An investigation into the contributing factors associated with work related musculoskeletal disorders of the neck and shoulders in non-secretarial computer users in a selected corporate banking environment

By

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I, Nigel Richard Peek, do hereby declare that this dissertation represents my own work in both concept and execution.

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Dedication

I dedicate this work to my father, Richard Peek, for your support, patience and understanding. Your outright passion and enthusiasm for all that you undertake has and always will be an inspiration to me.

Thank you

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Abstract

Musculoskeletal injuries in computer users are an increasing concern. The computer has become an essential working tool that is used throughout all levels of companies and organisations. Management and professional personnel are required to use computers, often without training in typing skills, this combined with higher stress and responsibility levels and lengthy work hours. Potentially this makes them a high-risk group for work related injury. Previous research has focused mainly on data entry and secretarial workers, who are often competent in typing and keyboard skills.

There is an increasing body of literature that implicates a wide variety of factors responsible for computer and office related musculoskeletal injury, however there is still much conflict as to what factors play the most influential role in development of these disorders. Conflict largely remains over the role of individual and constitutional factors versus workplace factors such as ergonomic design and patterns of computer use. The aim of this study was therefore to determine the prevalence of and related risk factors associated with work related musculoskeletal injuries of the neck and shoulder in non-secretarial computer users within the South African context.

A descriptive Co-Hort field study was conducted on 111 financial advisory and banking administrative staff in a selected corporate banking environment in the greater Durban area. A two-part survey study design was conducted. Part interview and part self-administered questionnaires were filled out and systematic observations were conducted. The subjects, who were age 20 and over were required to have at least one year of work experience and work at a computer for 2 or more hours per day. The incidence and prevalence of neck and shoulder disorders were investigated. Relationships between individual factors, working psychosocial and environmental factors, workstation design, level of computer skills and hours spent at video display terminals and neck and shoulder pain were also analysed.

The lifetime incidence of neck and shoulder pain was 82% and 54% respectively, with a point prevalence of 39% and 23%. Neck pain was reported more than shoulder pain. The one-year prevalence of female staff with neck and shoulder pain was 79% and 59%, was higher than male staff, 71% and 25%. These findings are similar in other studies and demonstrate that neck and particularly shoulder pain was more prevalent in women. 5.5% and 4.5% reported experiencing constant neck and shoulder pain, 13.5% and 7.2% reported taking time off work as a result of neck and shoulder pain. It was also noted that subjects felt that neck and particularly shoulder pain had more of an effect on leisure activity than work activity. The level of care seeking for neck and shoulder complaints was reported at 53% and 47% of those experiencing symptoms seeking health care advice and management. The most common forms of treatment utilised for neck and shoulder pain were physiotherapy and chiropractic, followed by pharmaceutical intervention and massage therapy, 2.3% of consultations were to orthopaedic and neurosurgeons.

The Pearson Chi-Square statistic was used to check the strength of association between certain factors and the severity of neck and shoulder disorders. Female gender was associated with shoulder pain. Lack of chair flexibility was associated with neck and shoulder pain severity and incorrect mouse height was related to shoulder pain severity. Subjects that reported being proficient typists had a greater severity of neck pain. Negative work perceptions were associated with a greater severity of neck and shoulder pain and high quantitative work demands were associated with severity of shoulder pain.

Ergonomic comparisons were conducted between laptop and desktop users, significant differences were noted particularly with keyboard, mouse and screen set-ups in favour of the laptop computer. Work related factors such as length of employment and hours and patterns of computer use were not associated with severity of neck and shoulder pain.

The results of this study suggest that non-secretarial (Financial management/advisory staff) represent a high-risk group for job related neck and shoulder pain. The findings do show that these disorders have a marked effect on activity in the workplace. The high prevalence of neck and shoulder disorders indicates the need for further investigation to further determine causality of the problem. The findings of this study support the role of a multifactorial approach to work related musculoskeletal disorders; this is demonstrated in the positive associations found for individual factors (Gender), workplace design and set-up as well as psychosocial and work related health perceptions. The results of this study support the need for further investigation, which should focus on appropriate health care management to limit the extent and potential disability related to these disorders.

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Definition of terms

Cervical syndrome: a general term referring to several conditions dealing with head, neck, and shoulders. It is caused by an injury to the cervical vertebrae and cervical intervertebral discs, and irritation of the cervical nerve roots, common related symptoms include; painful cramps in the shoulder muscles; pain and reduced mobility in the cervical spine, and in some cases painful radiation into the arms (Tayyari and Smith, 1997:163).

Ergonomics: is the application of scientific principles, methods, and data drawn from a variety of disciplines to the development of engineering systems in which people play a significant role. Among the basic disciplines are psychology, cognitive science, physiology, biomechanics, applied physical anthropometry, and industrial systems engineering (Kroemer and Kroemer, 2001:1).

Horopter: is the locus of points in space that appear binocularly fused to the observer. Anywhere else in space appears as a double image to the observer. The horopter varies across individuals and with fixation distance and gaze angle. In video display terminal operators a vertical screen orientation results in an angle of view that is inconsistent with the developed abilities of the visual system. This results in tilting the screen slightly away at the top to form an angle that is suitable for the natural visual system (Ankrum, Hansen, and Nemeth, 1995:135).

Job satisfaction: is defined as the extent to which a person derives pleasure from a job (Kroemer and Kroemer, 2001:29).

Neck and Shoulder Pain: Neck and or shoulder trouble (NST) is defined as pain, ache or discomfort from the neck and shoulder area, experienced sometimes, often or very often during the past 12 months. Considerable neck and/or shoulder pain (NSP) is neck and or shoulder trouble with “severe” or “very severe” functional impairment. “Severe” refers to having to take breaks during work and spare time, and “very severe” means having to be on the sick list periodically (Holmstrom, Lindell and Moritz, 1992)

Occupational disease: is defined, as a disease for which there is a direct occupational cause effect relationship between hazard exposure and disease e.g. asbestos mining and asbestosis (Armstrong et al., 1993).

Stress: is a psychological state caused by environmental conditions that lead to a person's specific psychological, behavioural, and physical reactions (Kroemer and Kroemer, 2001:35).

Tension neck syndrome: is defined clinically as the combination of (a) decreased range of neck flexion/extension, lateral bending, or rotation and (b) pain on palpation of the trapezius or sternocleidomastoid muscles.

Work related disease: defined as multifactorial where the workplace and the performance of work contribute significantly, but are one of a number of factors in the aetiology and causality of the disease. They can be caused by adverse work conditions and exacerbated by workplace exposures and they may impair work capacity. Major contributors to these diseases are personal characteristics, environmental and sociocultural factors (Armstrong et al., 1993).

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Work related musculoskeletal disorder (WMSD): which are also referred to as cumulative trauma injuries and repetitive motion disorders - are injuries and disorders of the muscles, tendons, ligaments, nerves, joints, cartilage and supporting structures (Dong-Chul and Blair, 2003). Current literature suggests that a progressive neuromusculotendinous syndrome occurs as a result of repetitive microtrauma to tissues sustained over a time through overload and/or overuse of the upper extremities, neck, shoulders and trunk (Street et al. 2003). The resulting inflammatory response that occurs may lead to tendon and synovial disorders, muscle tears, ligamentous injury, degenerative joint disease, bursitis, or nerve entrapment. (Rempel et al. 1992).

Chapter 1- Introduction

1.1 The relevance of the study

Musculoskeletal disorders account for at least one-third of all work related injuries. In the United States alone, they cost employers around US$15 to US$18 billion a year in workers' compensation (Dong-Chul and Blair, 2003), and further substantial losses occur through absenteeism and decreased productivity.

The computer has become an essential productivity-enhancing tool. However, this appears to come at the expense of its effect on the human musculoskeletal system. Considerable and growing concern exists in general and scientific communities that computers may place users at an increased risk of developing symptoms and disorders, particularly of the neck and shoulders. Therefore there is an obligation to ensure that the computer's usefulness is accompanied by its adaptability to the human form. Herein lies a niche for understanding and interrelationship between man and computer. To date, there is a growing and conflicting body of research that struggles to determine the causality of workplace exposures and musculoskeletal disorders.

Work related musculoskeletal injuries/disorders (WMSDs) – also referred to as *cumulative trauma injuries* and *repetitive motion disorders* - are injuries and disorders of the muscles, tendons, ligaments, nerves, joints, cartilage and supporting structures (Dong-Chul and Blair, 2003). Current literature suggests that a progressive neuromusculotendinous syndrome occurs as a result of repetitive microtrauma to tissues sustained over time through overload and/or overuse of the upper extremities, neck, shoulders and trunk (Street et al. 2003). The resulting inflammatory response may lead to tendon and synovial disorders, muscle tears, ligamentous injury, degenerative joint disease, bursitis, or nerve entrapment. (Rempel et al. 1992).

There appears to be little South African literature relating to the epidemiology and economic Impact of WMSDs, highlighting the need for further investigation.

1.2 The development of the idea

Lower back pain has been at the forefront of epidemiological research in the last two decades. However, more recently there is an increasing investigation and awareness of neck and shoulder pain particularly in relation to occupational exposure. Although generally not considered as debilitating as low back pain, there is increasing evidence to suggest that neck and shoulder disorders (particularly in computer and office workplaces) may have a pronounced impact in terms of their effect on working productivity and health care expenses. According to Rempel et al. (1992) neck pain and other upper extremity disorders are costly in terms of treatment, individual suffering, and time lost due to work absenteeism.

Neck disorders are common amongst the general population with one-year and lifetime prevalence and incidence ranging from 25% to 70% (Mäkelä et al., 1991; Bovim et al., 1994; Lau et al., 1996; Côté et al., 1998 and Siivola et al., 2004). However working population prevalence particularly of the neck and shoulders has consistently been found to be high, ranging from 50% to 70% (Kamwendo et al.1991; Holmström et al., 1992; Bergqvist et al., 1995:a; Owens and Patterson, 2000; Palmer et al., 2001; Chiu et al. 2002 and Gerr et al., 2002).

Early epidemiological indications in South African literature show that a large percentage of those seeking help for musculoskeletal injury (54.4% of patients presenting at a chiropractic teaching clinic and 57.4% of patients presenting to private chiropractic practitioners) complained of neck pain (Drew, 1995).

According to research, greater demands placed on the working population, particularly on management and professional staff, are leading to an increase in the incidence of WMSDs (Lau et al. 1996). Changing patterns of work require non-secretarial staff to use computers more extensively in order to perform their work more efficiently. Often these personnel are not trained sufficiently in computer skills, such as typing. This may lead to faulty postural habits, such as constantly looking down at the keyboard. Other factors that may vary in this group are prolonged and unvaried nature of computer use, along with its repetitiveness, associated static loads and restricted postures (Owens and Paterson, 2000).

1.3 Overall aims and goals of the study

Although there is an increasing body of literature that implicates a wide variety of factors, considerable conflict exists as to which play the most influential role in the development of computer related disorders. According to Andersen et al. (2002), conflict centres over the role of individual and constitutional factors versus workplace factors, such as ergonomic design and patterns of computer use. Such controversy indicates the need for further investigation.

The aim of this study was therefore, to investigate and further clarify associations between musculoskeletal symptoms, particularly of the neck and shoulders, and various factors relating to both the individual and to the ergonomic and organisational conditions at the workplace. Further, the following points were highlighted in a broad overview of the literature:

- The literature suggests that no such study has been conducted in South Africa. Such research would help in identifying working environments that are high-risk as well as quantifying the extent of the problem within the study group. It would aid in identifying high potential risk factors and therefore lead to potential recommendations for prevention and improved management.

