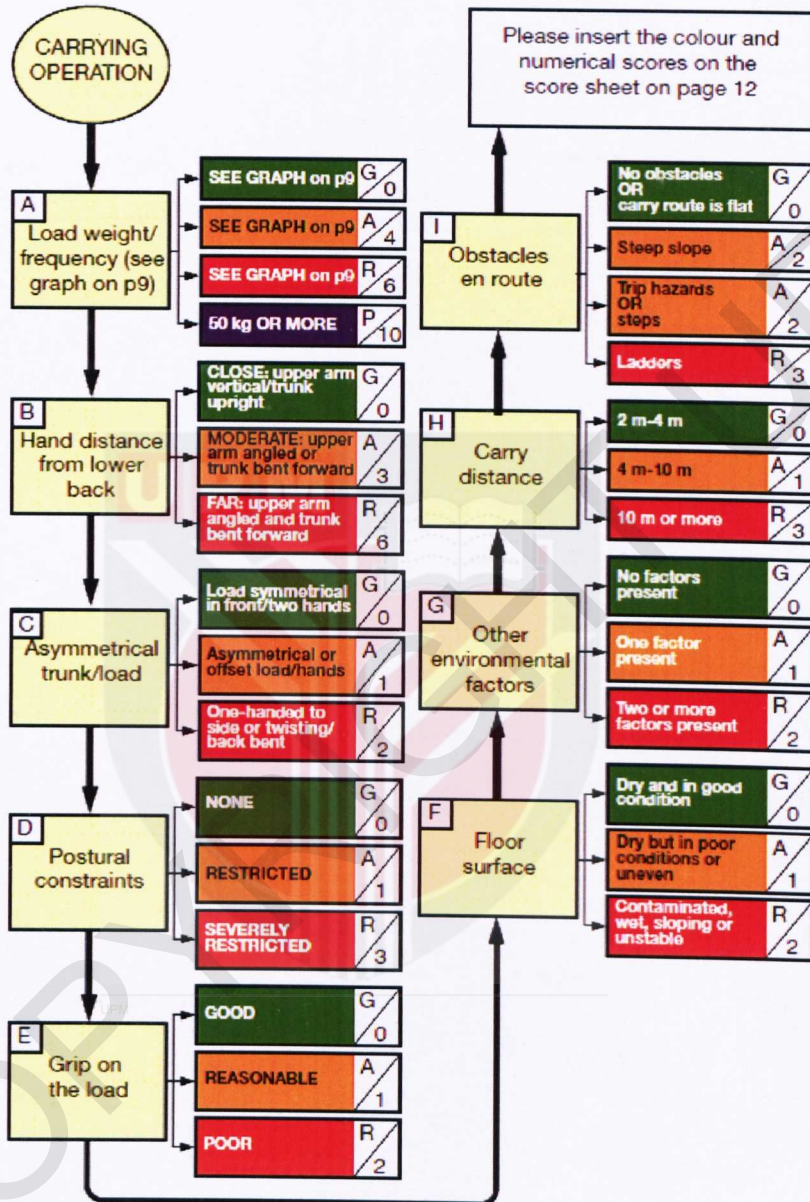
Source: British Health and Safety Executive 2009/2011

Figure 3.7: MAC score categories



Source: British Health and Safety Executive 2009/20

Figure 3.8: Lifting assessment chart



Source: British Health and Safety Executive 2009/2011

Figure 3.9: Carrying assessment chart

3.11 Quality Control

To ensure that data collection was reliable and valid, quality control on the instrument and procedure during data collection are as following:

Pre-test of questionnaire

Pre-test of questionnaire were conducted to 10% of the total respondents. The validity and reliability of the questionnaire were then determined using SPSS.

3.11 Study Limitation

There were some limitations to this study. This study is a cross-sectional study which only determined the risk factors and outcome at a specific period of time.

The risk of manual handling was determined using only self-administrated questionnaire, therefore the accuracy of severity of health related problem was defined

only base on the perception on subjective opinion from the worker. Recall bias element might also present in this study thus recall bias also was taken into consideration.

3.12 Ethical Approval

Ethical approvals for this study were obtained from Research Ethic Committee of University Putra Malaysia prior to the study. Approval from minimarket was obtained through the owners themselves.

CHAPTER 4

RESULTS

4.1 Socio-demographic Data of Respondents

A total of 87 respondents from various mini market workers around Cheras area in Selangor were involved in this study. Table 4.1 shows that, there were 63.2%(55) male and 36.8%(32) female respondents. Most workers age was at the range of 19 to 27 years old. The type of worker among study respondent were cashier, storekeeper and meat cutter. Table 4.2 shows work information for each type of works. The number of

working hour per days for meat cutter were the highest with the mean(SD) of 9.00(2.00) and years of employment was highest for cashier with the mean(SD) of 5.14(6.87).



Table 4.1: Socio-demographic distribution of respondents

Variable	Category	Frequency	Percentage, %
Gender	Male	55	63.2
	Female	32	36.8
Marital Status	Single	57	65.5
	Married	30	34.5
	Widowed	0	0.0
Education Level	Never been to school	0	0.0
	Primary school	1	1.1
	SRP/PMR	17	19.5
	MCE/SPM	48	55.2
	Diploma/Matriculation	15	17.2
	Bachelor	6	6.9
Type of work	Cashier	42	48.3
	Storekeeper	41	47.1
	Meat Cutter	4	4.6
Age	18 - 27	52	59.8
	28 - 37	19	21.8
	38 - 47	7	8.1
	48 - 57	9	10.3
N=87			

Table 4.2: Work information

Variable		Cashier	Storekeeper	Meat Cutter
		Frequency		
Gender	Male	18	33	4
	Female	24	8	-
Variable		Cashier	Storekeeper	Meat Cutter
		Mean (SD)		
Years of employment		5.15 (6\,87)	2.98 (4.69)	2.75 (3.50)
Hours of working per day		8.36 (1.25)	8.25 (0.98)	9.00 (2.00)
N = 87				

4.2 Manual Handling Assessment

The study identified hazards of manual handling among various types of minimarket workers. There were two types of score (eg: lifting and carrying score) which were recorded as Manual Handling Assessment Chart (MAC) score in order to quantify the hazard of manual handling. It showed that, lifting scores were in medium level among male meat cutter 2.38(2.326), while they were recorded low for other types of work; whereas carrying score were medium among male storekeeper 5.30(3.077) and

male meat cutter 6.50(2.380), and it is recorded as low of carrying hazard among other types of work.

Table 4.3: MAC score for lifting and carrying task.

Type of Work		Lifting Score			Carrying Score		
		Range	Mean(S.D)	Rating	Range	Mean(S.D)	Rating
Cashier	Male	1-7	3.44(1.917)	Low	1-7	3.61(1.883)	Low
	Female	1-7	3.46(1.933)	Low	1-8	3.50(2.000)	Low
Storekeeper	Male	1-11	4.76(2.634)	Low	1-11	5.30(3.077)	Medium
	Female	1-8	2.38(2.326)	Low	1-10	3.13(3.091)	Low
Meat	Male	4-8	5.50(1.915)	Medium	5-10	6.50(2.380)	Medium
Cutter	Female	-	-	-	-	-	-
N=87							

4.3 Posture assessment of worker during performing manual handling task

In order to identify the posture of worker while conducting manual handling Rapid Entire Body Assessment (REBA) score was used for the purpose of posture assessment. Table 4.4 showed that among various type of work, male storekeeper and male meat cutter has reached a medium score for REBA with mean(SD) of 4.76(1.733)

and 5.75(1.708) respectively. Female worker and male cashier showed a relatively low REBA score during posture assessment.

Table 4.4: REBA score for posture assessment.

Type of Work		REBA Score		
		Range	Mean(S.D)	Rating
Cashier	Male	2 - 8	3.89(1.811)	Low
	Female	2 - 8	3.21(1.382)	Low
Storekeeper	Male	2 - 8	4.76(1.733)	Medium
	Female	3 - 7	3.75(1.811)	Low
Meat Cutter	Male	4 - 8	5.75(1.708)	Medium
	Female	-	-	-

N=87

4.4 Correlation between carry distances of load with musculoskeletal disorder among worker.

The load carrying distances were measured. Kolmogorov-Smirnov Test was carried out and the result showed that the carrying distances for worker in mini market at Cheras district was normally distributed ($p > 0.05$).

The Pearson correlation test which a parametric test was carried out to determine the correlation between carry distances of load with musculoskeletal disorder among worker. The results were showed in Table 4.5, Table 4.6 and Table 4.7. Table 4.6 showed that there was a significant correlation ($p=0.034$) between carry distances of load with musculoskeletal disorder at wrist/hand region for male storekeeper worker with mean(SD) 11.27(2.44). It was also found that there was significant correlation ($p=0.049$) between carry distances of load with musculoskeletal disorder at upper back region for male storekeeper worker with mean(SD) 11.27(2.44). Table 4.6 showed that majority types of work have negative association with the increasing of carrying distance.

Table 4.5: The correlation between carrying distances of load among cashier with musculoskeletal disorder of respondent.

Body Region of MSD	Carry Distance N=87			
	Gender	Mean(S.D)	R	p
Neck	Male	10.84(3.21)	0.47	0.071
	Female	10.19(1.61)	-0.01	0.952
Shoulders	Male	10.84(3.21)	0.44	0.071
	Female	10.19(1.61)	-0.02	0.119
Elbows	Male	10.84(3.21)	0.41	0.094
	Female	10.19(1.61)	0.23	0.278
Wrists/Hands	Male	10.84(3.21)	0.26	0.297
	Female	10.19(1.61)	0.07	0.736
Upper back	Male	10.84(3.21)	-0.06	0.828
	Female	10.19(1.61)	-0.07	0.739
Lower back	Male	10.84(3.21)	0.26	0.296
	Female	10.19(1.61)	0.16	0.461
Thighs/Hips	Male	10.84(3.21)	0.13	0.598
	Female	10.19(1.61)	0.41	0.414
Knees	Male	10.84(3.21)	0.25	0.327
	Female	10.19(1.61)	0.15	0.484
Ankles/Feet	Male	10.84(3.21)	0.20	0.709
	Female	10.19(1.61)	-0.25	0.240

*p is significance at < 0.05

Table 4.6: The correlation between carrying distances of load among storekeeper with musculoskeletal disorder of respondent.

Body Region of MSD	Carry Distance		N=87	
	Gender	Mean(S.D)	R	p
Neck	Male	11.27(2.44)	-0.09	0.629
	Female	10.19(0.76)	-0.17	0.680
Shoulders	Male	11.27(2.44)	-0.24	0.186
	Female	10.19(0.76)	-0.54	0.169
Elbows	Male	11.27(2.44)	0.01	0.942
	Female	10.19(0.76)	-0.17	0.680
Wrists/Hands	Male	11.27(2.44)	-0.37	0.034*
	Female	10.19(0.76)	0.29	0.490
Upper back	Male	11.27(2.44)	-0.34	0.049*
	Female	10.19(0.76)	-0.53	0.181
Lower back	Male	11.27(2.44)	-0.18	0.326
	Female	10.19(0.76)	-0.55	0.157
Thighs/Hips	Male	11.27(2.44)	-0.20	0.272
	Female	10.19(0.76)	-0.08	0.844
Knees	Male	11.27(2.44)	0.15	0.415
	Female	10.19(0.76)	-0.32	0.443
Ankles/Feet	Male	11.27(2.44)	0.13	0.460
	Female	10.19(0.76)	0.24	0.573

*p is significance at < 0.05

Table 4.7: The correlation between carrying distances of load among meat cutter with musculoskeletal disorder of respondent.

Body Region of MSD	Carry Distance N=87			
	Gender	Mean(S.D)	R	p
Neck	Male	9.24(2.60)	-0.58	0.420
Shoulders	Male	9.24(2.60)	-0.58	0.420
Elbows	Male	9.24(2.60)	-0.58	0.420
Wrists/Hands	Male	9.24(2.60)	0.21	0.788
Upper back	Male	9.24(2.60)	0.21	0.788
Lower back	Male	9.24(2.60)	0.21	0.788
Thighs/Hips	Male	9.24(2.60)	-0.58	0.420
Knees	Male	9.24(2.60)	-0.17	0.831
Ankles/Feet	Male	9.24(2.60)	-0.17	0.831

*p is significance at < 0.05

4.5 The Correlation between hand distance from low back while carry load with musculoskeletal disorder among worker.

The load carrying distances were measured. Kolmogorov-Smirnov Test was carried out and the result showed that the hand distance from low back while carry load for worker in mini market at Cheras district was normally distributed ($p > 0.05$).