- Due to the scarcity of medical research on WMSDs, many health care professionals are unable to identify patients working in high-risk environments and are inadequately prepared to treat patients with symptomatic disorders (Rempel et al. 1992). This investigation will help qualify areas of significance.

- Few studies have been conducted focusing on the employees' perceptions of their working environment and work related health concerns. Therefore this study is important, as it will highlight some of these areas.

- Epidemiological research has shown that management and professionals have a higher incidence of neck pain (Lau et al. 1996), however there is little research into these environments to show which factors are influential in the development of WMSDs.

- ***1.4 Structure of the study***

The site for the research was a selected banking corporation in the central Durban area. This environment was chosen as it provided a means of collecting information from a relatively large selected population base i.e. non-secretarial computer users. This was an ideal environment in that the majority of employees use computers extensively on a day-to-day basis. A two-part survey design was required in order to capture the relevant information as follows:

- A self-administered questionnaire completed part in interview and part in self-administered format. This focused on employee demographics, patterns of computer use and skills, working environment conditions and effects, psychosocial job related factors and perceptions.

- Systematic observation of employees in their working environment. The researcher used an observation checklist and scoring system with prearranged categories to assess workstation design and postural habits.

Statistical analyses were undertaken to establish the role various factors on neck and shoulder symptoms.

1.5 Outline of the rest of the dissertation

The following points outline the key concepts in the chapters that follow:

- A broad overview of current related literature and a proposed theoretical model of factor interaction that will lend some coherence to this topic
- The methodological approach utilised in this investigation
- The results of this study (prevalence, incidence, related risk factors for neck and shoulder disorders and ergonomic comparisons)
- Discussion, interpretation and integration of the findings with other contemporary empirical, theoretical and methodological approaches
- Conclusion to this investigation and recommendations for future inquiry.

Chapter 2 - A review of the related literature on work related musculoskeletal disorders of the neck and shoulders

2.0. Introduction

Work related musculoskeletal disorders (WMSDs) occur as a result of an interaction between physiological, mechanical, individual, and psychosocial factors (Armstrong et al., 1993). Like other work related disorders, neck and shoulder disorders in computer users are no less complicated and a multifactorial approach is warranted to investigate causality.

This chapter outlines some of the factors that are well established in the literature as well as some areas where further investigation is warranted.

To this end, the chapter will focus on five themes:

1. The extent of neck and shoulder disorders in the general population and in the working population (the work relatedness of these disorders)
2. Why work related musculoskeletal disorders are a problem
3. Severity, frequency and disability of these disorders
4. Factors that are implicated in the development of disorders
5. How these factors interrelate with one another and result in disorder manifestation

The chapter will be concluded with a model of WMSDs. This will lend some coherence to this broad topic and give understanding of the design of empirical study undertaken.

2.1. General population and working population incidence and prevalence of neck and shoulder disorders

This section will illustrate that working population incidence and prevalence is high relative to the general population, emphasising the association of neck and shoulder disorders and occupation (i.e. the work relatedness of these disorders).

2.1.1. General population incidence and prevalence

Drews (1995) conducted an epidemiological investigation into neck disorders presenting to chiropractic practitioners in South Africa. She found that 54.4% of patients presenting at a chiropractic-teaching clinic and 57.4% of patients presenting to private chiropractic practitioners in South Africa complained of neck pain. It is difficult to draw conclusions from these figures as the focus of chiropractic care is on management of spinal disorders and therefore chiropractic practice will attract greater proportions of such disorders. Bland (1994) reports that working individuals between 25 and 29 years of age have a 25% to 30% incidence of one or more attacks of neck pain, this figure rising to 50% for those over 45 years of age. 45% of workingmen have had at least one such episode.

An apparent lack of epidemiological research locally highlights the need for further investigation.

There is, however, a greater body of literature to draw from outside of Africa that documents not only the epidemiology of neck disorders but also places focus particularly on the causality of the problem throughout the working environment.

In a recent population-based cross-sectional mailed survey in Canada, Côté et al. (1998) investigated the distribution, determinants and risks of spinal disorders in the province of Saskatchewan, Canada. These authors found age lifetime prevalence of neck pain to be as high as 66.7% with a point prevalence of 22.2%. However as with other studies, one of the limitations of this study was the effect of non-response bias i.e. subjects with neck disorders were more likely to be interested in the study and therefore response was greater in these subjects, leading to overestimation of results.

Siivola et al. (2004) reported an increase in weekly prevalence of neck and shoulder pain from 17% to 28% in a seven-year period. They also found that asymptomatic individuals at the start of the investigation reported 6 month incidence of occasional or weekly neck and shoulder pain of 59% seven years later.

In contrast to this study, a household survey conducted by Lau et al. (1996) consisting of 800 men and women aged over 30 years in Hong Kong, revealed the lifetime prevalence of neck pain to be 31% in men and 27% in women and the 1-year prevalence was 15% and 17% respectively. These authors also established that neck pain was more common in management and professional subjects. Somewhere between these studies Bovim et al. (1994) reported the 1-year prevalence in Norwegian adults to be 34.4%.

The variation in findings between populations highlights the need for further enquiry and determination of causality in the general population. Some of these variations are tabulated in Table 2.1.1.

Table 2.1.1. General population Incidence and prevalence

Population group	**Incidence**	**Prevalence**	**Author**
Finland	Lifetime NSP[1] 71%	1-month NSP 41.1%	Mäkelä et al. (1991)
Norway	Unreported	1-year NP[2] 34.4%	Bovim et al. (1994)
Hong Kong	Lifetime NP 28%	1-year NP 16%	Lau et al. (1996)
Canada	Lifetime NP 66.7%	Point NP 22.2%	Côté et al. (1998)

2.1.2. Working population incidence and prevalence

It has been shown that the incidence and prevalence, particularly of neck and shoulder complaints in the working population is high (Kamwendo et al., 1991; Holmström et al., 1992; Owens and Patterson, 2000 and Chiu et al., 2002). A number of studies have been conducted to investigate the association between neck and shoulder pain and occupation. Holmström et al. (1992) conducted a study of neck and shoulder pain in construction

[1] Neck and shoulder pain
[2] Neck pain

workers (n=1773) and reported the one-year prevalence for neck and shoulder trouble to be 56%, with severe neck and shoulder pain in 12% of subjects.

Chiu et al. (2002) investigated the prevalence and risk factors for neck pain in university academic staff. This study found the overall 1-year prevalence rate was 58.9% and included subjects who reported having pain before becoming staff. After exclusion of these subjects, the 1-year prevalence of neck pain after becoming academic staff was 46.7%.
In Sweden, Kamwendo et al. (1991) reported one-year prevalence rates of 63% and 62% and week prevalence rates of 33% and 34% for neck and shoulder pain respectively in medical secretaries. Owens and Patterson (2000) found similar results in their study of non-secretarial computer users with 65% of subjects reporting pain in both the neck and shoulders. Similar to these findings, Bergqvist et al. (1995:a) found the one-year prevalence of neck pain in computer users to be 61.5% (Summary in Table 2.1.2.)

The research to date into work related neck and shoulder disorders indicates that the incidence and prevalence is high relative to the general population, particularly in office workers and computer users. However, there is still wide variation and discrepancy in the findings between studies and methods of investigation. Definition and reporting lack standardisation and add speculation to the problem.

Table 2.1.2. Prevalence of neck and shoulder disorders in the working population

Population group	**Prevalence**			**Author**
Construction workers (n=1773)	1-year	NSP		Holmström et al. (1992)
		56%		
Medical secretaries (n=420)		NP	SP[3]	Kamwendo et al. (1991)
	1-year	63%	62%	
	1-week	33%	34%	
VDT operators Data entry (n=260)	1-year	NSP		Bergqvist et al. (1995:a)
		61.5%		
Non-secretarial computer users (n=170)	1-month	NSP		Owens and Patterson (2000)
		65%		
Regular keyboard users (n=1871)	1-week	NP	SP	Palmer et al. (2001)
		19%	18.8%	
University academic staff (n=150)	1-year	NP		Chiu et al. (2002)
		46.7%		

[3] Shoulder pain

2.2. Neck and shoulder pain in the workplace: why is this an issue?

Musculoskeletal disorders are a major cause of activity limitation and long-term disability in the population, and whilst the mortality associated with these disorders is generally low; they have a major impact on society in terms of morbidity and disability (Lee, 1994). Therefore attention given to these disorders arises largely out of the growing and costly burden on industry, society and the health care system.

According to Dong-Chul and Blair (2003), in the United States disorders such as carpal tunnel syndrome, tension neck syndrome and lower back pain are the most prevalent and expensive work-related injuries. Approximately 1.8 million workers report work related musculoskeletal disorders and 600 000 workers miss work annually as a result of these disorders, costing employers an estimated $15 to $18 billion in direct workers' compensation. Further substantial losses occur through absenteeism and decreased productivity. In a review of current literature on this subject Street et al. (2003) states that WMSDs are implicated as the "prime disablers" of adult workers and are believed to account for nearly half of work related injuries.

Generally the disability and economics relating to lower back pain are well documented (Cats-Baril and Frymoyer, 1991:97). Emphasis in this area has clearly overshadowed the necessity to investigate other areas despite the fact that the incidence and prevalence of neck and shoulder pain has consistently been found to be high in the working population. In order to determine the effect of these disorders in the workplace it is necessary to determine the relative disability that occurs as a result of these disorders. This is discussed in the following section.

2.3. Severity, disability and frequency of neck and shoulder disorders

Defining severity, disability and frequency of neck and shoulder disorders is important as it enables investigations into the working environment to determine the nature and functional effect of disorders on subject populations.

The association between these factors helps to determine the role of the *healthy worker effect* on study conclusions. This effect is particularly important in cross sectional studies where the aim is to investigate whether the group under study has an excess prevalence of a particular disorder that could be related to occupational exposure. If the disability of the disorder prevents a worker from continuing work, to the extent that they have to change jobs or duties then they will not be accounted for in the study i.e. only the healthy worker that is able to work will be accounted for. Disorders such as cervical disc disease that tend to be more functionally debilitating are likely to be inaccurately accounted for. In contrast to this, when a disorder causes little or no disability, high prevalence and reporting rates may occur (Hagberg and Wegman, 1987). Therefore an understanding of severity, frequency and disability is important as it gives a more comprehensive definition in terms of the nature and effect of these disorders. Hasvold and Johnsen (1993) established a close relationship between frequency and disability of neck and shoulder complaints highlighting the usefulness of complaint frequency as a measure of intensity or burden of complaint.

As an example of the relationship between these factors Holmström et al. (1992) compiled a two-part definition in which severity of neck and shoulder pain was defined according to frequency of pain as well as functional disability as follows:

- *Neck/shoulder trouble* (NST) was defined as ache pain or discomfort experienced sometimes, often or very often in the last 12 months.
- *Neck/shoulder pain* (NSP) was defined as neck/shoulder trouble with severe or very severe functional impairment. Severe meant "I have to take breaks at work or in spare time" and very severe meant "I have to be on the sick list periodically."

According to these definitions they found that for construction workers, the one-year prevalence rate for NST was 56% and that for NSP was 12%.

Similarly Bergqvist et al. (1995:b), differentiated disability of neck and shoulder disorders in two parts:

- *"Neck/shoulder discomfort"* defined as ache, pain or discomfort within the given area in the last 12 months.
- *"Intensive neck/shoulder discomfort"* defined as discomfort in the last seven days that interfered with work activity.

These authors found that 59.6% reported neck and shoulder discomfort in the last 12 months and 7.4% reported intensive neck and shoulder disorders.

Côté et al. (1998) reported that 55.4% of Canadian adults reported having neck pain of more than 31 days in the previous six months, and that 4.6% experience pain that significantly restricts daily activity.