In order to determine the correlation between hand distances from low back while carry load with musculoskeletal disorder among workers, Pearson Correlation test was carried out and summarized in Table 4.8, Table 4.9 and table 4.10. From this study it was found that there was significant correlation ($p=0.039$) between hand distance from low back while carrying load with musculoskeletal disorder at wrist/hand region for female storekeeper worker. Table 4.9 showed that majority types of work have negative association with the increasing of hand distance from low back while carry load.

Table 4.8: The correlation between hand distances from lower back while carrying load among cashier with musculoskeletal disorder of respondent.

Body Region of MSD	Hand distances from lower back while carrying load			
	Gender	Mean(S.D)	R	p
Neck	Male	38.06(14.26)	0.01	0.992
	Female	37.92(14.37)	0.12	0.577
Shoulders	Male	38.06(14.26)	0.01	0.992
	Female	37.92(14.37)	-0.02	0.936
Elbows	Male	38.06(14.26)	0.21	0.413
	Female	37.92(14.37)	0.21	0.318
Wrists/Hands	Male	38.06(14.26)	0.06	0.860
	Female	37.92(14.37)	-0.21	0.333
Upper back	Male	38.06(14.26)	0.05	0.852
	Female	37.92(14.37)	0.19	0.372
Lower back	Male	38.06(14.26)	-0.06	0.823
	Female	37.92(14.37)	0.26	0.216
Thighs/Hips	Male	38.06(14.26)	0.26	0.298
	Female	37.92(14.37)	-0.15	0.479
Knees	Male	38.06(14.26)	0.05	0.852
	Female	37.92(14.37)	-0.25	0.248
Ankles/Feet	Male	38.06(14.26)	0.24	0.852
	Female	37.92(14.37)	-0.19	0.371

*p is significance at < 0.05

Table 4.9: **The correlation between hand distances from lower back while carrying load among storekeeper with musculoskeletal disorder of respondent.**

Body Region of MSD	Hand distances from lower back while carrying load			
	Gender	Mean(S.D)	R	p
Neck	Male	40.91(13.78)	0.14	0.436
	Female	48.75(9.91)	-0.46	0.253
Shoulders	Male	40.91(13.78)	-0.02	0.893
	Female	48.75(9.91)	-0.08	0.855
Elbows	Male	40.91(13.78)	-0.02	0.922
	Female	48.75(9.91)	-0.46	0.253
Wrists/Hands	Male	40.91(13.78)	-0.15	0.922
	Female	48.75(9.91)	-0.73	0.039*
Upper back	Male	40.91(13.78)	-0.11	0.404
	Female	48.75(9.91)	-0.17	0.680
Lower back	Male	40.91(13.78)	-0.15	0.528
	Female	48.75(9.91)	0.00	1.000
Thighs/Hips	Male	40.91(13.78)	-0.06	0.402
	Female	48.75(9.91)	-0.55	0.162
Knees	Male	40.91(13.78)	-0.11	0.760
	Female	48.75(9.91)	-0.23	0.578
Ankles/Feet	Male	40.91(13.78)	0.05	0.765
	Female	48.75(9.91)	-0.54	0.168

*p is significance at < 0.05

Table 4.10: The correlation between hand distances from lower back while carrying load among meat cutter with musculoskeletal disorder of respondent.

Body Region of MSD	Hand distances from lower back while carrying load			
	Gender	Mean(S.D)	R	p
Neck	Male	42.50(15.00)	0.56	0.444
Shoulders	Male	42.50(15.00)	0.57	0.444
Elbows	Male	42.50(15.00)	0.56	0.444
Wrists/Hands	Male	42.50(15.00)	0.78	0.222
Upper back	Male	42.50(15.00)	0.78	0.222
Lower back	Male	42.50(15.00)	0.78	0.222
Thighs/Hips	Male	42.50(15.00)	0.56	0.444
Knees	Male	42.50(15.00)	-0.33	0.667
Ankles/Feet	Male	42.50(15.00)	-0.33	0.667

*p is significance at < 0.05

4.6 Correlation between body postures with musculoskeletal disorder among worker

The body postures were rated using REBA method. Kolmogorov-Smirnov Test was carried out and the result showed that the body postures for worker in mini market at Cheras district was normally distributed ($p > 0.05$).

Pearson correlation test was carried out to determine the relationship between body postures with musculoskeletal disorder among worker. This study found that there was no significant correlation between body postures with musculoskeletal disorder at any part of body region for both male and female for cashier, storekeeper and meat cutter.

4.7: Contributing factors influencing the musculoskeletal disorder among worker at various body regions.

4.7.1: Contributing factors influencing the musculoskeletal disorder among worker at neck region.

Logistic regression test was carried out to determine the relationship between multiple contributing factors (eg: gender, smoking habit, previous health status, sport involvement and age) that influencing musculoskeletal disorder at neck body region among worker. From the study it showed that there was no significant relationship between gender, smoking habit, previous health history and sport involvement with musculoskeletal disorder at neck body region among workers. The prediction model of musculoskeletal disorder among workers:

$$\text{Logit (P)} = \ln [P/1-P] = \beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_ix_i$$

Overall worker that perform manual handling have decrease odds of having musculoskeletal disorder at neck region.

4.7.2: Contributing factors influencing musculoskeletal disorder among worker at shoulders region.

In determined the relationship between multiple contributing factors (eg: gender, smoking habit, previous health status, sport involvement and age) that influencing musculoskeletal disorder at shoulders region among worker the logistic regression test was carried out. The study identify that there is no significant relationship between gender, smoking habit, previous health history and sport involvement with musculoskeletal disorder at shoulders body region among workers. The prediction model of musculoskeletal disorder among workers:

$$\text{Logit (P)} = \ln [P/1-P] = \beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_ix_i.$$

4.7.3: Contributing factors influencing musculoskeletal disorder among worker at elbows region.

In order to determine the relationship between multiple contributing factors (eg: gender, smoking habit, previous health status, sport involvement and age) that influencing musculoskeletal disorder at elbows region among worker the logistic

regression test was carried out. From the study it showed that there was no significant relationship between gender, smoking habit, previous health history and sport involvement with musculoskeletal disorder at elbows body region among workers. The prediction model of musculoskeletal disorder among workers:

$$\text{Logit (P)} = \ln [P/1-P] = \beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_ix_i$$

4.7.4: Contributing factors influencing musculoskeletal disorder among worker at wrists/hands region.

In this study logistic regression test was carried out in order to determine the relationship between multiple contributing factors (eg: gender, smoking habit, previous health status, sport involvement and age) that influencing musculoskeletal disorder at wrists/hands region among worker. From the study it showed that there was no significant relationship between gender, smoking habit, previous health history and sport involvement with musculoskeletal disorder at wrists/hands body region among workers. The prediction model of musculoskeletal disorder among workers:

$$\text{Logit (P)} = \ln [P/1-P] = \beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_ix_i$$

4.7.5: Contributing factors influencing the musculoskeletal disorder among worker at upper back region.

The logistic regression test was carried out to determine the relationship between multiple contributing factors (eg: gender, smoking habit, previous health status, sport involvement and age) that influencing musculoskeletal disorder at upper back region among worker. The relationship between multiple contributing factors that effecting musculoskeletal disorder at upper back body region among worker was summarized in Table 4.11. Table 4.11 showed that there was no significant relationship between gender, smoking habit, and previous health history. However, there is significant relationship for sport involvement with musculoskeletal disorder at upper back body region among workers (0.006). The prediction model of musculoskeletal disorder among workers:

$$\text{Logit (P)} = \ln [P/1-P] = \beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_ix_i$$

From the study it was found that worker that perform manual handling have increase on odds of having musculoskeletal disorder at upper back region for both gender and smoking habit which were 1.02 and 4.41 respectively. In the other hand, previous health history and sport involvement showed that associated with musculoskeletal disorder decrease on odds by 0.48 and 0.25 in every increase in one unit of respondent. Even thou

there was significant relationship between sport involvement and it was negatively association.

The finding for the relationship between ages factors that effecting musculoskeletal disorder at upper back among workers display in Table 4.11. It showed that there was no significant relationship between ages with musculoskeletal disorder at upper back body region among workers.

Table 4.11: Factors influencing the musculoskeletal disorder among worker at upper back region.

Variables			Crude OR 95% CI	Adjusted OR 95% CI	Wald Statistic (df)	P value
Upper Back	Gender	Male	1.00	1.00	0.33(1)	0.566
		Female	1.29 (0.54,3.10)	1.02 (0.35,2.97)		
	Smoking	Yes	1.00	1.00	3.08(1)	0.051
		No	2.55 (0.99,6.54)	4.41 (1.30,14.96)		
	Health History	Yes	1.00	1.00	1.37(1)	0.242
		No	0.55 (0.21,1.49)	0.48 (0.16,1.45)		
	Sport Involvement	Yes	1.00	1.00	7.59(1)	0.006*
		No	0.28 (0.11,0.69)	0.25 (0.09,0.66)		
	Age		1.02	1.03	1.08 (1)	0.299
			(0.98,1.07)	(0.99,1.08)		

*p is significance at < 0.05

4.7.6: Contributing factors influencing the musculoskeletal disorder among worker at lower back region.

For the purpose of determining the relationship between multiple contributing factors (eg: gender, smoking habit, previous health status, sport involvement and age) that influencing musculoskeletal disorder at lower back region among worker logistic regression test was carried out. The relationship between multiple contributing factors that effecting musculoskeletal disorder at lower back body region among worker was summarized in Table 4.12. It was showed that there was no significant relationship between gender, smoking habit, and previous health history. However, there was significant relationship for sport involvement with musculoskeletal disorder at lower back body region among workers (0.015). The prediction model of musculoskeletal disorder among workers:

$$\text{Logit (P)} = \ln [P/1-P] = \beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_ix_i$$

From the study it was found that worker that perform manual handling have increase on odds of having musculoskeletal disorder at lower back region for both gender and smoking habit which were 1.80 and 1.61. However, previous health history and sport involvement showed that associated with musculoskeletal disorder decrease on odds by 0.65 and 0.27 in every increase in one unit of respondent. Even thou there was significant relationship between sport involvements but, it were negative association.

The finding for the relationship between ages factors that effecting musculoskeletal disorder at lower back among workers display in Table 4.12. It showed that there was no significant relationship between ages with musculoskeletal disorder at lower back region among workers.

Table 4.12: Factors influencing the musculoskeletal disorder among worker at lower back region.

Variables			Crude OR 95% CI	Adjusted OR 95% CI	Wald Statistic (df)	P value
Lower Back	Gender	Male	1.00	1.00	1.45(1)	0.228
		Female	1.73 (0.71,4.21)	1.80 (0.63,5.14)		
	Smoking	Yes	1.00	1.00	1.47(1)	0.226
		No	1.74 (0.71,4.29)	1.61 (0.55,4.70)		
	Health History	Yes	1.00	1.00	0.69(1)	0.407
		No	0.65 (0.24,1.79)	0.65 (0.22,1.88)		
	Sport Involvement	Yes	1.00	1.00	5.96(1)	0.015*
		No	0.32 (0.13,0.80)	0.27 (0.10,0.72)		
	Age		1.05	0.99	0.12(1)	0.729
			(0.95,1.03)	(0.95,1.04)		

*p is significance at < 0.05

4.7.7: Contributing factors influencing the musculoskeletal disorder among worker at thighs/hips region.

To determine the relationship between multiple contributing factors (eg: gender, smoking habit, previous health status, sport involvement and age) that influencing musculoskeletal disorder at thighs/hips region among worker logistic regression test was carried out. It was showed that there was no significant relationship between gender, smoking habit, previous health history, and sport involvement with musculoskeletal disorder at thighs/hips region among workers. The prediction model of musculoskeletal disorder among workers:

$$\text{Logit (P)} = \ln [P/1-P] = \beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_ix_i$$

4.7.8: Contributing factors influencing the musculoskeletal disorder among worker at knees region.

In determining the relationship between multiple contributing factors (eg: gender, smoking habit, previous health status, sport involvement and age) that influencing musculoskeletal disorder at knees region among worker logistic regression test was carried out. The relationship between multiple contributing factors that effected

musculoskeletal disorder at knees region among worker was summarized in Table 4.13. It was showed that there was significant relationship between gender, smoking habit, and previous health history. However, there was no significant relationship for sport involvement with musculoskeletal disorder at knees region among worker. The prediction model of musculoskeletal disorder among workers:

$$\text{Logit (P)} = \ln [P/1-P] = \beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_ix_i$$

From the study it was found that worker that perform manual handling have increase on odds of having musculoskeletal disorder at knees region for both gender and smoking habit. However, previous health history and sport involvement showed that associated with musculoskeletal disorder decrease on odds by 0.18 and 0.49 in every increase in one unit of respondent.

The finding for the relationship between ages factors that effecting musculoskeletal disorder at knees among workers display in Table 4.13. It showed that there was significant relationship between ages with musculoskeletal disorder at knees region among workers.

Table 4.13: Factors influencing the musculoskeletal disorder among worker at knees region.

Variables			Crude OR 95% CI	Adjusted OR 95% CI	Wald Statistic (df)	P value
Knees	Gender	Male	1.00	1.00	3.87(1)	0.049*
		Female	2.70 (1.00,7.27)	1.82 (0.54,6.09)		
	Smoking	Yes	1.00	1.00	6.27(1)	0.012*
		No	7.11 (1.53,32.97)	7.69 (1.23,47.96)		
	Health History	Yes	1.00	1.00	4.80(1)	0.038*
		No	0.33 (0.11,0.94)	0.18 (0.05,0.66)		
	Sport Involvement	Yes	1.00	1.00	0.50(1)	0.479
		No	0.70 (0.26,1.87)	0.49 (0.15,1.56)		
	Age		0.94	0.94	6.30(1)	0.012*
			(0.90,0.99)	(0.90,1.00)		

*p is significance at < 0.05

4.7.9: Contributing factors influencing the musculoskeletal disorder among worker at ankles/feet region.

To determining the relationship between multiple contributing factors (eg: gender, smoking habit, previous health status, sport involvement and age) that influencing musculoskeletal disorder at ankles/feet region among worker logistic regression test was carried out. The relationship between multiple contributing factors that effected musculoskeletal disorder at ankles/feet region among worker was summarized in Table 4.14. It was showed that there was significant relationship between gender, and previous health history. However, there was no significant relationship for smoking habit, and sport involvement with musculoskeletal disorder at ankles/feet region among worker. The prediction model of musculoskeletal disorder among workers:

$$\text{Logit (P)} = \ln [P/1-P] = \beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_ix_i$$

The study it was showed that worker that perform manual handling have increase on odds of having musculoskeletal disorder at ankles/feet region for both gender and smoking habit. However, previous health history and sport involvement showed that associated with musculoskeletal disorder decrease on odds by 0.16 and 0.44 in every increase in one unit of respondent.

The finding for the relationship between ages factors that effecting musculoskeletal disorder at ankles/feet among workers display in Table 4.14. It showed that there was no significant relationship between ages with musculoskeletal disorder at ankles/feet region among workers.

Table 4.14: Factors influencing the musculoskeletal disorder among worker at ankles/feet region.

Variables			Crude OR 95% CI	Adjusted OR 95% CI	Wald Statistic (df)	P value
Ankles/ Feet	Gender	Male	1.00	1.00	4.24(1)	0.040*
		Female	2.56 (1.05,6.24)	2.78 (0.92,8.44)		
	Smoking	Yes	1.00	1.00	3.27(1)	0.071
		No	2.38 (0.93,6.10)	1.97 (5.93,6.55)		
	Health History	Yes	1.00	1.00	7.29(1)	0.007*
		No	0.23 (0.08,0.67)	0.16 (0.05,0.54)		
	Sport Involvement	Yes	1.00	1.00	1.48(1)	0.225
		No	0.58 (0.24,1.39)	0.44 (0.16,1.23)		
	Age		0.96	0.96	3.50(1)	0.061
			(0.92,1.00)	(0.91,1.00)		

*p is significance at < 0.05

CHAPTER 5

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 DISCUSSION

5.1.1 Socio-demographic of respondents

A total of 87 respondents from various mini market workers around Cheras area in Selangor were involved in this study. From the total of 87 respondents, there were 55 (63.2%) male and 32 (36.8%) female respondents. Both gender were included in this study as male and female have different physiological body build up thus the body region that have musculoskeletal disorder were different. According to Widamako

Females reported a statistically significantly higher prevalence of symptoms in the neck, shoulders, wrist/hands, upper back and hips/thighs/buttocks regions compared with males. However, males had a higher prevalence than females for symptoms in the elbows, low back and knees (Widarnako, 2005).

As for educational level it was found that most of the respondent only studied until primary school level, 1 (1.1%), followed by until Sijil Penilaian Rendah (SRP) or Penilaian Menengah Rendah (PMR) 17 (19.5%), Malaysian Certification Examination (MCE) or Sijil Pelajaran Malaysia (SPM) 48 (55.2%), diploma or matriculation 15 (17.2%) and lastly until Bachelor Degree 6 (6.9%). Despite the different educational background among the respondent, the question been asked to the respondent were well understand by the respondent.

Type of worker involved in this study were cashier, 42 (48.3%), storekeeper, 41 (47.1%) and meat cutter 4 (4.6%). According to a study by Saghir and Jonson (2001) the same trend was observed: they found that 75% of the handling time in the retail chain occurs in the store and according to Rodacki (2006) musculoskeletal disorder have been reported among cashier and has become most reasons for seeking medical care.

Age of respondents in this study ranges from 19 to 55 years old among the 87 respondents. The median for age of respondents in this study is 25.00 years old and on the other hand, the mean is 28.62 ± 10.51 years old. According to a study by Widarnako (2005) there were no statistically significant differences in prevalence between age groups for all body regions for males, females, and the whole population. However according to Grimby (1999) stated that nearly two thirds of the elderly age above 75 years old reported with pain on musculoskeletal. Thus for this study only worker below 55 years old were included into this study.

5.1.2 Respondents job description

The ergonomics assessment was carried out in minimarket around Cheras area. In order to describe components of physical load of this work; time, posture, lifting activities and load were observed. Work activities of 42 cashier, 41 storekeeper and 4 meat cutter were observed in this study. The worker postures were evaluated using REBA assessment and manual handling activities were score using MAC assessment. The worker were observed and videotaped for short (10-15 minutes) periods occurring randomly throughout a 2-3 hours monitoring period (Grant, 1994).

Respondents who worked as a cashier was observed to obtained their job requirement. From the observation cashier job required cashier to seat with upper back curved and head slightly bend forward. Sometimes they need to stand while uploading purchased items into plastic bags. Three main tasks that the cashier needed to perform during executing their job were calculating purchase items, packing and transacting payment. Most of the time workers spend waiting for customer and packing items. The items needed to be packed weigh between 10 g to 10 kg. Cahier hand flexion while uploading items into the plastic bags were between 0° to 90° .

Respondents that worked as a storekeeper was observed to obtained their job requirement. From the observation storekeeper job required workers to lift items manually with awkward body posture; overreaching, site bending, body flexion and head slightly bend forward and back. They also need to carry items to put in the store or on shelve. Sometimes when there was no item needed to be uploaded for the day the storekeeper will perform work like unpacked the stored items, shelved the items, arranging shelve items, and polish the shelve items. Three main tasks that the storekeeper needed to perform during executing their job were listing items from the lorry, shelved items and polish items on shelve. The items needed to be lifted and carried weigh between 5 kg to 20 kg. The storekeeper hand flexion while uploading items into shelve were between 0° to 180° and body band forward and back were between 0° to 40° .

Respondents that worked as a meat cutter was observed to obtained their job requirement. From the observation the job required meat cutter needed to stand while cutting meat and head slightly bends forward. Sometimes they need to uploaded meat into plastic bags. Three main tasks that the cashier needed to perform during executing their job were lifting and carrying container filled with meat, fishes and poultry, cutting meat, and packing the meat into plastic bags. Most of the time workers spend waiting for customer and packing items. The items needed to be packed weigh between 200 g to 20 kg. Meat cutter hand flexion while cutting meat was between 0° to 90° . Meat cutter hand flexion while uploading items into the plastic bags were between 0° to 90° .

5.1.3 Manual Handling Assessment Chart Score

From this study, it was found that the lifting score for worker of mini market male cashier around Cheras district ranged from 1 to 7, with mean(SD) of 3.44(1.917) and for female cashier ranged from 1 to 7, with mean(SD) of 3.46(1.933). This shows that hazard of manual handling for male and female cashier were low. This might be due to the fact that most items lifted during performing job task such as packing items into plastic bags were light ranging less than 3kg only. For heavy items were lifted by the

customer themselves. In particular, the effect on worker musculoskeletal caused by product of different weight ranging from light, moderate and heavy (Rodacki, 2006). For female and male cashier the variation of items weight were so minimum therefore, the lifting score were low.

The lifting score for worker of mini market male storekeeper around Cheras district ranged from 1 to 11, with mean(SD) of 4.76(2.634). This indicated that lifting exposure toward male storekeeper were medium. This may due to the fact that the load that carried by the worker were ranging from 5kg to 20kg which is far more heavier compare to the weight that should been lifted by the worker and usually load must be lifted were around 1 to 50 items per day. The load constant for the NIOSH equation is 23kg and 6 lifts per minutes (Ceriello, 1999). The study showed that male storekeeper lifted items less than 23kg. However the frequency of lifting in a day were between 1 to 50 times per day therefore, the lifting score for male storekeeper were medium. The score of worker of mini market female storekeeper around Cheras district ranged from 1 to 8, with mean(SD) of 2.38(2.326). These indicate that the lifting score for female storekeeper were low. This may be due to the fact that most lifting of heavy items which weigh above 10kg was done by male storekeeper or the supplier workers. The female storekeeper only lifted items below 10kg and shelved the items. The load constant for the NIOSH equation is 23kg and 6 lifts per minutes (Ceriello, 1999). Seen the worker perform lifting of items half from the NIOSH equation constant and the lifting frequency

was less than 6 lifts per minutes therefore, the score for female storekeeper were low. These indicate that the male storekeeper was more exposed to musculoskeletal disorder compared to female storekeeper.

The lifting score for workers of mini market male meat cutter around Cheras district ranged from 4 to 8, with mean(SD) of 5.50(1.915). This indicated that manual handling exposure toward male meat cutter were medium. This may be due to the fact not only the meat cutter focus on cutting the meat but also need to perform lifting the meat in an ice box and arranged it on the table. The load needed to be lifted was less than 23kg and the working duration are less 8 hours per day. However there is an awkward position for meat cutter while cutting meat and reaching for meat that needed to be cut. Thus the lifting score for meat cutter was medium.

The carrying evaluation in manual handling risk assessment showed that male cashier who works at mini market around Cheras district were ranged from 1 to 7, with mean(SD) of 3.61(1.883). The score for female cashier of mini market workers around Cheras district ranged from 1 to 8, with mean(SD) of 3.50(2.000). Both male and female cashier scores low for carrying assessment. According to British HSE (2002) if the carrying distances below 4 meters it indicate that the carrying task severity was low. Cashier only perform lifting procedure when they needed to pack items into plastic bags

and carrying item from the back shelve to the counter which was less than 4 meters. The carrying distance for both male and female cashier was lower than 4 meters therefore, the score for carrying were low.

The score for worker of mini market male storekeeper around Cheras district ranged from 1 to 11, with mean(SD) of 5.30(3.077). This indicated that carrying exposure toward male storekeeper were medium. The score of worker of mini market female storekeeper around Cheras district ranged from 1 to 10, with mean(SD) of 3.13(3.091). This indicated that carrying exposure toward female storekeeper were low. Most of carrying was done by the male worker and the carrying distance was between 4 meters to 10 meters which was medium risk according to British HSE (2002). Thus male worker was more expose to carrying load therefore, male carrying score were higher than female carrying score.

The score for worker of mini market male meat cutter around Cheras district ranged from 5 to 10, with mean(SD) of 6.50(2.380). This indicated that manual handling exposure toward male meat cutter were medium. This may be due to the fact that meat cutter not only needed to cut the meat but also need to perform lifting and carrying the meat in an ice box. The load needed to be lifted was less than 23kg and the carrying distance were between 4 meters to 10 meters with a postural constrain. The awkward

position carrying the ice box also contributes to the score given. Thus the carrying score for meat cutter was medium.

5.1.4 Posture assessment of worker during performing manual handling task

As for posture assessment, it was found that the REBA score for worker of mini market male cashier and female cashier around Cheras district was low.