Kamwendo (1991) reported that 32% and 29% of medical secretaries reported occasional pain, whilst 15% and 17% suffered constant neck and shoulder pain respectively. They also found that of those that reported pain, 13% reported reducing daily activity as a result. Sauter et al. (1991) reported that constant discomfort was experienced in the neck (27%) and shoulders (10-15%) of data entry workers.

The results appear to vary quite considerably between studies and different occupational groups. It is also apparent that although studies quantify the extent of the problem, they do not seem to approach the subject with common methodological and outcome goals. This is apparent in the definitions that relate to severity, disability and frequency of the problem.

Differentiation in level of disability is important as it enables investigation to determine the effect of disorders on functional activity, thus giving more accurate estimates in terms of absenteeism, lost productivity and health care compensations. For the purposes of discussion a two-part definition can be applied:

- *Manageable dysfunction*; usually defined as a *symptom* experienced, that is generally not functionally debilitating and able to be managed with simple contemporary medical and health care practice; having minimal effect on productivity and absenteeism. The symptom generally does not affect the individual's ability to perform daily activity (common terminology applied to this is *somatic pain syndrome* or *tension neck syndrome).*
- *Unmanageable dysfunction*; Usually termed a *disorder* that is functionally debilitating, i.e. there is a noticeable effect on daily functional activity (i.e. productivity). Specialist medical services may be required in the treatment of these disorders, making them costly in terms of absenteeism and health care compensation (termed cervical disc disease, cervical disorders/syndrome (Hagberg and Wegman, 1987), radicular pain syndrome (Gerr et al. 2002).

Although it may be assumed that manageable dysfunction does not imply serious functional disability it is nevertheless important to understand that pain may be a precursor to disorder manifestation.

The distinction between severity, disability and frequency of neck and shoulder disorders is interrelated to give a better overall picture of the effect of these disorders. This is important as it enables researchers to determine the amount of time lost due to absenteeism and to determine the effect on productivity in the workplace.

Defining neck and shoulder disorders by means of severity, frequency and disability therefore seems important as it differentiates a relatively common symptom (manageable dysfunction) from a functionally debilitating disorder (unmanageable dysfunction) where the individuals ability to perform daily functional activities is impaired. This also prevents researchers from over reporting the extent of work related problems, but also ensures accurate reporting in areas where disorders clearly have an effect not only in terms of the workplace but also on the individual.

2.4. Risk factors associated with WMSDs of the neck and shoulders

Current literature implicates numerous factors associated with WMSDs. With this in mind and for the purposes of discussion the more important aspects/factors involved in the causality of neck and shoulder disorders will be subdivided according to Ariëns et al. (2001:a) as follows:

- Individual factors (gender, age, lifestyle factors)
- Physical factors (working posture, job activity, workstation set-up and design)
- Psychosocial factors

In this dissertation physical factors will be discussed under the heading physical and work related factors

2.4.1. Individual Factors

a. Gender

Gender (being female) has consistently been found to be a predictor of neck and shoulder pain (Hagberg and Wegman, 1987, Bergqvist et al., 1995; Owens and Patterson, 2000; Chiu et al., 2002 and Gerr et al., 2002).

In a study of university academic staff, Chiu et al. (2002) reported the one-year prevalence of neck pain to be 60.7% in females and 38% in males (p=0.02). Palmer et al. (2001) found one-week prevalence rate differences of 22.9% (female) and 14.8% (male) for neck and 21.2% and 16.4% for shoulder pain respectively in regular keyboard users.

Gerr et al. (2002) conducted a longitudinal study on neck and shoulder disorders in computer users and found that after a 6 month follow up period, 42% of women and 27% of men had experienced neck and shoulder symptoms, and after 1 year 48% of women and 36% of men experienced symptoms. Their results establish the association between female gender and neck and shoulder symptom development. Like other authors, they further conclude that symptoms may be more prevalent in women because of increased exposure to etiologic factors, increased biological susceptibility or because women may have a lower threshold for reporting symptoms than men.

Table 2.4.1. Prevalence of neck and shoulder disorders and gender

Population Group	**Prevalence**		**Author**
	Female	**Male**	
Regular keyboard users	22.9% (NP) (1-week)	14.8% (NP) (1-week)	Palmer et al. (2001)
	21.2% (SP) (1-week)	16.4% (SP) (1-week)	
University academic staff	60.7% (NP) (1-year)	38% (NP) (1-year)	Chiu et al. (2002)
Computer users	48% (NSP) (1-year)	36% (NSP) (1-year)	Gerr et al. (2002)

Owens and Patterson (2000) and Fredriksson et al. (2000) propose that differences between sexes may be due to the fact that greater proportions of women work in high-risk environments (secretarial and administrative work), and that there may be further differentiation with regard to type of work, task variety, and hours spent without breaks. The role of women in the home may equally have an impact on symptom development. Other considerations are socialisation and cultural differences with regard to symptom reporting (Owens and Patterson, 2000).

Fredriksson et al. (2000) reported that neck pain appeared to be associated with physical overload and/or combinations of physical and psychosocial factors among men. In women it appeared to be associated with combinations of work and non-work related physical and psychosocial factors.

Armstrong et al. (1993) state that " a worker's willingness to report musculoskeletal problems may be strongly related to cultural differences which influence their perception and willingness to tolerate pain."

Bergqvist et al. (1995:a) and Gerr et al. (2002) found strong associations between children at home and neck and shoulder complaints and the concept of a double shift i.e. at work and at home on women's musculoskeletal problems is discussed. Bergqvist et al. (1995:a) also found that there was a particularly strong correlation between gender (being female) and shoulder disorders.

Ashton-Miller (1999:79) discusses the physiological differences in tendon and ligament between sexes, but points out that there could also be a difference between gender groups in the mechanisms underlying the human response to pain.

b. Age

Significant correlation between older age and neck and shoulder disorders has been established in previous studies (Kamwendo et al., 1991; Holmström et al., 1992; Bergqvist et al., 1995:a; Fredriksson et al., 2000; Owens and Patterson, 2000 and Gerr et al., 2002). This association is in part explained by various changes in muscle mass and endurance as well as tendon and ligamentous biomechanical changes (Ashton-Miller, 1999:79).

Chiu et al. (2002) did not find any associations between age and neck pain. This lack of effect for age may in part be explained using the health based decision model; young staff may be more healthy than senior staff, they may therefore choose to stay at work even when neck pain is provoked, and will stop only when pain becomes intolerable. On the other hand older staff may be less healthy and more concerned about their health. They may stop work before or at the onset of pain. Therefore there may be more young staff with neck pain at work (Krause et al. 1997).

c. Lifestyle factors

Pietri-Taleb et al. (1994) found physical exercise was preventative in the development of neck pain in office workers. Siivola et al. (2004) reported that upper extremity dynamic muscular activity was associated with a lower prevalence of neck and shoulder pain. Holmström et al. (1992) support this; they found that neck/shoulder trouble was greater in more sedentary overweight workers. Other studies do not show an association between inactivity and neck and shoulder disorders (Barnekow-Bergkvist et al., 1998 and Fredriksson et al., 2000).

There does not appear to be conclusive evidence that smoking has an effect on neck and shoulder pain. Holmström et al. (1992) and Pietri-Taleb et al. (1994) found weak associations between smoking and neck and shoulder disorders.

Mäkelä et al. (1991) reported a relationship between smoking and chronic neck syndrome, particularly in men, whilst Fredriksson et al. (2000) established that smoking was associated with female gender and neck and shoulder pain. Positive relationships within this area concur with the literature on mechanical lower back pain (Leboeuf-Yde et al., 1996), if one assumes that the aetiology and pathophysiology of neck and shoulder pain and smoking is congruent with that of the lower back. However, there still appears to be some conflict and disparity in this area, advocating the need for further investigation.

2.4.2. Physical and work related factors

a. Working posture, job activity and patterns of computer use

Holmström et al. (1992) state, "When confounders such as age, individual factors and employee related factors were excluded, the physical factors (e.g. working posture) significantly contributed to neck and shoulder pain."

According to biomechanical criteria the ideal computer processing posture is defined as follows; “elbows at keyboard height with forearms parallel to floor, upper limbs in line with trunk, trunk reclined between 100º and 110º; neck flexion not exceeding 15º, eyes in line and at or slightly above screen level, knees at the level or slightly higher than hips, and feet on the floor or footrest” (Greico and Molteni, 1999:1784)

Even with such an ideal seating model in mind, there is still much controversy over what is termed “correct” seated posture, Greico and Molteni (1999:1783) review some of the current literature on this subject.

Three different and alternative postures have been proposed for Video Display Terminal (VDT) operation:

- Upright posture; with the joints of the hip, knee and ankle at right angles.
- Backward leaning; spine fully supported and resting on backrest.
- Forward tilted; operator perched on front of seat, knees or feet supporting most of body weight.

These authors uphold that upright posture is not supported by any physiologic or orthopaedic reason and is rarely chosen spontaneously by VDT operators. The backward leaning posture has been scientifically tested and shown to reduce pressure on the lower back, however this posture may increase viewing distance and may force the operator to flex the neck, thus increasing discomfort in the neck. The forward tilted posture is recommended as it results in forward rotation of the pelvis, reducing lumbar intervertebral pressure. However this posture is unusual and requires supporting the body weight with the feet or knees. This may be awkward and unsuitable for computer processing (Greico and Molteni, 1999:1783).

Sauter et al. (1991) found that erect/upright sitting postures reduced discomfort in VDT operation. However although this type of posture is seen as ideal, other more recent texts emphasise the importance of regular changes in posture.

Kroemer and Kroemer, (2001:65) maintain that although there is nothing wrong with upright sitting, it is unrealistic to expect that an erect spine can be maintained for prolonged periods of time. Sitting in maintained postures results in compression of tissues, deficiency in blood circulation, accumulation of distal extra-cellular fluid and reduction in metabolism. Regular changes in posture are instinctive attempts to take strain and tension away from muscles that are working to maintain such postures.

Chiu et al. (2002) found that computer posture (characterised by a forward head positioning) had a significant effect on neck discomfort. This type of posture increases loads on the posterior cervical musculature, resulting in raised levels of neck discomfort as a result of fatigue and myofascial pain (Travell and Simons', 1999:436).

If postures do not change for long periods of time, such as trunk postures during computer (VDT) work, the task may be called static (Wells, 1999:779). In such static postures, with lower force demands, the overall posture of the body and the number of rest pauses largely determine the loading pattern on muscles (Viikari-Juntura, 1999:847).

Periods of computer use and patterns of rest pauses have been linked to neck and shoulder disorders. Chiu et al.(2002) found that computer use exceeding more than 4.45 hours per day without rest periods was a risk factor for neck pain. They add that having rest periods during computer processing helped reduce severity of neck pain. Bergqvist et al. (1995:b) had similar results; they found that more than 20 hours of data entry per week was a risk factor for neck/shoulder discomfort. Bergqvist et al. (1995:a) establish that limited rest break opportunities appear to be a major contributor to neck and shoulder discomfort and cervical disorders.

Tayyari and Smith (1997:371) suggest frequent breaks or rests and neck relaxation exercises during computer use.

b. Workstation set-up and design factors

According to Andersen et al. (2002) the major conflict that exists within the field of computer and office related musculoskeletal disorders is the role of individual and constitutional factors versus physical factors such as ergonomic design, posture and patterns of computer use.

The workstation and its components vary widely between worksites and job tasks. However the office environment universally employs various common components and some of these aspects have been investigated to determine their role in work related musculoskeletal disorders.