The REBA score of male mini market storekeeper around Cheras district was medium. This may resulted from the lifting activities which required workers to lift the items manually with awkward body posture, overreaching while placing items, site bending, body flexion and head slightly bend forward and back. From other study, they found that abnormal ergonomic features including the high frequency of trunk twisting, bending and extension, and weight lifting were found to increase risks of musculoskeletal disorder (Meksawi, 2011). Most of the male shopkeeper lifted heavy boxes from floor, so there was a banding of back region. In the other hand, most women storekeeper placed the small items on the shelf which less overreaching and less bending of back region. Thus the REBA scoring for male storekeeper is higher than female storekeeper around Cheras district ranged from 3 to 7, with mean of 3.75(1.811).

The score for male meat cutter of mini market workers around Cheras district were medium with mean of 5.75(1.708). Meat cutter hand flexion while cutting meat was between 0° to 90°. The job required meat cutter to stand while cutting meat and head slightly bends forward hand will have flexion while cutting meat between 90° to 160° and hand flexion while uploading items into the plastic bags were between 0° to 90°.

5.1.5 Relationship between carry distances of load with musculoskeletal disorder among worker.

The study was carried out to determine the relationship between carry distances of load among worker with musculoskeletal disorder. This study found that there was a relationship between carry distances of load with musculoskeletal disorder at wrist/hand region ($p=0.034$) and upper back region ($p=0.049$) for male storekeeper. These may resulted from the activities such as carrying heavy items more than 4 meters in a day and large number of heavy items carried in a day. Numbers of heavy items carried in a day range from 1 to 50 items in a day. Large number of manual handling work performed during the working day may be problematic for other structures of the body. In fact, the high incidence of musculoskeletal problems in upper limbs—hands, wrists, elbows,

shoulders and neck (Lehman, 2001) highlights the necessity for further studies. A study has shown that work-cycles with short durations movement for more than half working day significantly increased the risk of hand and wrist joint injuries and other musculoskeletal problems (Rodacki, 2006).

5.1.6 The relationship between hand distance from low back while carry load with musculoskeletal disorder among worker.

The study was carried out to determine the relationship between hand distance from low back while carry load among worker with musculoskeletal disorder. This study showed that there was a relationship between hand distance from low back while carry load with musculoskeletal disorder at wrist/hand region ($p=0.039$) for female storekeeper. The combination of weight lifted, lift origin region and lift asymmetry were intended to represent the range of lift exertion variable combinations expected of a worker. In lift origin regions it would be expected to be the least stressful biomechanically and in the cases of both compression, the largest difference in loading occurred in the shoulder lift origin region followed by the waist lift origin region (Marras, 2004). However, the association between hand distance from low back while carry load with musculoskeletal disorder at wrist/hand region were negative. Study

found that when the distance of lifting load from the lower back were shorter than the higher the chances of having musculoskeletal disorder on wrists/hands region. The reason behind this finding may be due to the hand position while lifting the load. Instead of doing the carrying load in a distance the female storekeeper done the shafting of smaller items into the shelf. From the observation female storekeeper tend to load heavier items on the bottom of the shelf. While loading items at the lower part of shelf the distance of load from lower back was nearer but the hand will be push outward creating an unnatural body posture for the hand and wrist. The awkward position of wrist/hands creates a discomfort feeling on wrists/hands region among female storekeeper.

5.1.7 Relationship between body postures with musculoskeletal disorder among worker

REBA method was used to score worker body postures. From the REBA score the relationship between body postures with musculoskeletal disorder among worker was looked into. However, from this study it was found that there was no relationship between body postures with musculoskeletal disorder at any part of body region among worker include both male and female for cashier, storekeeper and meat cutter. Most

manual handling injuries are classified as being caused by lifting and carrying objects or other handling of objects (Straker, 1999). Thus body posture may contribute to musculoskeletal disorder however it was not the main contributing factor. Also, abnormal ergonomic features including the high frequency of trunk twisting, bending and extension, and weight lifting were found to increase risks of musculoskeletal disorder (Meksawi, 2011). When the proprioceptive tolerance limits developed by the body that unwilling to lifted and carried load before will became tolerable by the body because human body will adapt with the alternative lifting strategies (Marras, 2004).

5.1.8 The relationship between hand distance from low back while carry load with musculoskeletal disorder among worker.

The study was carried out to determine the relationship between hand distance from low back while carry load among worker with musculoskeletal disorder. This study showed that there was a relationship between hand distance from low back while carry load with musculoskeletal disorder at wrist/hand region ($p=0.039$) for female storekeeper. The combination of weight lifted, lift origin region and lift asymmetry were intended to represent the range of lift exertion variable combinations expected of a worker. In lift origin regions it would be expected to be the least stressful biomechanically and in the cases of both compression and A/P shear, the largest

difference in loading occurred in the shoulder lift origin region followed by the waist lift origin region (Marras, 2004). However, the association between hand distance from low back while carry load with musculoskeletal disorder at wrist/hand region were negative. Study found that when the distance of lifting load from the lower back were shorter than the higher the chances of having musculoskeletal disorder on wrists/hands region. The reason behind this finding may be due to the hand position while lifting the load. When the loads were near to the lower back origin region, the arms were push outward creating an awkward posture on wrists/hands region. The awkward position of wrist/hands thus creates a discomfort feeling on wrists/hands region among female storekeeper.



Figure 5.1: A posture of wrists/hands region where arms were push outward.

5.1.9 Various contributing factors that effecting musculoskeletal disorder among worker

The study showed that gender is a significant contributing factor for musculoskeletal disorder at knees and feet region among workers. A female workers have increase odds of having musculoskeletal disorder by 1.8 at knees region and 2.8 at ankles/feet region compare to male workers. According to (Widarnako, 2005) females reported a statistically significantly higher prevalence of symptoms in the neck, shoulders, wrist/hands, upper back and hips/thighs/buttocks regions compared with males. However, males had a higher prevalence than females for symptoms in the elbows, low back and knees. This is contradicting from the finding.

Smoking habit also showed a significant relationship with musculoskeletal disorder. Workers who did not smoke have increase odds of having musculoskeletal disorder by 7.7 at knees region compare to smoking workers. This showed that non-smoker were more at risk to have musculoskeletal disorder at knees region among worker. Smokers were usually will have a higher chances to have back and muscle pain when compare to the non smokers, because the muscle cells were constantly being damaged by the chemical present in the cigarette. Smoking can also reduce the blood

flow to the body because nicotine will harden the blood vessel thus it will reduce the blood flow to the whole body, so there were less oxygen exchange can occur at the muscles causing worker feel pain and fatigue at the body region. Individuals with a lifetime history of chronic back pain were significantly more likely to smoke cigarettes daily than those without lifetime chronic back pain or arthritis (Zvolensky, 2010). This indicate that smoking have affected workers musculoskeletal system. However from the study it have showed non-smoker at higher risk. This is because nicotine is one or the chemical present in cigarette which have the calming effect so the worker who smoke will feel less pain compare to the non-smoker.

Other than that, workers past health history (injury, undergo surgery and fractures on any part of body region) also showed a significant result when compare with musculoskeletal disorder for knees region. Workers who with health history decrease odds of having musculoskeletal disorder by 0.1 at knees and ankles/feet region compare to workers without health history. This may due to the fact that the already recovery state so, some discomfort feeling not present any longer. A significant result showed between sport involvement and musculoskeletal disorder at upper back and lower back region. Workers who actively involve with sport have decrease odds of having musculoskeletal disorder by 0.3 at upper back and lower back region compare to workers who were not involve with sport. Previous study showed that 20 percent of athletes have an acute or chronic injury related to their sport (Heere, 1988). However those who involve in sport will improve their musculoskeletal system.

Age showed a significant difference for this study. Workers who were older have decrease odds of having musculoskeletal disorder by 0.9 at knees and ankles/feet region compare to younger workers. However, in another study, they found that age finding was not surprising given the generally higher occurrence of back pain. Older patients have accumulated more spinal damage over their working lives and are exposed to repeated microtrauma to the spine which might account for increased susceptibility to recurrent injury outcomes found in the literature for older patients (Evans, 2001). According to a study by Widarnako (2005) there were no statistically significant differences in prevalence between age groups for all body regions for males, females, and the whole population. However according to Grimby (1999) stated that nearly two thirds of the elderly age above 75 years old reported with pain on musculoskeletal. This was contradicting from the study.

5.2 Conclusion

From the study, it can be summarized that there different work types will have different lifting score, carrying score and posture score. Male storekeeper and male meat cutter showed slightly higher score (lifting, carrying and posture) compare to cashier and meat cutter types of works.

This study also showed that there was a significant relationship between carrying distances of load among worker with musculoskeletal disorder while conducting manual handling. However, only male storekeeper showed a significant relationship and it only involved wrists/hands and upper back body region.

For the relationship of hand distance from lower back while carrying load with musculoskeletal disorder showed that it was only significant for female storekeeper. While the other types of work showed no significant relationship.

As for body posture there is no significant relationship between body postures with musculoskeletal disorder. This indicates that poor working posture may not be the main contributing factor for musculoskeletal disorder.

Carrying distance of load and hand distance from lower back while carrying load were the main contributing factor causing musculoskeletal disorder at hand/wrist and upper back region only. Other factors like smoking habit, age, gender, sport involvement and past health history also contribute to the discomfort feeling of musculoskeletal system among retail store industry worker.

5.3 Limitation

The limitations in this study were this study did not consider pushing and pulling, and repetitive activities aspect of manual handling. Other than that, quantitative measurements of musculoskeletal disorder were not able to be conducted in this study. The Nordic Questionnaire only provides semi quantitative measurement of musculoskeletal disorder among worker. This study also may have certain limitation of bias such as recall bias. Respondent required to memorized the pain and discomfort on musculoskeletal disorder for past 12 month. It was difficult for the respondent to memorized their past experience of musculoskeletal discomfort because it was not recorded.

5.4 Recommendation

In order to address this problem modification toward work area, load, items equipment and tools, working environment and system of work, work organization and practice should be done. In redesigning the layout of storage area what can be done is modified the storage area so that the heaviest items can be store between mid-thigh and chest height so that no overreaching is done while uploading heavy items.

Other than that, for load modification what can be done is break down the load into smaller loads so that the load will not burden the worker while lifting and carrying. Provide appropriate equipment like trolley so that the severity of exposure of manual handling toward worker can be reduce by reducing carrying distance of load and muscle burden while carrying load from front of shop to the storage area.

Provide adjustable work benches and appropriate work station highs for cashier so that it can lower the exposure or awkward posture while loading the items into plastic

bags. The condition of floor should always maintain so that effective lifting and carrying of load can be done. Provide adequate rest break, task variety, and rotation of work area can allow worker to use different action and posture. Plane items delivery so that there is no peak delivery time in a day or week. For administrative control what can be done is produce procedure and training to worker on safe manual lifting technique.



REFERENCES

- Beardmore, D., The identification and control of musculoskeletal risks to supermarket checkout workers. M.Sc. Dissertation, University of Salford, Manchester, England, 1998.
- Britain Health and Safety Executive; Getting to grips with manual handling a short guide; (2002) pg 1-12.
- Britain Health and Safety Executive; A guide for new and expectant mothers who work; pg 1-8.
- Carstens E., Irritant and pain-reducing effects of nicotine; Nicotine Dependence, University of California, Davis; 1997.
- Ciriello M. V., Snook S. H., Hashemi L., Cotnam J.; Distributions of manual materials handling task parameters, International Journal of Industrial Ergonomics 24 (1999) 379}388
- Department of Occupational Safety and Health, Ministry of Human Resource Malaysia (2008), Guidelines for Hazard Identification, Risk Assessment and Risk Control (HIRARC), pg 1-34.

Coyle A.; Compensation of the rapid entire body assessment and the New Zealand manual handling 'Hazard Control Record' for assessment of manual handling hazard in the supermarket industry, (2005), pg 111-116.

Darren M. Wai E. K., Paul, Kwon B.K., Dagenais S.; Causal assessment of workplace manual handling or assisting patients and low back pain: results of a systematic review; The Spine Journal 10 (2010) 639–651.

European Agency for Safety and Health at Work; Work related musculoskeletal disorders in the service and retail sectors, 2002

Forciera L. et al; Supermarket Worker: Their work and their health, particularly their self-reported musculoskeletal problem and compensation, (2008) pg.493-510.

Government of Malaysia, Eight Malaysia Plan, 2001.

Government of Western Australia, Manual task in Supermarket, pg 1-8.