According to Sauter et al. (1991), Bergqvist et al. (1995:a) and Owens and Patterson (2000) the following workstation component variables have been isolated as potential contributors to disorders;

- Screen distance, horizontal and vertical position.
- Keyboard and mouse vertical position and distance.
- Seat height and depth.
- Relative size of back support.
- Backrest inclination.
- Resting of the wrists whilst typing.

Much emphasis has been placed on the design and layout of the workstation and its components. More recent texts strongly emphasise the importance of adjustability, in that components can be suited to individuals of varying proportions and space for free movement is considered essential. (Greico and Molteni, 1999:1788 and Kroemer and Kroemer, 2001:99).

Some of the individual parts of the workstation have been isolated and discussed in the literature; the more important aspects follow;

b.i. Computer monitor / VDT

Prolonged and intensive use of the visual display terminal (VDT) is an important risk factor in the development of work related musculoskeletal disorders (James, Harburn and Kramer, 1997 and Viikan-Juntura, 1997). Kamwendo et al. (1991), found strong associations between neck and shoulder disorders and static neck postures in viewing the computer display.

With regard to screen positioning and placement, Kroemer and Kroemer (2001:101) recommend that the screen be placed directly in front of the user in a low position such that the user looks slightly down to the screen - a small degree of neck flexion is recommended. Bergqvist et al. (1995:a) findings substantiate this, where high placement of the VDT was associated with intense neck/shoulder discomforts.

Ankrum and Nemeth (2000) conducted a study defining neutral head position at computer workstations found that a relatively greater degree of neck flexion (monitor placed 35-38.5° below eye level) was preferable. This study also shows that monitors placed at eye level or slightly below eye level result in neck extension with resulting discomfort. Ankrum, Hansen, and Nemeth (1995:135) establish that a screen that tilts slightly away from the user at the top (i.e. a positive horopter angle) is preferable and causes less visual and postural discomfort.

b.ii. Keyboard and mouse

Palmer et al. (2001) found that regular keyboard use was significantly associated with pain in the shoulders but not in the neck.

Bergqvist et al. (1995:a) found correlation between keyboard placement and neck and shoulder discomfort regardless of the type of VDT work. The explanation for this is that when the desk or keyboard is too low, the user flexes the back, which shifts the weight of the head forward. During such posture the neck muscles that support the head become tense and strained (Tayyari and Smith, 1997:371). On the contrary if the keyboard is too high, the user may compensate by bunching or shrugging the shoulders and such shortening of muscle may also lead to discomfort and muscular pain (Travell and Simons', 1999:287).

In a 24-year longitudinal study based on a sample of the general population, Fredriksson et al. (2000) reported that the factor most consistently associated with neck and shoulder disorders was frequent hand and finger movements.

b.iii. Chair

The Chair provides a critical primary support system for any seated working station. There is much controversy over design, aesthetics and functionality (Dainoff, 1999:1761).

It is clear that seated working posture is intimately related to chair design and functionality. The chair must provide the base for correct and comfortable posture; part of this is giving the right support in terms of varying body proportions as well as providing a means by which the subject can move around freely when changes in posture are necessary. The presence and use of a backrest is also recommended giving the user support in the appropriate areas of the spine (supporting spinal curvature contour), and providing the opportunity to rest between periods of work. Armrests are also recommended for the support of the weight of the hands, arms and trunk. Adjustability is essential to suit different proportions (Kroemer and Kroemer, 2001:65-101).

b.iv. Type of computer

Variation in computer type is in part explained by differences in height, positioning and dimension of monitor relative to the user, as well as keyboard location and size, hence a person using a notebook computer will adopt a different spinal posture to a desktop user (Szeto and Lee, 2002).

A recent ergonomic comparison of notebook and desktop computers conducted by Szeto and Lee (2002) found that:

- The smaller notebook computers induced a more flexed spinal posture with a possible increase in spinal loading resulting in an increased risk of musculoskeletal discomfort.
- Keyboard skills were notably better on the desktop computer i.e. faster typing speed and less difficulty finding keys.

These authors also found that participants in their study did not change workstation set-up (chair height and position) in order to accommodate for differences in computer type, but adjusted posture instead.

b.v. Computer Skills

Repeated and prolonged neck flexion may lead to the development of cervical syndrome (Tayyari and Smith, 1997:371). Owens and Patterson (2000) hypothesised that computer skill, or lack thereof may be a potential risk factor on the basis that poor typing skill can lead to repetitive neck flexion to find keys, leading in turn to neck discomfort. However the results of this study did not find this conclusive.

2.4.3. Psychosocial Factors

In addition to individual, biomechanical and ergonomic risk factors, psychosocial work factors and psychological stress have been linked to musculoskeletal disorders in the work environment. Many studies have established this association (Kamwendo et al. 1991; Holmström et al., 1992; Bergqvist et al., 1995:a; Owens and Patterson, 2000 and Siivola et al., 2004). According to Ariëns et al. (2001:a), most of the attention given to neck pain has focused on the physical risk factors, despite the fact that psychosocial risk factors also appear to play a significant role in the development of neck pain. Siivola et al. (2004) conducted a seven-year longitudinal study investigating the predictive factors for neck and shoulder pain in young adults. This study concluded that psychosomatic symptoms in adolescence were associated with a higher prevalence of neck and shoulder pain in adulthood.

There is current literature that attempts to explain in part the physiological and psychological links to these disorders. One theory is that job stress may increase static muscle activity and that this may lead to increased lactic acid accumulation and loss of nutrient substrate within the muscle. The resultant pain, being due to inability and lack of time for muscle recovery (Greico and Molteni, 1999:1783).

In a review of current literature Ariëns et al. (2001:a), propose three mechanisms that account for possible associations between psychosocial factors and musculoskeletal disorders: first, that psychosocial demands can exceed an individual's coping mechanisms, resulting in stress response, increased muscle tension and static loading. Second, psychosocial demands may influence awareness and reporting of musculoskeletal disorders, or result in attribution to the work environment. Third, a psychosocial response may occur in direct association with physical demands.

In a comparative study of three different occupational groups of working men, Pietri-Taleb et al. (1994) found that occupation and psychological factors were the most influential factors in the development of severe neck pain. Holmström et al. (1992) found psychosocial factors at work and psychosomatic symptoms to be the most influential and prominent factors associated with neck and shoulder trouble.

There is still, however, some controversy over the role of certain psychosocial factors as contributors to musculoskeletal disorders:

Kamwendo et al. (1991) demonstrated a significant relationship between psychosocial factors at work and neck and shoulder pain in 420 medical secretaries; they found that lack of appraisal from superiors, high quantitative job demands and lack of job control had a significant impact on neck and shoulder pain. Carayon (1993) found a similar relationship with regard to lack of job control, but also emphasised the importance of career and future concerns as being a noteworthy contributor to these disorders.

Associations between high job demand such as time pressure, high concentration and large work volume and shoulder disorders are well established (Viikari-Juntura, 1999:847). Ariëns et al. (2001:a) reported similar findings with regard to high quantitative job demands but also found low co-worker support to play a significant role.

In a study of neck and shoulder pain in university academic staff, Chiu et al. (2002) reported a low correlation between psychosocial factors and neck and shoulder pain. They did report, however, that perceived stress was an important contributor. Hill et al. (2004) conducted a study to determine the factors associated with persistent neck pain in a one year follow study in the general population, these authors suggest that although psychosocial factors appear to be important contributors to neck pain persistence in the workplace, they are less influential as contributors in the general population.

Ariëns et al. (2001:b) conducted a systematic review of psychosocial risk factors for neck pain. The aim of this study was to give an indication of which psychosocial factors could be implicated as factors in the development of neck disorders. An analysis of 1026 studies was conducted of which 29 were included in the study. Studies were graded according to certain criteria. The strength of evidence for potential risk factors was assessed by defining four levels of evidence as follows: strong evidence, moderate evidence, some evidence, inconclusive evidence. According to this grading system, they found some evidence for high quantitative job demands, low co-worker support, low social support, lack of job control, and lack of job satisfaction. Inconclusive evidence was found for low supervisor support, conflicts at work and in leisure time, job strain, low job security and limited rest break opportunities. These authors did not report on any strong and moderate influence studies, thus highlighting the need for further determination of certain factors. Studies on combined neck and shoulder pain were excluded even if they may have scored favourably in terms of methodological considerations, and this may well have had an impact on the results.

The influence of the psychosocial working environment is illustrated and highlighted in nearly all of the available literature, and much emphasis should be placed on further understanding and interpretation of this component.

2.5. Factors affecting investigation outcome (methodological considerations)

Current limitations in establishing causality in this field lie in methodological approaches. These limitations should not be seen as a barrier to the interpretation of results from studies, but rather limitations that exist in many areas of health care research (Armstrong et al., 1993).

As discussed previously, one of the common limitations of many of the studies into work related musculoskeletal disorders is that they often have a cross sectional design. Such designs are susceptible to survivor bias that is workers that have left their job as a result of disorders are unaccounted for. This is also known as the "healthy worker effect" whereby the study only takes into account those that are still able to work (Bergqvist et al., 1995:b). Another limitation of these studies that is pertinent to the understanding of the aetiology of disorders is the fact that risk factors and outcomes are measured at the same time. This makes establishing cause and effect relationships difficult (Ariëns et al., 2001:b).

Other factors that need to be considered when interpreting the results of investigations are that many studies do not classify disorders according to their severity and functional disability. Many only give prevalence figures and overestimation of the extent of the problem may therefore ensue. This may result in misleading information (Hagberg and Wegman, 1987).

2.6. *Biomechanical and Pathophysiological considerations in development of neck and shoulder WMSDs (the interrelationship of factors)*

Investigation into the area of work related disorders require an understanding of the relationship and interaction between factors. Current research proposes an interaction between physiological, mechanical, individual, and psychosocial factors in the development of disorders.

This interaction of factors differentiates a work related disease from what is termed an occupational disease. Work related diseases are defined as multifactorial, they can be partially caused by adverse work conditions, exacerbated by work place exposures and may impair working productivity. It is important to know that personal characteristics, environmental and sociocultural factors usually play a role in development of these diseases/disorders (Armstrong et al., 1993).

Armstrong et al. (1993) proposed a dose-response model of interaction between contributing factors and disorder development of the neck and upper limb. This model is characterised by four sets of interacting variables: exposure, dose, capacity and response.

- *Exposure* refers to the external factors (e.g. work requirements) that produce the internal dose (e.g. tissue loads and metabolic demands). For example the layout and design of the workplace are important determinants of work posture.
- *Dose* refers to those factors that in some way alter the internal state of the individual; this can be in the form of mechanical (tissue forces and deformations), physiological (metabolic substrate consumption) or psychological disturbances (anxiety about work load and lack of social support).
- *Capacity* may be physical or psychological refers to the ability of the individual to resist destabilisation due to various doses. Capacity may be reduced or enhanced by previous doses and responses.
- *Response* includes the changes that occur in the state of the individual for example; changes in ion concentrations, temperature and shape of tissues. One response can therefore lead to a new dose, which then produces another response.

Note: most individuals are able to adapt to certain types and levels of activity. This may occur through repeated and prolonged activity resulting in compositional tissue changes, resulting in an increased dose tolerance. These changes are referred to as adaptation and are therefore the desirable outcome of work activity. However, if such changes result in reduced capacity the resulting effect is undesirable and development of disorders may result. It is also important to note that some tissues adapt at different rates (e.g. muscle may adapt more rapidly than tendon). This imbalance may further result in disorder manifestation.

Some of the factors highlighted in the literature that are believed to have a significant impact in the development WMSDs of the neck and shoulders are; repetition, awkward joint pressure and prolonged constrained posture. Combinations of these factors are said to increase potential for development of WMSDs significantly (Rempel et al. 1992).

Tayyari and Smith (1997:371) further outline some of the risks that favour the development of WMSDs within the office environment. These authors primarily discuss the role of repetitive movements and defective or restricted postures that in turn may lead to nerve pinching, tendon irritation, and blood flow restriction. The following combinations of factors are believed to have the greatest impact on development:

- Repetitive motions with fast and forceful movements;
- Awkward work posture due to poor work habits and workstation design, or improperly adjusted equipment;
- Insufficient rest breaks over long working periods, that is, uninterrupted, prolonged use of equipment.

This can be summarised by stating that the most critical risk factor in office jobs is the requirement of performing the same few motions over and over, without sufficient postural changes to relieve fatigue.

According to Ashton-Miller (1999:77), stiffness, tenderness and muscle pain, particularly in the neck and shoulder regions are common work-related complaints. This author adds to the above-mentioned risk factors, the role of visual control and relatively high levels of mental concentration as significant in the development of work related muscular disorders. Such would be the case in prolonged intense computer use.

Holmström et al. (1992) found that static workloads played a more significant role than dynamic workloads in the development of neck and shoulder complaints in construction workers. According to Owens and Patterson (2000), the prolonged and unvaried nature of computer use, along with its associated static loads and restricted postures, affect the development and progression of disorders.

Repetitive accumulative forces applied to tissues over prolonged periods in the same muscle group, joint or tendon may cause soft tissue microtears and trauma and the resulting inflammatory reaction may lead to tendon, synovial, muscle, and ligamentous disorders, degenerative joint disease, bursitis, and/or nerve entrapment (Rempel et al. 1992).

Interactive models and discussions represent a means by which investigators can interpret the importance of certain variables in aetiology and causality of disorders. Such is the complex nature and interaction of factors with regard to the aetiology of these disorders, that continuous understanding and investigation in establishing causality is critical. Necessity for understanding these disorders is further warranted as many organisations and companies have not yet investigated the extent of the problem. Dong-Chul and Blair (2003) estimate that 80-85% of firms in the USA have not yet evaluated ergonomic hazards or implemented preventative training measures to reduce risks. Such figures would be comparable, if not greater, within the South African context.

2.7. A proposed model for computer and office work related neck and shoulder disorder manifestation (Figure 2.7)

A model of the interaction between physiological, mechanical, individual and psychosocial factors provides a framework for the understanding of WMSDs. The model that follows (Figure 2.7) was developed to:

- Highlight the multifactorial nature of these disorders
- To lend some coherence to current theoretical and methodological approaches
- Provide a tool for further research planning and study interpretation
- To summarise and highlight the important aspects discussed in this chapter

The core of this model is based on the concept that work related musculoskeletal disorder development evolves out of the influence of the various factors highlighted in the literature. The model is a representation of the researchers' understanding of current theory and development within this field.

According to Ariens et al. (2001:a) three main groups of risk factors are implicated in the development of WMSDs, as follows (a) individual (b) physical (c) psychosocial risk factors. The role of Individual and psychosocial risk factors have been discussed according to current literature in sections 2.4.1 and 2.4.3 (these are summarised under these headings in the model that follows).

It is at this point, however, important to discuss the physical risk factors these are subdivided in this model into three subsections as (b.i) postural, (b.ii) workstation design and (b.iii) biomechanical risks. The interrelationship between these factors can be explained in the examples that follow:

- If a working individual is unable to take rests/breaks during work hours (i.e. limited rest break opportunity) and if we assume that they do not change their posture for a prolonged period, the resultant biomechanical effects will be awkward joint pressure and prolonged constrained posture.
- If workstation equipment is improperly adjusted (e.g. screen too far away) this in turn will lead to faulty posture (e.g. Forward head positioning).
- Laptop computers (computer type) can lead to rounded postures and repetitive neck flexion to find keys, this occurs as a result of the compact size of the keyboard and the limited adjustability of the laptop.

The interaction and association between these components of the model are interlinked, i.e. a risk in one component usually arises out of a combination of risks in other components (this interrelationship is illustrated in Figure 2.7 by means of a two-way arrows). Current empirical and theoretical approaches related to this component are discussed in section 2.4.2.

The pathophysiological response (d) refers to the changes that occur within the individual, this occurs as a result of a single risk or a combination of risks. According to Armstrong et al. (1993) these risks are termed exposures and doses. Exposure refers to the external factors (e.g. work requirements) that produce the internal dose (e.g. tissue loads and metabolic demands). For example the layout and design of the workplace are important determinants of work posture.

According to this model (Figure 2.7) the resultant effect of a dose is termed a pathophysiological response (e.g. blood flow restriction or muscle hypertonicity that may occur as a result of psychological stress and/or smoking). It is also important to mention that a primary pathophysiological response such as muscle hypertonicity may in turn create a secondary response (blood flow restriction and/or nerve irritation).

From this point forward, the changes that occur within the individual are critical to the development of disorders. The capacity (e) of the individual, which may be physical or psychological, refers to the ability of the individual to resist destabilisation due to various doses. Capacity may be reduced or enhanced by previous doses and responses i.e. a reduced capacity will result in disorder manifestation (f), whereas an enhanced capacity results in the desirable effect of adaptation (g). It is important to reiterate that although some tissues will adapt to demands placed on them, other tissues do not respond at satisfactory rates, this imbalance of adaptation in different compositional tissue types may result in disorder manifestation i.e. muscle will develop at a more rapid rate than tendon, this may result in inflammation and degeneration of the tendon. Therefore the capacity of the individual is central and is what determines whether a pathophysiological response results in a disorder i.e. can the individual adapt to the structural and functional changes, resulting in strengthening and enhanced endurance.

The concept of individual capacity and response can illustrate further the definitions of manageable and unmanageable dysfunction (section 2.3). Manageable dysfunction may account in part for what is termed in this model a pathophysiological response (symptoms reported as pain and stiffness). Unmanageable dysfunctions refer to pathophysiological responses that overcome the individuals' capacity, thus resulting in disorder development; a more complex picture of recurrent and chronic pain usually develops.

Three possible scenarios represent the outcome to this model:

- Individual outcome (h): disorders affect the individual's daily functional ability with resultant decrease in quality of life, and may result in psychological changes such as depression and anxiety.

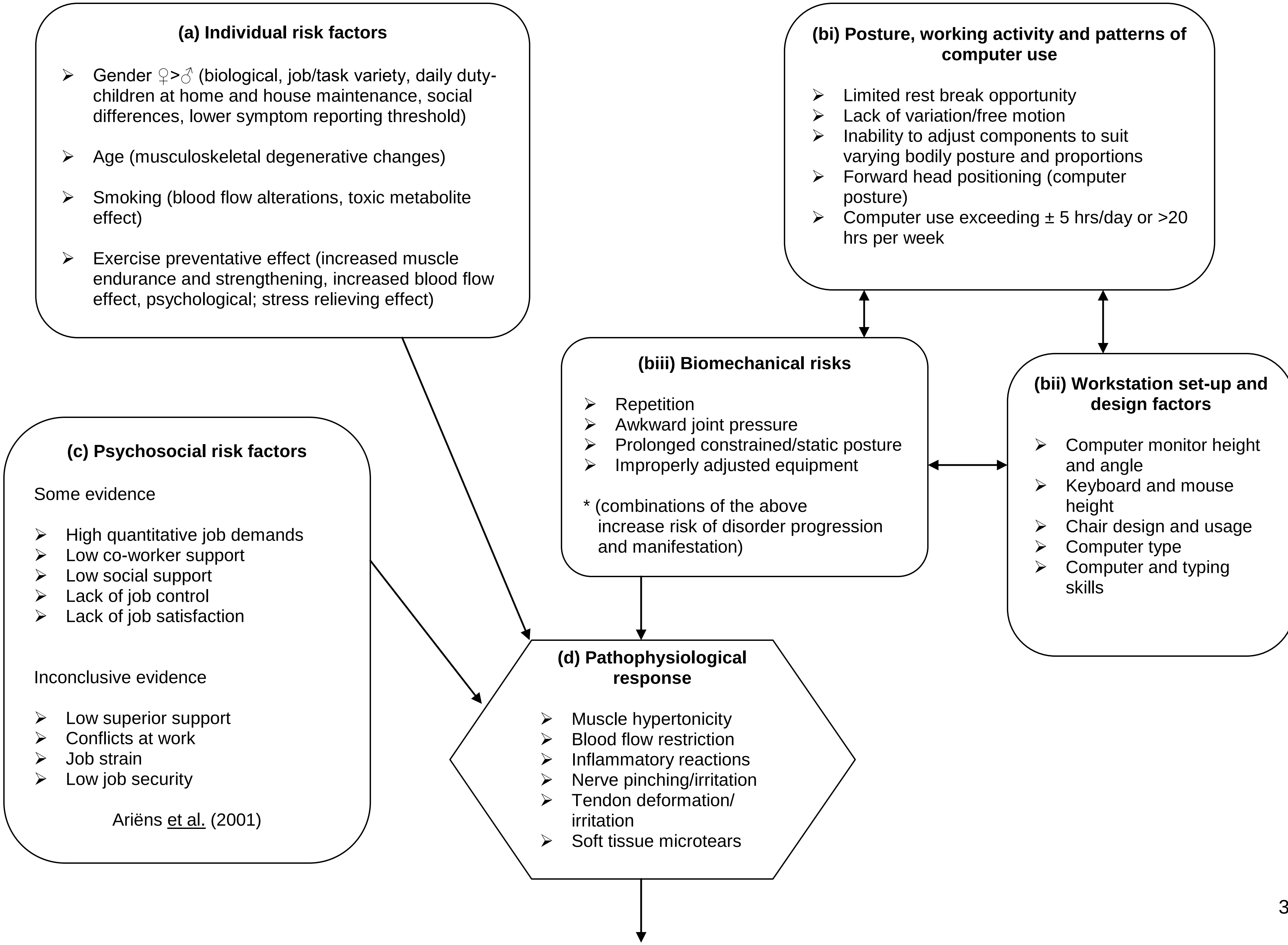
- Workplace outcome (i): disorder reduces individual's functional ability in the workplace resulting in loss of productivity, absenteeism and company health care expenses.
- Employee well-being (j): Individual adapts to psychological, physical and working demands,