Grant K.A., Daniel J. Hahes and Sherry L. Baron; An ergonomics evaluation of cashier work activities at checker-unload workstations; Applied Ergonomics 1994 25(5) 310-318

Heere, P., Piroxicam in acute musculoskeletal disorders and sports injuries; The American Journal of Medicine; Volume 84, Issue 5, Supplement 1, 20 May 1988, Pages 50–55

Kumar, S.,. The epidemiology and functional evaluation of low-back pain: a literature review, European Journal of Physical Medicine and Rehabilitation 4, (1994)15–25.

Kuorinka I. Jonsson B., Kilbom A., Vinterberg H., Biering-Sorensen F. ,Andersson G. and Jorgensen K.; Standardised Nordic for the analysis of musculoskeletal symptoms; Applied Ergonomics 1987, 18.3, 233-237.

Lehman, K.R., Balancing perception and biodynamics: designing the cashier interface on checkout scanners, AT&T Human Factors and Behavioral Sciences Symposium '95, Homedale NJ 1995.

MacKay, C., Musculoskeletal Disorders in Supermarket Cashiers. HSE Books, Sheffield, Inglaterra, 1998.

Management of Health and Safety at Work. Management of Health and Safety at Work

Regulations 1999. Approved Code of Practice and guidance (L21) (Second Edition) HSE Book 2000 ISBN 0 7176 2488 9

Odile Heran-Le Roy, Isabelle Niedhammer, Nicolas Sandret, Annette Leclerc; Manual materials handling and related occupational hazards: a national survey in France; International Journal of Industrial Ergonomics 24 (1999) 365}377.

Patrick G. et al; Ergonomics investigation of retail ice cream operations; Applied Ergonomics 31 (2000) 121-130

Quiros, L.,. BNL Ergonomics Bulletin, Vol. 4. Brookhaven National Laboratory, New York, 2001

Rodacki A.F., Eduardo J., Vieiraa A., Lu´cia M., Okimotoc L.R., Fowlerb N.E., Rodacki C.L.; The effect of handling products of different weights on trunk kinematics of supermarket cashiers, International Journal of Industrial Ergonomics, (2006), pg 129–134.

Sakata, K., Kogure, A., Hosoda, M., Isozaki, K., Masuda, T., Morita, S., Evaluation of the age-related changes in movement smoothness in the lower extremity joints during lifting Gait & Posture 31 (2010) 27–31

Shinnara A., et al.; Survey of ergonomic features of supermarket cash registers,
International Journal of Industrial Ergonomics, (2004), pg 535–541

Straker L.M.; An overview of manual handling injury statistics in Western Australia;
International Journal of Industrial Ergonomics 24 (1999) 357}364.

St-Vincent M., Denis D., Imbeau D., Laberge M.; Work factors affecting manual
materials handling in a warehouse superstore; International Journal of Industrial
Ergonomics 35 (2005) 33–46.

Sue Hignett and Lynn McAtamney; Rapid Entire Body Assessment (REBA); Applied
Ergonomics 31 (2000) 201-205.

Widanarko B. Legg S., Stevenson M., Devereux J., Eng A., Mannetje A., Cheng S.,
Douwes J., Ellison-Loschmann L., McLean D., Pearce N.; Prevalence of
musculoskeletal symptoms in relation to gender, age, and occupational/industrial
group; International Journal of Industrial Ergonomics 41 (2011) pg 561-572.

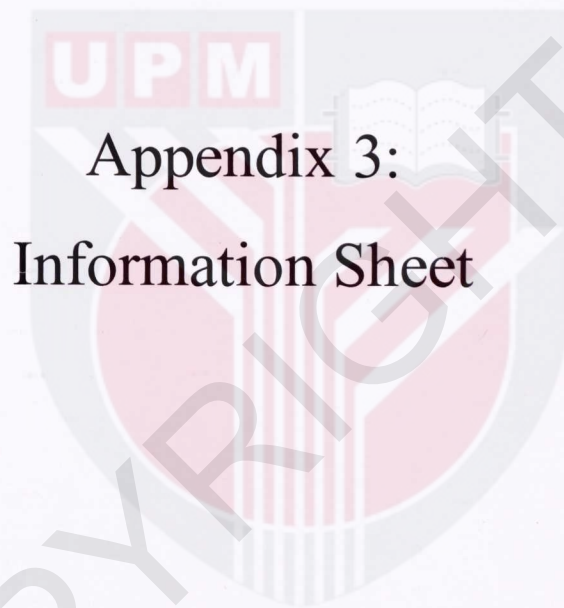
Zander, J.E., King, P.M., Ezenwa, B.N., Influence of flooring conditions on lower leg
volume following prolonged standing, International Journal of Industrial
Ergonomics, 2004;34, 2

UPM

Appendix 1:
Ethic Approval Letter

Appendix 2:

Application Letter for the permission of
Conducts the Research



Appendix 3: Information Sheet

RESPONDENT'S INFORMATION SHEET

Please read the following information carefully, do not hesitate to discuss any questions you may have with your researcher.

STUDY TITLE

Risk Assessment of manual handling among workers in retail store industry

INTRODUCTION

Manual handling is one of various work tasks that present in every day work procedure of a worker working in supermarket. The nature of manual handling if it is not performed in a proper way it will lead to health problem related to manual handling.

WHAT WILL YOU HAVE TO DO?

By using Manual Handling Assessment Charts (MAC) which is in the form of questionnaire it is designed to assess the most common risk factors in lifting, carrying and team handling operations and Nodic questionnaire that use interview method to obtain information on musculoskeletal disorder among worker. By using the assessment guide and flow chart the level of risk for each risk factor can be determine. Some video taping will also be include in this research to identify their hazards exposure for REBA method and some intervie will be conducted to gain information from the respondent.

WHO SHOULD NOT ENTER THE STUDY?

Those that not involve with manual handling task in supermarket work setting will not be included in this study. Pragnenent women, workers with body injury and workers above 50 years old will also be excluded from this study.

WHAT WILL BE BENEFITS OF THE STUDY:

(a) TO YOU AS THE SUBJECT?

Able to gain knoledge and information on manual handling hazards.

b) TO THE INVESTIGATOR?

Able to give information on manual handling hazard to the employer and employee so remedial action can be taken to minimise the health effect.

ARE THERE ANY RISKS?

There is no risk will be involve in this study.

WHAT ARE THE POSSIBLE DRAWBACKS?

There is no possible drawback in this study.

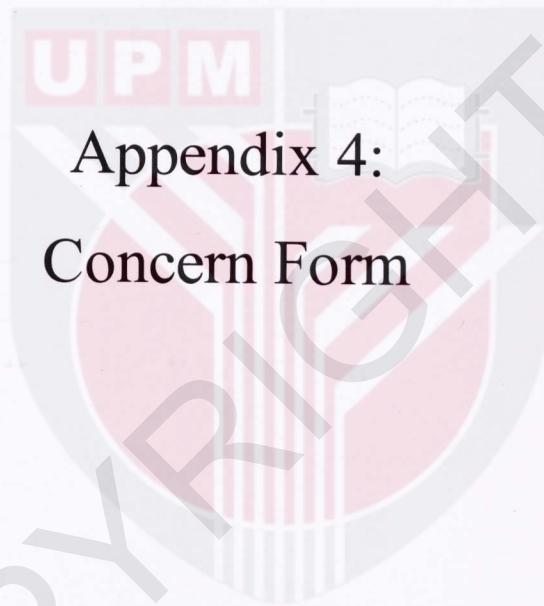
WILL THE INFORMATION AND MY IDENTITY REMAIN CONFIDENTIAL?

All workers information and identity will remain cofidential.

WHO SHOULD I CONTACT IF I HAVE ADDITIONAL QUESTIONS DURING THE COURSE OF THE RESEARCH?

Resercher: Nur Azreen Azizan from University Putra Malaysia

Phone Number: 0179778646



Appendix 4:
Concern Form



CONSENT FORM (RESPONDENT)

RESEARCH TITLE : Risk Assessment of manual handling among workers in retail store industry

RESEARCHER :

I Identity Card No.
address.....
.....hereby voluntarily agree to take part in the clinical
research *(clinical study, questionnaire study/ drug trial) specified above.

I have been informed about the nature of the clinical research in terms of methodology, possible adverse effects and complications (refer to Information Sheet). I understand that I have the right to withdraw from this clinical research at any time without assigning any reason whatsoever. I also understand that this study is confidential and all information provided with regards to my identity will remain private and confidential.

I wish to *know/don't wish to know the results of the tests performed on my sample.

* delete where necessary

Signature
(Respondent)

Signature
(Witness)

Date :

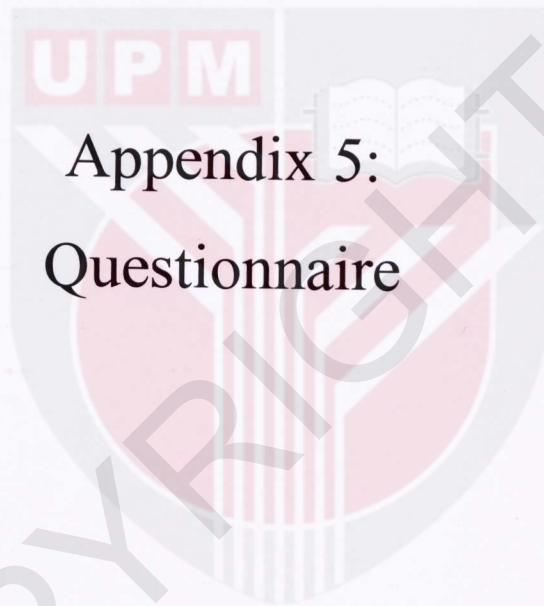
Name :

I/C No. :

I confirm that I have explained to the respondent the nature and purpose of the above –mentioned clinical research.

Date

Signature
(Researcher)



Appendix 5: Questionnaire

Seksyen A: Maklumat Latar Belakang Responden

Arahan: Jawab semua soalan saripada setiap seksyen dan tandakan (✓) bagi setiap soalan berikut.

1. Umur: Tahun
2. Jantina: 1. ☐ Leleki 2. ☐ Perempuan
3. Status Perkahwinan: 1. ☐ Bujang 3. ☐ Berceraai
2. ☐ Berkahwin
4. Pendidikan: 1. ☐ SRP/PMR 3. ☐ STPM/Diploma
2. ☐ SPM 4. ☐ Ijazah
5. Adakah anda ada melakukan kerja sambilan selepas waktu bekerja?
1. ☐ Ya 2. ☐ Tidak
6. Adakah anda merokok?
1. ☐ Ya 2. ☐ Tidak
7. Adakah anda terlibat dengan sebarang jenis sukan?
1. ☐ Ya 2. ☐ Tidak Jika Ya: _____
8. Pernahkah anda mempunyai sebarang jenis kecederaan/ patah pada mana-mana bahagian tubuh badan?
1. ☐ Ya 2. ☐ Tidak
Jika ya nyatakan bahagian tersebut?
1. ☐ Leher 6. ☐ Siku
2. ☐ Pegelangan tangan 7. ☐ Atas belakang
3. ☐ Bawah belakang 8. ☐ Peha kanan/kiri atau kedua-duanya
4. ☐ Lutut kanan/kiri atau kedua-duanya 9. ☐ Kaki kanan/kiri atau kedua-duanya
5. ☐ Bahu

Sekyen B: Latar belakang pekerjaan

9. Berapa lamakah anda telah berkhidmat untuk syarikat ini ?

_____ tahun.

10. Jenis kenderaan yang anda gunakan untuk ke tempat kerja:

1. ☐ Motosikal

4. ☐ LRT/ Komuter

2. ☐ Kereta

5. ☐ Berjalan kaki

3. ☐ Bas

11. Nyatakan jumlah waktu berehat anda sepanjang waktu bekerja:

12. Nyatakan waktu berehat anda:

13. Adakah terdapat waktu berehat yang singkat antara waktu kerja?

1. ☐ Ya

2. ☐ Tidak

14. Apakah jenis pekerjaan anda?

1. ☐ Juruwang

3. ☐ Jurujual

5. ☐ Lain-lain:

2. ☐ Petugas stor

4. ☐ Pemotong daging

15. Adakah tugas anda mempunyai kaitan dengan melakukan pengendalian manual?

1. ☐ Ya

2. ☐ Tidak

16. Kekeraan mengangkat barang berat dengan menggunakan teknik pengendalian manual dalam sehari?

1. ☐ 1 hingga 50 kali sehari

4. ☐ 151 hingga 200 kali sehari

2. ☐ 51 hingga 100 kali sehari

5. ☐ 201 hingga 250 kali sehari

3. ☐ 101 hingga 150 kali sehari

6. ☐ Lebih daripada 250 kali sehari

**BAHAGIAN C: (BORANG SOAL SELIDIK NORDIC)
MASALAH OTOT RANGKA**

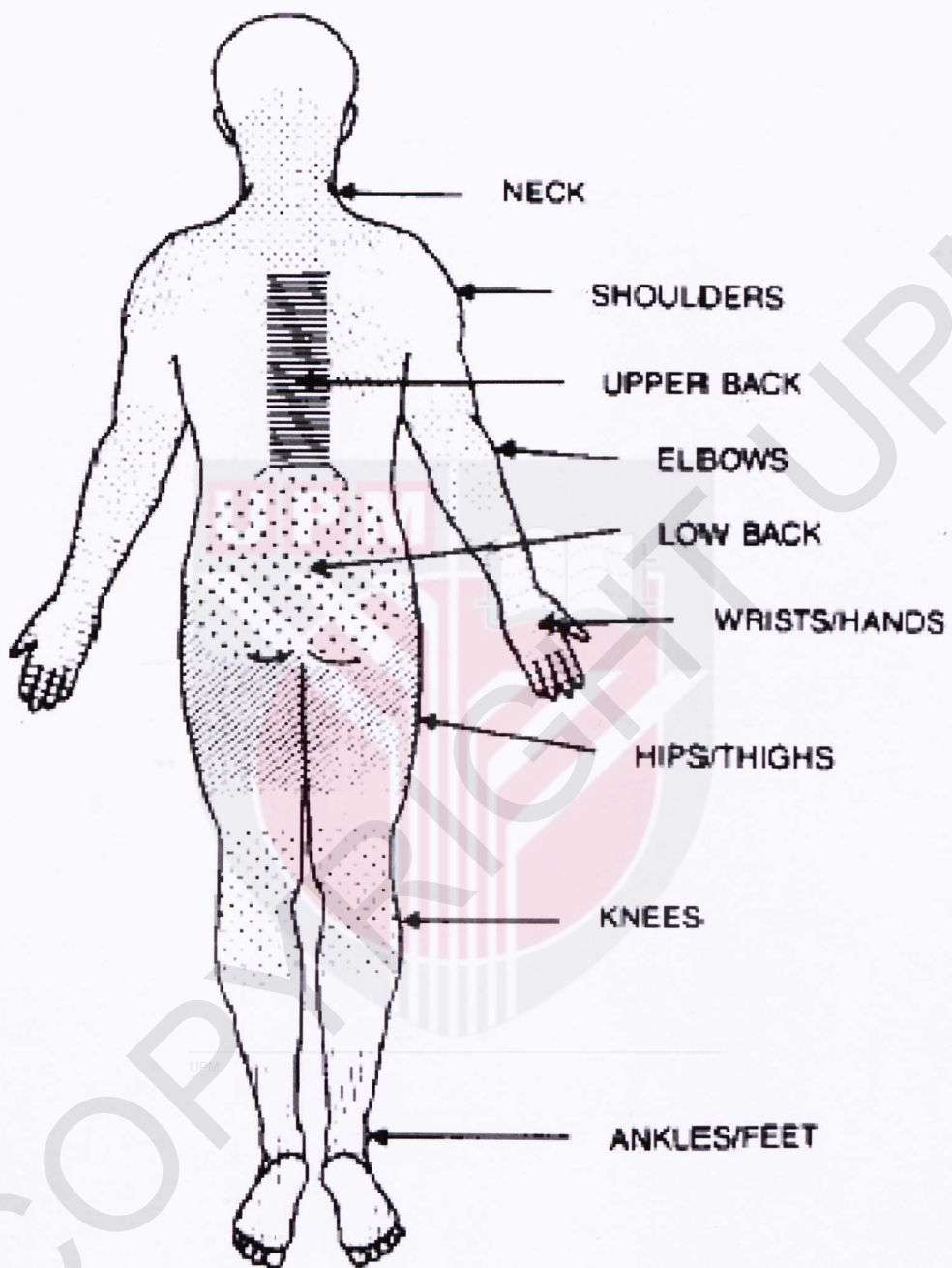
Untuk menjawab soalan ini, sila rujuk gambarajah (lampiran)

	Bahagian badan	Adakah anda mengalami masalah bila-bila masa, dalam tempoh 12 bulan kebelakangan (perit,sakit,tidak selesa) pada bahagian anggota berikut:	Adakah anda pernah merasa sakit, lenguh-lenguh, perit, atau tidak selesa pada bahagian anggota badan dibawah dalam masa 7 hari kebelakangan ini?	Adakah dalam tempoh 12 bulan kebelakangan ini, masalah yang dihadapi menghalang anda melakukan kerja secara normal? (di tempat kerja/di rumah)	Adakah anda merasakan maslah itu berpunca dari tempat kerja?
17.	i. Leher 1. ☐ Ya 2. ☐ Tidak Jika ya , jawab soalan ii,iii dan iv. Jika tidak terus ke soalan berikutnya	ii. 1. ☐ Ya 2. ☐ Tidak	iii. 1. ☐ Ya 2. ☐ Tidak	iv. 1. ☐ Ya 2. ☐ Tidak	
18.	i. Bahu 1. ☐ Ya 2. ☐ Tidak Jika ya, *kiri/ kanan/ kedua-dua belah? (bulatkan) Jika ya , jawab soalan ii,iii dan iv. Jika tidak terus ke soalan berikutnya	ii. 1. ☐ Ya 2. ☐ Tidak	iii. 1. ☐ Ya 2. ☐ Tidak	iv. 1. ☐ Ya 2. ☐ Tidak	
19.	i. Siku 1. ☐ Ya 2. ☐ Tidak Jika ya, *kiri/ kanan/ kedua-dua belah? (bulatkan) Jika ya , jawab soalan ii,iii dan iv. Jika tidak terus ke soalan berikutnya	ii. 1. ☐ Ya 2. ☐ Tidak	iii. 1. ☐ Ya 2. ☐ Tidak	iv. 1. ☐ Ya 2. ☐ Tidak	

20.	i. Lengan bawah/ Tangan 1. ☐ Ya 2. ☐ Tidak Jika ya, *kiri/ kanan/ kedua-dua belah? (bulatkan) Jika ya, jawab soalan ii,iii dan iv. Jika tidak terus ke soalan berikutnya	ii. 1. ☐ Ya 2. ☐ Tidak	iii. 1. ☐ Ya 2. ☐ Tidak	iv. 1. ☐ Ya 2. ☐ Tidak
21.	i. Belakang atas 1. ☐ Ya 2. ☐ Tidak Jika ya, jawab soalan ii,iii dan iv. Jika tidak terus ke soalan berikutnya	ii. 1. ☐ Ya 2. ☐ Tidak	iii. 1. ☐ Ya 2. ☐ Tidak	iv. 1. ☐ Ya 2. ☐ Tidak
22.	i. Belakang bawah/ pinggang 1. ☐ Ya 2. ☐ Tidak Jika ya, jawab soalan ii,iii dan iv. Jika tidak terus ke soalan berikutnya	ii. 1. ☐ Ya 2. ☐ Tidak	iii. 1. ☐ Ya 2. ☐ Tidak	iv. 1. ☐ Ya 2. ☐ Tidak
23.	i. Peha 1. ☐ Ya 2. ☐ Tidak Jika ya, *kiri/ kanan/ kedua-dua belah? (bulatkan) Jika ya, jawab soalan ii,iii dan iv. Jika tidak terus ke soalan berikutnya	ii. 1. ☐ Ya 2. ☐ Tidak	iii. 1. ☐ Ya 2. ☐ Tidak	iv. 1. ☐ Ya 2. ☐ Tidak
24.	i. Lutut 1. ☐ Ya 2. ☐ Tidak Jika ya, *kiri/ kanan/ kedua-dua belah? (bulatkan) Jika ya, jawab soalan ii,iii dan iv. Jika tidak terus ke soalan berikutnya	ii. 1. ☐ Ya 2. ☐ Tidak	iii. 1. ☐ Ya 2. ☐ Tidak	iv. 1. ☐ Ya 2. ☐ Tidak

25.	i. Kaki 1. ☐ Ya 2. ☐ Tidak Jika ya, *kiri/ kanan/ kedua-dua belah? (bulatkan) Jika ya, jawab soalan ii,iii dan iv. Jika tidak terus ke soalan berikutnya	ii. 1. ☐ Ya 2. ☐ Tidak	iii. 1. ☐ Ya 2. ☐ Tidak	iv. 1. ☐ Ya 2. ☐ Tidak
-----	--	---	--	---





In this picture you can see the approximate position of the parts of the body referred to in the questionnaire. Limits are not sharply defined, and certain parts overlap. You should decide for yourself in which part you have or have had your trouble (if any).

Appendix 6:

Manual Handling Assessment Chart Instruction

Manual handling assessment charts



This is a web-friendly
version of leaflet INDG383

Introduction

Work-related musculoskeletal disorders (MSDs), including manual handling injuries, are the most common type of occupational ill health in the UK and their prevention is a priority for HSE. It is important to remember that:

- things can be done to prevent MSDs;
- preventative measures are cost-effective;
- you cannot prevent all MSDs, so early reporting of symptoms, proper treatment and suitable rehabilitation is essential.

The steps to follow

The Manual Handling Operations Regulations 1992 (as amended) establish a clear hierarchy of measures for dealing with risks from manual handling. These are:

- avoid hazardous manual handling operations so far as reasonably practicable;
- assess any hazardous manual handling operations that cannot be avoided; and
- reduce the risk of injury so far as reasonably practicable.

The MAC

The Manual Handling Assessment Charts (MAC) is a new tool designed to help health and safety inspectors assess the most common risk factors in lifting (and lowering), carrying and team handling operations. Employers, safety officers, safety representatives and others may also find the MAC useful to identify high-risk manual handling operations and help them complete their risk assessments.

Structure of the MAC

There are three types of assessment that can be carried out with the MAC:

- lifting operations pages 2-5;
- carrying operations pages 6-9;
- team handling operations pages 9-11.

For each type of assessment there is an assessment guide and a flow chart. There is a score sheet to complete on page 12.

Note:

The MAC is not appropriate for some manual handling operations, for example those that involve pushing and pulling. Its use does **not** comprise a full risk assessment (see *Manual handling*, 'Further reading'). You must consider individual and psychosocial issues when completing the score sheet. Also, the MAC is not designed to assess risks from workplace upper limb disorders (see *Upper limb disorders in the workplace*, see 'Further reading').

How to complete a MAC assessment

- Spend some time observing the task to ensure that what you are seeing is representative of normal working procedures. Consult employees and safety representatives during the assessment process. Where several people do the same task, make sure you have some insight into the demands of the job from all workers' perspective. It may help to videotape the task so you can view it over again, away from the workplace, if necessary.
- Select the appropriate type of assessment (ie lifting, carrying or team handling). If a task involves lifting and carrying, consider both.
- Ensure you read the assessment guide before you make your assessment.
- Follow the appropriate assessment guide and flow chart to determine the level of risk for each risk factor. Information on risk reduction can be found on the website (see address below). The levels of risk are classified below:

G = GREEN - Low level of risk The vulnerability of special risk groups (eg pregnant women, young workers etc) should be considered where appropriate.
A = AMBER - Medium level of risk - Examine tasks closely
R = RED - High level of risk - Prompt action needed This may expose a significant proportion of the working population to risk of injury.
P = PURPLE - Very high level of risk Such operations may represent a serious risk of injury and should come under close scrutiny, particularly when the entire weight of the load is supported by one person.

- Enter the colour band and corresponding numerical score on the score sheet on page 12. The colour bands help determine which elements of the task require attention.
- Add up the total score. The total scores help prioritise those tasks that need most urgent attention and help check the effectiveness of those improvements.
- Enter the remaining task information asked for on the score sheet.

Remember:

The purpose of the assessment is to identify and then reduce the overall level of risk of the task.