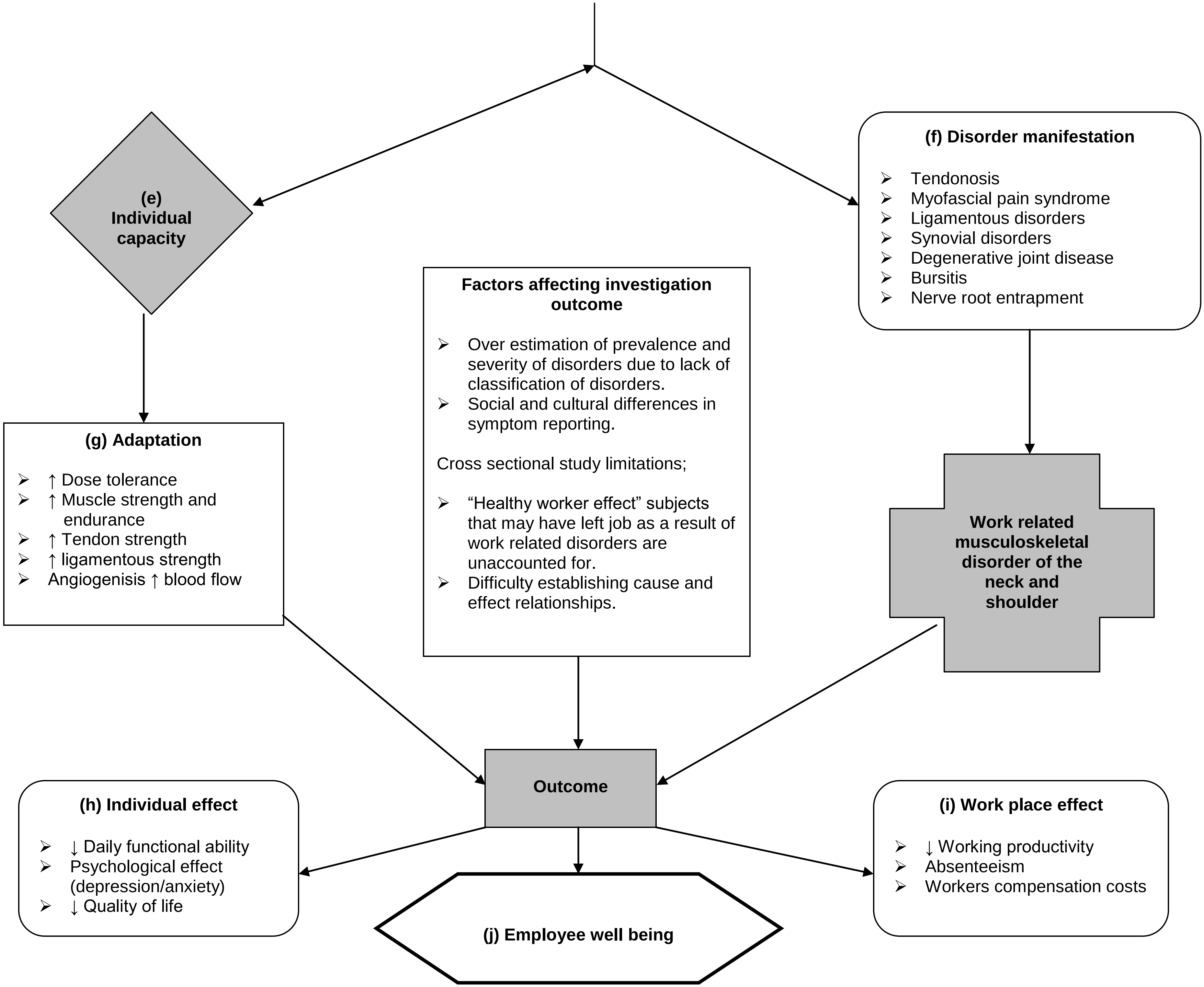
Disorder manifestation results in further susceptibility to the effect of new exposures and doses, affecting individuals with a lower threshold for new or more complicated disorder manifestation.

Limitations in study design as well as differences in symptom reporting may lead to error in overestimation or underestimation of the problem, these are discussed further in section 2.5 and illustrated in the model as factors affecting investigation outcome.

Note: this model was designed to provide a broad interactive overview of WMSDs, the aim of which is to give the reader an understanding of the complex and multifactorial nature of these disorders. This model is a schematic representation and it should be remembered that the interaction and complexity of factors between different individuals is unique.

Figure 2.7. A proposed model for computer and office work related neck and shoulder disorder manifestation




(e) Individual capacity
(f) Disorder manifestation
Tendonosis
Myofascial pain syndrome
Ligamentous disorders
Synovial disorders
Degenerative joint disease
Bursitis
Nerve root entrapment
Factors affecting investigation outcome
Over estimation of prevalence and severity of disorders due to lack of classification of disorders.
Social and cultural differences in symptom reporting.
Cross sectional study limitations;
“Healthy worker effect” subjects that may have left job as a result of work related disorders are unaccounted for.
Difficulty establishing cause and effect relationships.
(g) Adaptation
↑ Dose tolerance
↑ Muscle strength and endurance
↑ Tendon strength
↑ ligamentous strength
Angiogenisis ↑ blood flow
Work related musculoskeletal disorder of the neck and shoulder
Outcome
(h) Individual effect
↓ Daily functional ability
Psychological effect (depression/anxiety)
↓ Quality of life
(i) Work place effect
↓ Working productivity
Absenteeism
Workers compensation costs
(j) Employee well being

2.8. Conclusion

The results of studies on the general population conducted in other countries suggest that prevalence of neck disorders varies between populations. However investigations of these disorders in computer and office workers have shown a consistently high prevalence. This largely supports the suggestion that neck and shoulder pain are predominantly work related disorders.

There is some literature that indicates that neck and shoulder disorders have a debilitating effect resulting in limitation of daily activity. This in turn may result in absenteeism and loss of productivity in the workplace, factors that evidently cost the employer substantially. The literature on the disability related to neck and shoulder disorders however is limited, and this highlights the need for further understanding and enquiry.

Previous studies into WMSDs have established that these disorders arise from a complex interaction of factors that are not only associated with the physical aspects to working activity such as computer work, but also individual and psychosocial aspects.
Conflict within this field largely remains over the role of individual factors and ergonomic design.

Individual factors such as gender (being female) and older age are well-recognised risk factors and contributors to the development of disorders. It has also been shown that individual lifestyle factors such as exercise may be preventative in the progression of disorders.

Computer workstation set-up and design factors related to neck and shoulder disorders are screen, keyboard and mouse height as well as type of computer used. Other significant work related factors are length of employment, duration of computer use and opportunity for rests/breaks during work.

The role of psychosocial factors in the development of disorders has been established in other studies and found to play significant part in causality and aetiology. However there is still debate over the role of certain individual factors such as anxiety over career and future opportunities, high quantitative job demands, low co-worker support, lack of appraisal from superiors and lack of job control.

Like the rest of the world, South Africa relies very heavily on the use of computers in the workplace. However no epidemiological or other studies appear to have been conducted to establish the nature and extent of the problem locally. Therefore, the aim of this study was to establish the prevalence of WMSDs of the neck and shoulders in computer users within a defined environment and to establish similarities and differences to the rest of the world in terms of their aetiology. This information will provide a base for further investigation to determine preventative and intervention strategies.

Participatory ergonomics programs that should follow evaluation and investigations should focus on adoption of more appropriate work postures and behaviours, safe work practices, problem-solving skills, promotion of self-responsibility, and enhanced worker based participation in decision-making (Street et al. 2003).

Chapter 3- Study method

This chapter deals with the data collection process and the research methodology utilised in this study. An outline of the statistical analysis is also discussed.

3.1. Study type

The study conducted was a descriptive cohort field study into the factors associated with work-related musculoskeletal disorders of the neck and shoulder in non-secretarial computer users in a selected corporate banking environment.

3.2. Study design

Due to the nature and complexity of factors involved in WMSDs, the current study used an interview survey design to collect the broadly scattered data. To achieve this collection process the study was divided into two parts:

- Use of a questionnaire (Appendix A) in order to capture and collect information on a wide range of issues. This was completed part in interview format, and part in self-administered format enabling the information to be gathered accurately and within time constraints given by the corporation.
- Use of systematic observation (Appendix B) with the use of an observational checklist and scoring system.

This design was suitable according to Sommer and Sommer (1997:147) as interviews have the advantage of:

- Allowing for observations in addition to question response
- Assessing non-verbal behaviours as well as elements of the surroundings
- Recording information accurately
- Dealing with more complex issues
- Giving explanation and understanding of questions to respondents.

3.3. Sampling and recruitment

3.3.1. Sampling technique in selection of research site

A non-probability convenience sampling with random allocation technique was used when selecting the banking corporation.

This site was chosen as it employed a large number of people who used a computer extensively and who worked in professions that were non-secretarial (i.e. a defined sample in one location), as this would enable more definitive results to be concluded relating to this type of work.

3.3.2. Participant sampling

Non-secretarial computer users were selected for this study, as this group generally lacks typing skill, a factor that is believed to be important in ensuring good posture and preventing musculoskeletal injury to the neck and shoulders. Other factors that may be unique to this group that sets them apart from secretarial and data entry work are; stress levels, hours of computer use and workstation factors. In order to determine the effect of computer use on work related injury a minimum of one year's work experience and 2 hours of computer use per day were required (Owens and Patterson, 2000).

Selection criteria profile:

- Non-secretarial computer users
- Use of a computer for at least 2 hours per day
- At least one year of work experience
- Age ≥ 20 years

Employees that were suitable for the study were recruited electronically via email by human resources two weeks prior to the study commencing.

3.3.3. Sampling process

A numerical list of names of employees was given to the researcher by human resources and candidates were recruited by random number selection. If the candidate was not willing or was unable to be interviewed, another random number was selected. This enabled equal individual chance of selection to the entire population (Sommer and Sommer, 1997:238/39).

For statistical purposes the study required one hundred or more participants (n= 100). This is a representative percentage of the subject/participant population of around 400 in total at the selected corporate branch (Bennett, 2004).

3.4. Questionnaire background and structure

The first part of the questionnaire was designed for collecting personal information including age, gender, education level, job title and job description and length of employment as well as lifestyle factors (smoking history and exercise) (Appendix A: Sections 1 & 2).

Psychosocial factors at work were based on the psychosocial questions used by Kamwendo et al. (1991) and Chiu et al. (2002). (Appendix A: Section 4). Each question contained one statement. Subjects needed to decide whether they agreed or not. All questions used a 1-4 category scale with 1 representing “strongly agree” and 4 representing “strongly disagree”. A total score was calculated ranging from 11-44. A poor psychosocial environment is a score ranging between 21 and 44 points while a good psychosocial working environment is a score of 0-20 points.

Standardized Nordic Musculoskeletal Questionnaires (Appendix A: Section 5) were used to extract specific information on neck and shoulder pain. These questionnaires were designed to serve as instruments in the screening of musculoskeletal disorders in an ergonomics context and for occupational health care service (Kourinka et al. 1987).

The remaining questions were used to investigate the employees’ perceptions of their working environment, their level of typing and computer skills, type of computers used, performance and productivity, and work related health concerns (Appendix A: Section 3). This section also consisted of 11 questions that were compiled by the researcher in accordance with the some of the other more important aspects of the literature. The scoring method used was the same as in the psychosocial component. This section was aimed at collecting basic qualitative information on employees' perceptions of the workplace as well as some work related health concerns.

3.4.1. Face validity

Face validity is determined by an agreement between researchers and those with a vested interest in a questionnaire, that on "the face of it" the tool seems valid (Bernard, 2000). This was attempted prior to the study using a focus group.

A group of six participants, four from the health care profession (two chiropractors, a psychologist and an occupational therapist), two corporate banking representatives and the researcher as facilitator. These participants were recruited via word of mouth. Six of the respondents came forward, expressing interest in the group.

Before commencing, the participants were provided with a letter of information and gave informed consent. All participants signed a confidentiality statement. The questionnaire (Appendix A) was then given to the participants and they were asked to comment on how the questionnaire could be modified in order to accurately record the relevant information within the study group and in the South African context. The meeting was recorded by means of video and will be kept with the raw data at the Chiropractic Department, Durban Institute of Technology.

Changes to the questionnaire were made in order to better record relevant aspects. The more important changes included: adding an exercise intensity scale to differentiate between light, moderate and intense forms of exercise, inclusion of a point prevalence and point severity visual analogue scale to the neck and shoulder questionnaire and expansion of different treatments sought for neck and shoulder problems. Other changes were mainly grammatical in order to achieve better understanding in the meaning of questions and reduce the need for interpretation by respondents.

3.5. Observation background and structure

The second component of this study was conducted in the form of systematic observation. The researcher used an observation checklist (Appendix B) and a scoring system with prearranged categories in keeping with those used in other studies (Sauter et al.1991; Bergqvist et al. 1995 and Owens and Patterson, 2000). However, a more comprehensive checklist was developed for this study in order to cover some other relevant aspects. These were included to record other factors that could not be assessed using the questionnaire as follows:

- Working posture was assessed in order to give clarity to postural relationships at the workstation.
- Greater emphasis was also placed on workstation set-up so that a more comprehensive analysis could be extracted, which would ultimately provide a more objective measurement of workstation and postural factors and give clarity to their role over other factors. Other factors in the observation checklist were extracted from Kroemer and Kroemer (2001).

Six main categories of importance were included in the observational checklist as follows: screen, keyboard, mouse, seat, postural and other factors, and these were further subdivided into individual key components. For each item observed as incorrect, a score of 1 was given. Scores were then added. The result was a workstation score out of 25, with a score of 25 reflecting the worst possible workstation. This scoring system was used previously by Owens and Patterson (2000).

3.5.1. Limitations

Limitations of this type of observation lie in the effects from being observed; a guinea pig effect (also known as the “Hawthorne effect”) in which awareness of being watched changes behaviour (Sommer and Sommer, 1997).

3.6. Participant selection criteria

3.6.1. Inclusion criteria for the study

- Participants must fit the criteria (non-secretarial, one-year work experience and use a computer for at least 2 hours per day)
- The employee must read the letter of information and fill in and sign the relevant informed consent.
- Age $\geq$ 20 years

3.6.2. Exclusion criteria

- Secretarial computer users.
- Age $<$ 20 Years.
- Existing or pre-existing medical history related to other causes of neck and shoulder pain; traumatic neck or shoulder injury, related metabolic disorders, infection and tumour.

3.6.2.1. Excluded subjects

Nine subjects were excluded on the basis of existing or pre-existing medical conditions related to the neck and shoulder.

Six were excluded as a result of the following neck related conditions:

- 5 subjects had a history of traumatic neck injury
- 1 subject had recently had viral encephalitis

Three were excluded as a result of the following shoulder related conditions:

- 1 subject with a history of traumatic shoulder dislocation
- 1 subject with rotator cuff strain
- 1 traumatic shoulder injury

3.7. Ethical considerations

Access to research questionnaires was limited to the researcher and the researcher's supervisor. Questionnaires were numbered after completion and data was coded so that the association of patient details to their names was inaccessible to the researcher, thus ensuring participant confidentiality.

3.8. Statistical analysis

Statistical analysis was conducted using SPSS (version 11.5) software suite (this statistical software program was manufactured by SPSS Inc, 444N. Michigan Avenue, Chicago, Illinois, USA). Descriptive and inferential statistical techniques were used. The descriptive procedures used were tables, graphs and summary statistics including but not limited to means, proportions and percentages.

Inferential statistics included hypothesis-testing techniques. Due to sample size, namely greater than 30, parametric statistical tests were used. All tests set the type one error at 5%, or alternatively, $\alpha = 0.05$. If the p-value as reported is less than 0.05 we will declare a significant result and our Null Hypothesis was rejected.

3.8.1. The Chi-Square Test

Chi-square test was used to test the relationship between neck and shoulder pain severity and risk factors such as age, gender, smoking, exercise, length of employment, computer type, time before break, working environment and psychosocial factors, relationship between neck and shoulder pain and workstation set-up factors.

3.8.2. The Independent T-Test

The independent T-Test is used to determine if the population mean from one variable is significantly different from the population mean for another variable.

If the p-value is less than 0.05, then H_o is rejected and there is sufficient evidence to suggest that the population means from both variables are significantly different. If the p-value is greater than 0.05 H_o is not rejected and hence there is not sufficient evidence to suggest that the population means are significantly different.

These tests were conducted on mean differences for neck and shoulder pain groups versus no neck and shoulder pain groups for overall working environment score.

3.8.3. Analysis of Variance Test (ANOVA)

If the categorical data has more than two categories, the ANOVA test was conducted preceding multiple T-tests. This test was conducted to test for the equality of means for psychosocial scores for the three different severity groups of neck and shoulder pain.

3.8.4. Kruskal-Wallis Test

The Kruskal-Wallis test was conducted to test for the differences between pain ratings in the three different locations for shoulder pain.

3.9. Conclusion

A descriptive cohort field study survey design was conducted. A two-part structure was chosen to capture a range of data, part interview and part self administered questionnaires were completed and systematic observations were conducted on each employee. Specific participant selection criteria were required in order to obtain a uniform sample.

Various statistical procedures were conducted in order to test the relationships between variables and neck and shoulder pain. The results of the study follow in chapter four.

Chapter 4 – Results

4.0. Introduction

This chapter reports the results of the study according to the following sections:

1. Demographic characteristics of the sample population
2. Details of incidence, prevalence, severity and frequency of neck and shoulder pain
3. Graphic demonstration of gender and age associations with severity of neck and shoulder pain
4. Disability due to neck and shoulder pain
5. Source of past and present treatment for neck and shoulder pain
6. Workstation design and postural observation results
7. Summary of working environment and work related health perception results
8. Summary of psychosocial results
9. Results of the special statistical analysis;
   - Observation comparisons
   - Associations between workstation components individual factors, work related factors, working environment factors, psychosocial factors and the severity of neck and shoulder pain
   - The relationship between neck and shoulder pain
   - Absenteeism, and disability associated with neck and shoulder pain
10. Conclusion

The chapter is concluded with summary tabulations of the significant findings

4.1. Demographic characteristics of the sample population

4.1.1. Sample size

The sample consisted of 120 non-secretarial computer users in the selected corporate banking environment. Nine subjects were excluded on the basis of existing or pre-existing medical conditions related to the neck and shoulder.

The full sample size was used when assessing workstation set-up and ergonomic comparisons between laptop and desktop users; this enabled a greater sample base to assess these factors, i.e. it was not necessary to exclude subjects as this component did not set out to define the relationship between these factors and neck and shoulder pain, it was purely an exercise to determine the differences between desktop and laptop set up and postural effect.

To assess work relatedness of neck and shoulder pain to various factors nine subjects with existing or pre-existing medically related neck and shoulder pain were excluded.

4.1.2. Age distribution of the sample population

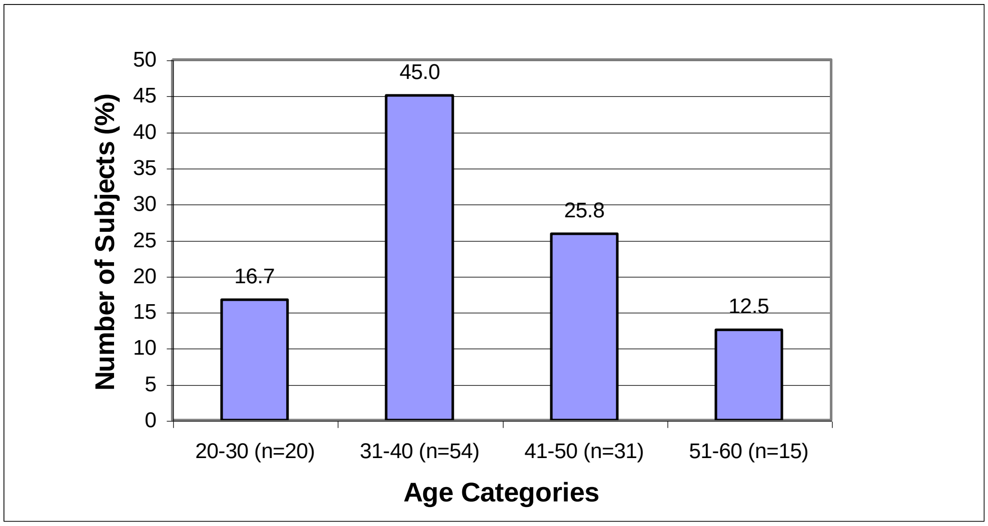


Figure 4.1.2. Age distribution of the sample population

Figure 1 depicts the age distribution of the sample population (n=120). A large percentage (45%) were in the 31-40 age group. This age group generally represents the majority of the working class.

4.1.3. Gender distribution in the sample population

Table 4.1.3. Gender distribution in the sample population

Gender	Female	Male
No. of subjects	n=76	n=35
%	68.5%	31.5%

Table 4.1.3. illustrates the gender distribution in the sample population is largely female 68.5% (n=76) as opposed to males 31.5% (n=35). This may not be fully representative of the whole work force at the selected corporate, but may give some indication of gender proportions in the corporate banking field.

4.1.4. Ethnic distribution in the sample population

Table 4.1.4. Ethnic distribution in the sample population

Ethnicity	Black	White	Indian	Coloured
Number of subjects (%)	5%	57%	34%	4%

Figure 3 illustrates that of the 120 subjects involved in the study 57% were White, 37% Indian, 5% Black and 4% Coloured.

4.2. Details of incidence, prevalence, severity and frequency of neck and shoulder pain

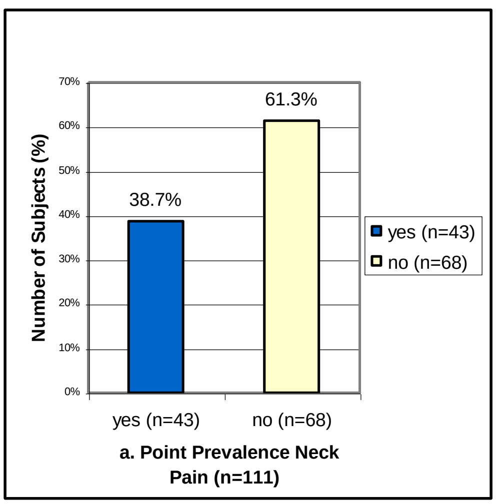
4.2.1. The lifetime incidence of neck and shoulder pain in the sample population

Table 4.2.1. The lifetime incidence of neck and shoulder pain

Lifetime incidence	Yes	No
Neck (n=111)	80.2% (n=89)	19.8% (n=22)
Shoulder (n=111)	52.3% (n=58)	47.7% (n=53)

Table 4.2.1. Depicts the lifetime incidence of neck and shoulder pain in the sample population. Neck pain (82.0%) was experienced considerably more than shoulder pain (54.1%). The sample size (n=111) was used; this excluded subjects with a history of traumatic neck injury or other existing or pre-existing medical condition related to neck pain.

4.2.2. Point prevalence neck and shoulder pain



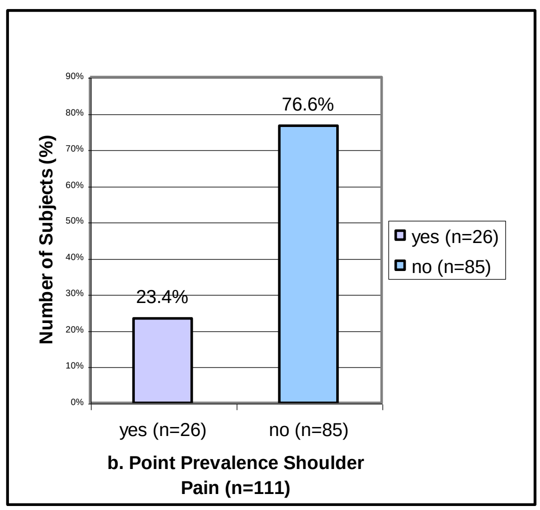


Figure 4.2.2.a & figure 4.2.2.b. Point prevalence of neck and shoulder pain

Figure 4.2.2.a depicts that a total of 43 subjects reported that they were suffering form neck pain at the time of the interview, giving a prevalence of 38.7%. Figure 4.2.2.b illustrates that 26 subjects reported having shoulder pain at the time of interview, with a

prevalence of 23.4% (n=26). The point prevalence of neck pain (38.7%) was considerably higher than that of shoulder pain (23.4%).