Further information on the MAC, including on-line training, can be found at <http://www.hse.gov.uk/msd/mac/index.htm>

Assessment guide for lifting operations

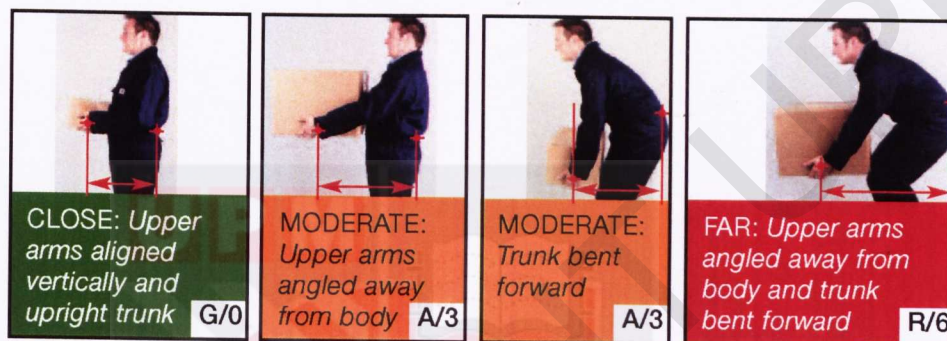
A Load weight/frequency

Note the weight of the load and the repetition rate of the lifting operation. Read off the risk banding on the graph on page 4 and enter the colour band and numerical score on the score sheet. If the colour band is purple the task should be examined very closely, such operations may represent a serious risk of injury and should come under close scrutiny, particularly when the entire weight of the load is supported by one person. Note: High frequency handling operations of light weights will fall within the GREEN zone, but may be associated with upper limb

problems. Please refer to *Upper limb disorders in the workplace* (see 'Further reading') for advice on further assessment.

B Hand distance from the lower back

Observe the task and examine the horizontal distance between the operative's hands and their lower back. Always assess the 'worst case scenario'. Use the following to guide your assessment:



C Vertical lift region

Observe the position of the operative's hands at the start of the lift and as the lift progresses. Always assess the 'worst case scenario'. Use the following illustrations as a guide:



D Trunk twisting and sideways bending

Observe the operative's trunk as the load is lifted. If the trunk twists in relation to the hips and thighs or the operative leans to one side as the load is lifted, the colour band is amber and the numerical score is 1. If the trunk both twists **and** bends to the side as the load is lifted the colour band is red and the numerical score is 2.

E Postural constraints

If the movements of the operative are unhindered, the colour band is green and the numerical score is 0. If the operative adopts restricted postures during the lift because of the space available (eg a narrow gap between pallet load and hopper) or the workstation design (eg an excessively high monorail conveyor), the colour band is amber and the numerical score is 1. If the posture is severely restricted, the colour band is red and the numerical score is 3 (eg work in confined areas such as baggage holds).

F Grip on the load

GOOD	REASONABLE	POOR
G/0	A/1	R/2
Containers with well-designed handles or handholds, fit for purpose	Containers with poor handles or handholds	Containers of poor design. Loose parts, irregular objects, bulky or difficult to handle
Loose parts enabling comfortable grip	Fingers to be clamped at 90 degrees under the container	Non-rigid sacks or unpredictable loads

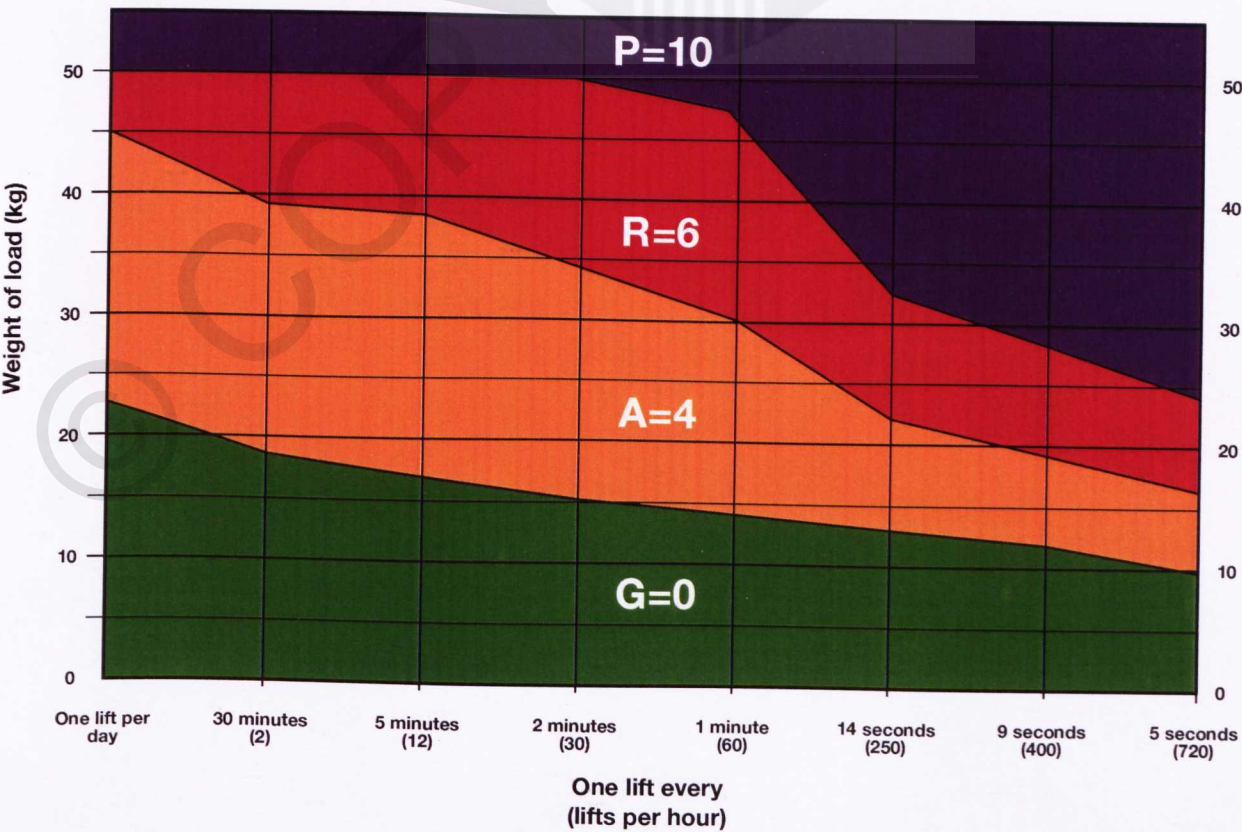
G Floor surface

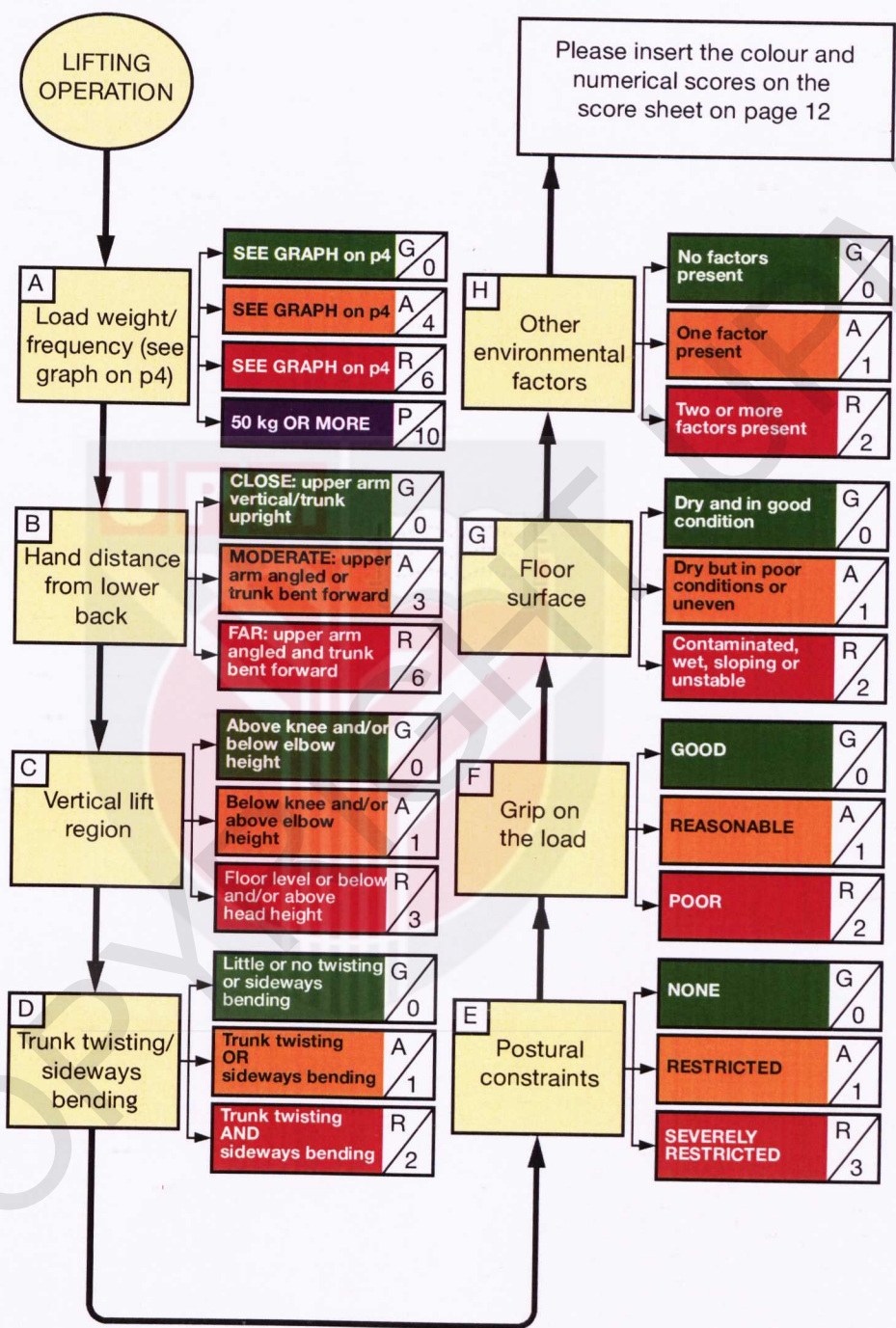
Dry and clean floor in good condition	Dry floor but in poor condition, worn or uneven	Contaminated/wet or steep sloping floor or unstable footing
G/0	A/1	R/2

H Other environmental factors

Observe the work environment and score if the lifting operation takes place: in extremes of temperature; with strong air movements; or in extreme lighting conditions (dark, bright or poor contrast). If one of the risk factors are present score 1, if two or more of the risk factors are present score 2.

Load weight/frequency graph for lifting operations





Assessment guide for carrying operations

A Load weight/frequency

Note the weight of the load and the frequency of the carrying operation. Read off the risk banding on the graph on page 9 and enter the colour band and numerical score on the score sheet. If the colour band is purple the task should be examined very closely, such operations may represent a serious risk of injury and should come under close scrutiny, particularly when the entire weight of the load is carried by one person.

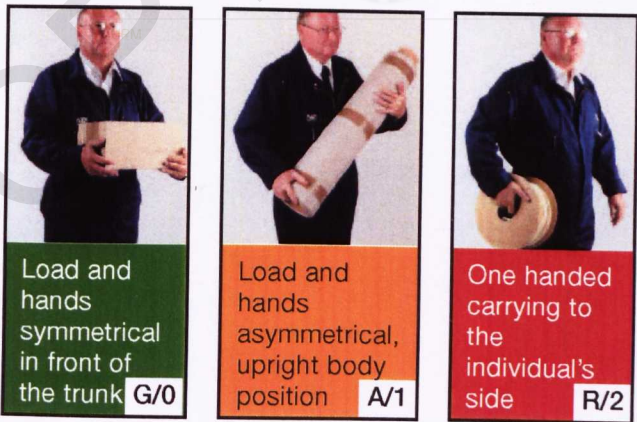
B Hand distance from the lower back

Observe the task and examine the horizontal distance between the operative's hands and their lower back. Always assess the 'worst case scenario'. Use the following illustrations to guide your assessment:



C Asymmetrical trunk/load

The operative's posture and the stability of the load are risk factors associated with musculoskeletal injury. The following illustrations should guide your assessment.



D Postural constraints

If the operative's movements are unhindered, the colour band is green and the numerical score is 0. If the operative adopts restricted postures during the carry (eg a narrow doorway making the operative turn or move the load to get through), the colour band is amber and the numerical score is 1. If the posture is severely restricted, the colour band is red and the numerical score is 3 (eg carrying loads in a forward bent posture in areas with low ceilings such as cellars).

E Grip on load

GOOD G/0	REASONABLE A/1	POOR R/2
Containers with well-designed handles or handholds, fit for purpose	Containers with poor handles or handholds	Containers of poor design. Loose parts, irregular objects, bulky or difficult to handle
Loose parts enabling comfortable grip	Fingers to be clamped at 90 degrees under the container	Non-rigid sacks or unpredictable loads

F Floor surface

Dry and clean floor in good condition G/0	Dry floor but in poor condition, worn or uneven A/1	Contaminated/wet or steep sloping floor or unstable footing R/2
--	--	--

G Other environmental factors

Observe the work environment and score if the carrying operation takes place: in extremes of temperature; with strong air movements; or in extreme lighting conditions (dark, bright or poor contrast). If one of the risk factors are present score 1, if two or more of the risk factors are present score 2.

H Carry distance

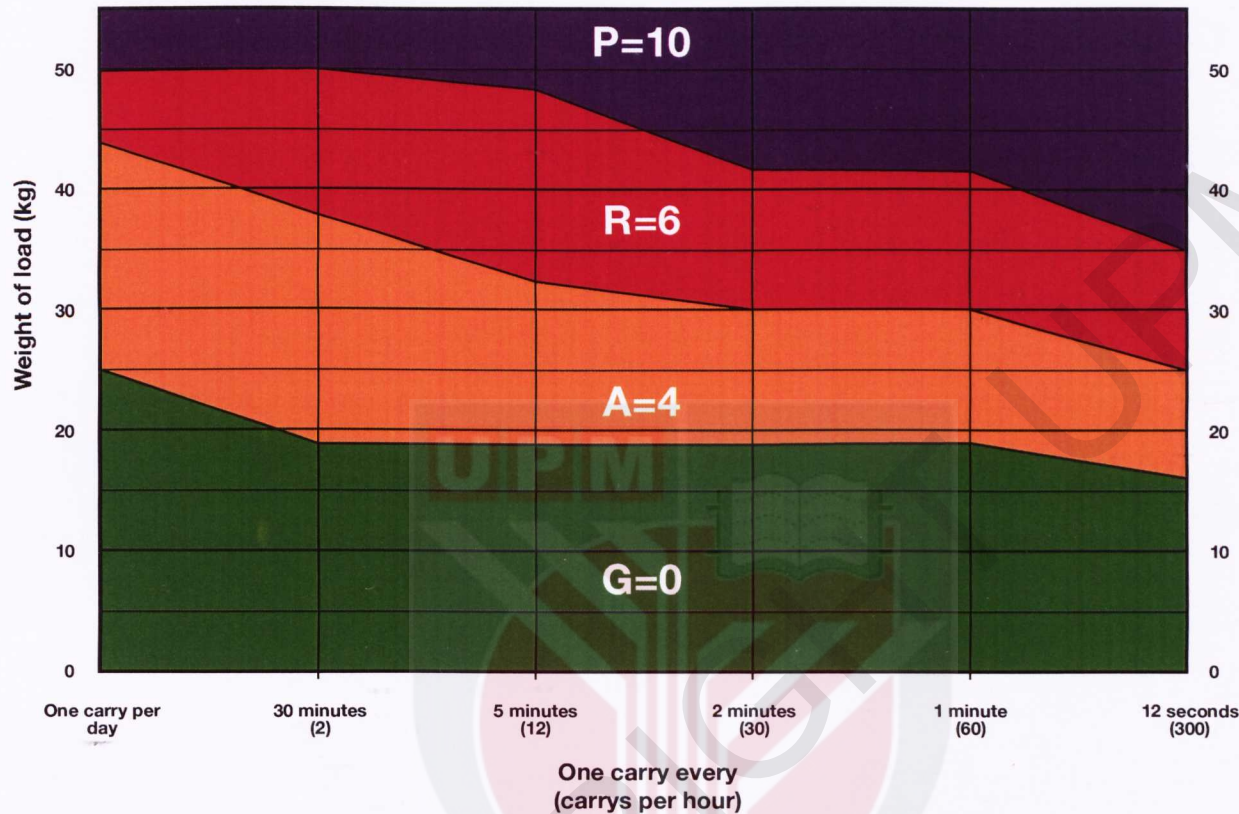
Observe the task and estimate the total distance that the load is carried (not the distance 'as the crow flies').

I Obstacles en route

Observe the route. If the operator has to carry a load up a steep slope, up steps, through closed doors or around tripping hazards, the coloured band is amber and the numerical score is 2. If the task involves carrying the load up ladders, enter 'R' (red) for the colour band and 3 for the numerical score. If the task involves more than one of the risk factors (ie a steep slope and then up ladders) total the scores on the score sheet. Enter the ladder height data and/or the angle in the task description box on the score sheet.



Load weight/frequency graph for carrying operations



Assessment guide for team handling operations

A Load weight

Note the weight of the load and the number of operatives performing the task. Enter the colour band and numerical score on the score sheet. If the colour band is purple the task should be examined very closely, such operations may represent a serious risk of injury and should come under close scrutiny, particularly when the entire weight of the load is supported by the team.

B Hand distance from the lower back

Observe the task and examine the horizontal distance between each operatives' hands and their lower back. Always assess the 'worst case scenario'. Use the following illustrations to guide your assessment:



C Vertical lift region

Observe the position of the operatives' hands at the start of the lift and as the lift progresses. Always assess the 'worst case scenario'. Use the following illustrations as a guide:



D Trunk twisting and sideways bending

Observe the operatives' trunks as they lift the load. If the trunk twists in relation to the hips and thighs or if the operatives lean to one side as the load is lifted, the colour band is amber and the numerical score is 1. If the trunk both twists **and** bends to the side as the load is lifted, the colour band is red and the numerical score is 2.

E Postural constraints

If the movements of the operatives are unhindered, the colour band is green and the numerical score is 0. If the operatives adopt restricted postures during the lift because of the space available (eg narrow space between team members) or the workstation design (eg an excessively high monorail conveyor), the colour band is amber and the numerical score is 1. If the postures are severely restricted, the colour band is red and the numerical score is 3 (eg work in confined areas such as baggage holds).

F Grip on load

GOOD G/0	REASONABLE A/1	POOR R/2
Containers with well-designed handles or handholds, fit for purpose	Containers with poor handles or handholds	Containers of poor design. Loose parts, irregular objects, bulky or difficult to handle
Loose parts enabling comfortable grip	Fingers to be clamped at 90 degrees under the container	Non-rigid sacks or unpredictable loads

G Floor surface

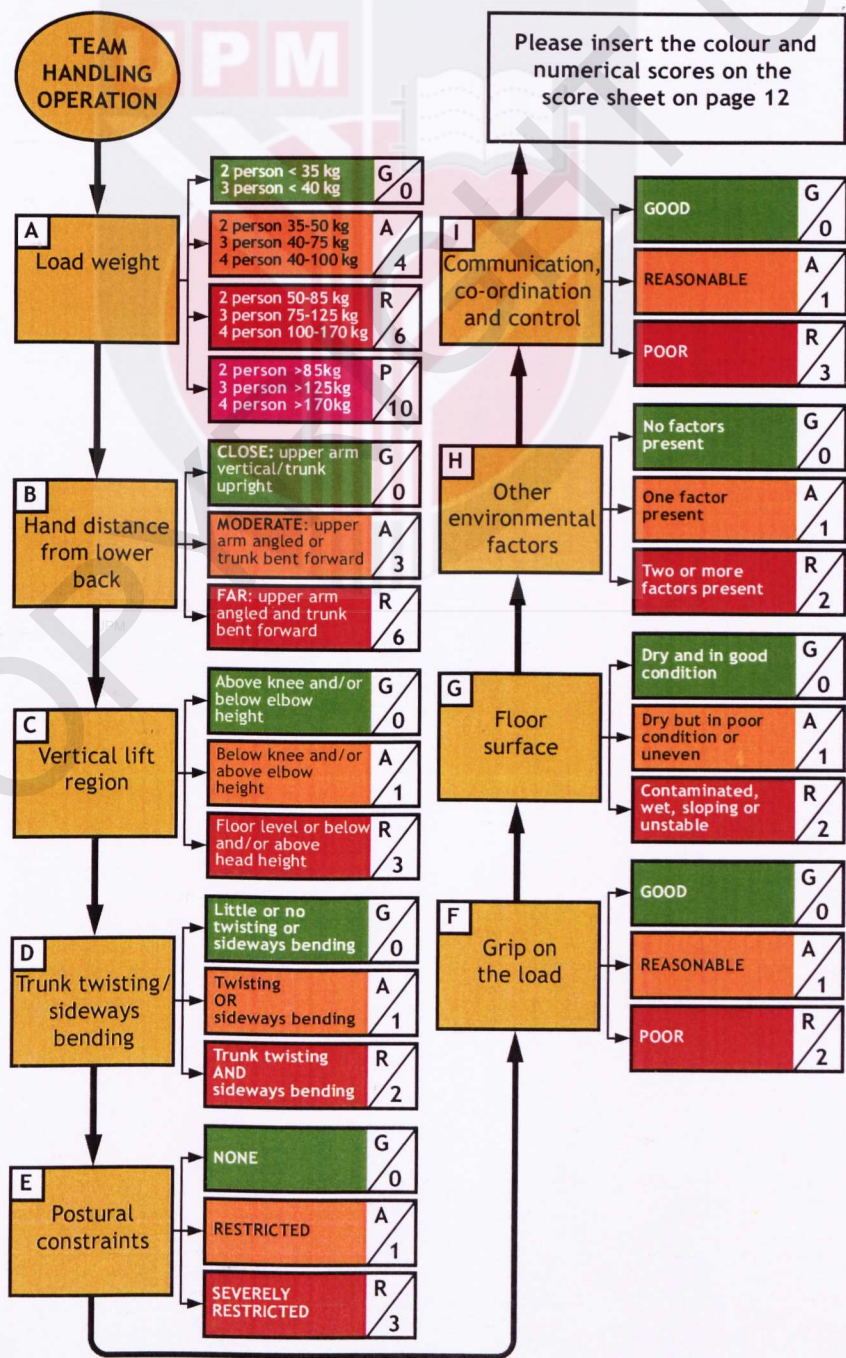
Dry and clean floor in good condition G/0	Dry floor but in poor condition, worn or uneven A/1	Contaminated/wet or steep sloping floor or unstable footing R/2
--	--	--

H Other environmental factors

Observe the work environment and score if the lifting operation takes place: in extremes of temperature; with strong air movements; or in extreme lighting conditions (dark, bright or poor contrast). If one of the risk factors are present score 1, if two or more of the risk factors are present score 2.

I Communication, co-ordination and control

Communication between the operatives is essential when lifting as part of a team. Examples of good communication would be that you may hear the operatives counting 'one, two, three' etc prior to the lift. Look to see if the team have control of the load, that it is lifted smoothly, and that all members lift together. An uncoordinated team lift may leave one member of the team bearing the entire weight.



Further reading

Manual handling. Manual Handling Operations Regulations 1992 (as amended). Guidance on Regulations L23 (Third edition) HSE Books 2004
ISBN 978 0 7176 2823 0

Upper limb disorders in the workplace HSG60 (Second edition) HSE Books 2002
ISBN 978 0 7176 1978 8

Further information on the MAC, including on-line training, can be found at www.hse.gov.uk/msd

For information about health and safety, or to report inconsistencies or inaccuracies in this guidance, visit www.hse.gov.uk/. You can view HSE guidance online and order priced publications from the website. HSE priced publications are also available from bookshops.

This leaflet contains notes on good practice which are not compulsory but which you may find helpful in considering what you need to do.

This leaflet is available in priced packs of 10 from HSE Books, ISBN 978 0 7176 2741 7. Single copies are free and a web version can be found at: www.hse.gov.uk/pubns/indg383.pdf.

© Crown copyright If you wish to reuse this information visit www.hse.gov.uk/copyright.htm for details. First published 08/03.

MAC: Score sheet

Company name:

Task Description:

Are there indications that the task is high risk?
(Tick the appropriate boxes)

☐ Task has a history of manual handling incidents (eg company accident book, RIDDOR reports).

☐ Task is known to be hard work or high risk.

☐ Employees doing the work show signs that they are finding it hard work
(eg breathing heavily, red-faced, sweating).

☐ Other indications, if so what?

Date:

Signature:

Insert the colour band and numerical score for each of the risk factors in the boxes below, referring to your assessment, using the tool.

Risk factors	Colour band (G, A, R or P)			Numerical score		
	Lift	Carry	Team	Lift	Carry	Team
Load weight and lift/carry frequency						
Hand distance from the lower back						
Vertical lift region						
Trunk twisting/sideways bending Asymmetrical trunk/load (carrying)						
Postural constraints						
Grip on the load						
Floor surface						
Other environmental factors						
Carry distance						
Obstacles en route (carrying only)						
Communication and co-ordination (team handling only)						
Other risk factors, eg individual factors, psychosocial factors etc (see website - address on page 12)						
TOTAL SCORE:						