4.2.3. Point severity of neck and shoulder pain

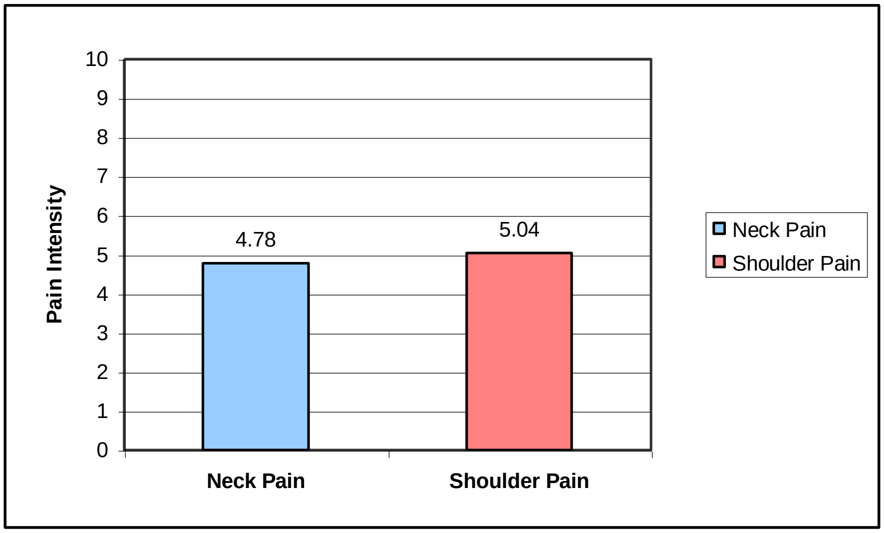


Figure 4.2.3. Point severity of neck and shoulder pain

Figure 4.2.3. illustrates the average point severity according to the Visual Analogue Scale for neck pain was 4.78, which was slightly less than that for shoulder pain (5.04).

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4.2.4. Frequency of neck and shoulder pain

4.2.4.a. Frequency of neck pain

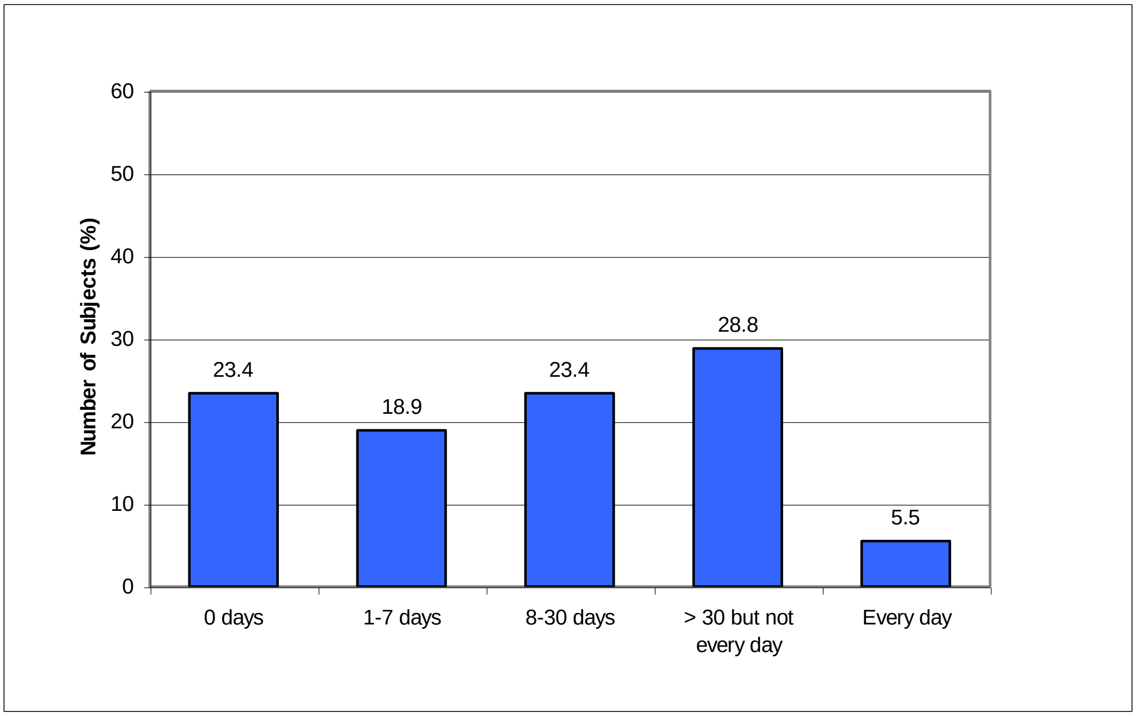


Figure 4.2.4.a. Frequency of neck pain in the last 12 months

Figure 4.2.4.a. represents the number of days in the year that participants experienced neck pain. The distribution shows that a relatively large proportion (23.4%) (26/111) had no pain. The highest percentage of subjects experiencing neck pain was in the "more than 30 days but not every day group" with 28.8% (32/111). 5.5% (6/111) of subjects experienced pain every day.

4.2.4.b. Frequency of shoulder pain

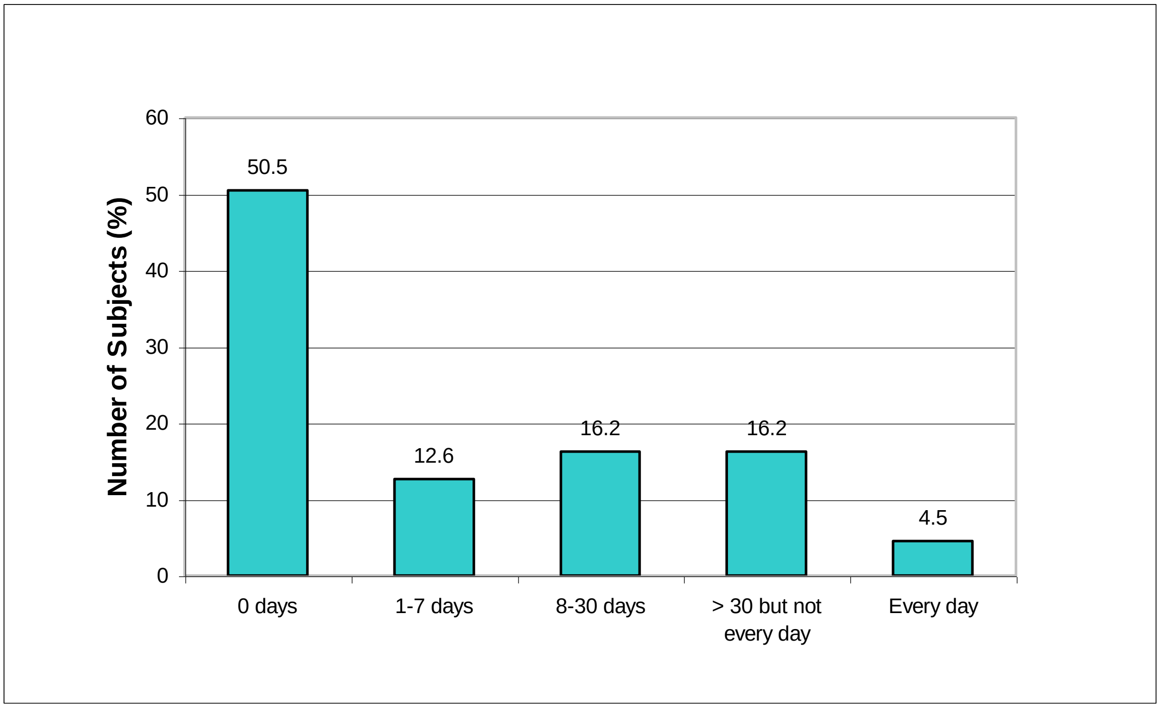


Figure 4.2.4.b. Frequency of shoulder pain in the last 12 months

Figure 4.2.4.b*.* depicts the number of days subjects experienced shoulder pain in the last year. The no pain group is represented by the highest proportion, giving the distribution a bimodal appearance. 50.5% (57/111) of subjects reported no pain in the shoulders in the last 12 months. Equal number of subjects (18/111) reported having pain in the “8-30 days” and “more than 30 days but not every day” categories.

4.2.5. The prevalence of neck and shoulder pain according to gender

4.2.5.a. The one-year prevalence of neck pain according to gender

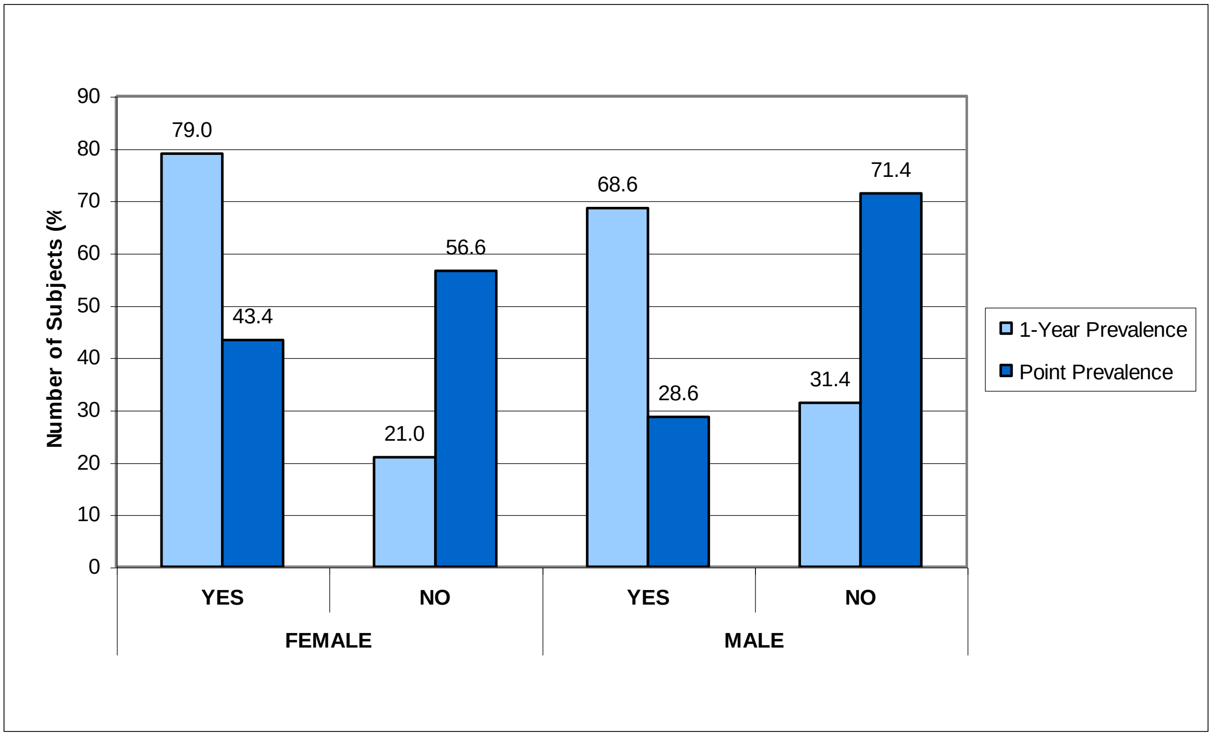


Figure 4.2.5.a. One-year prevalence and point prevalence of neck pain according to gender

Figure 4.2.5.a. depicts the one-year prevalence and point prevalence of neck pain according to gender in the participant population.

79% (60/76) of females reported having neck pain in the last year (1-year prevalence), with a point prevalence (those experiencing neck pain at the time of the interview) of 43% (33/76).

The 1-year prevalence for males was 69% (24/35) with a point prevalence of 29% (10/35). There is considerable variation in point prevalence of neck pain between females (43%) and males (29%).

4.2.5.b. The one-year prevalence of shoulder pain according to gender

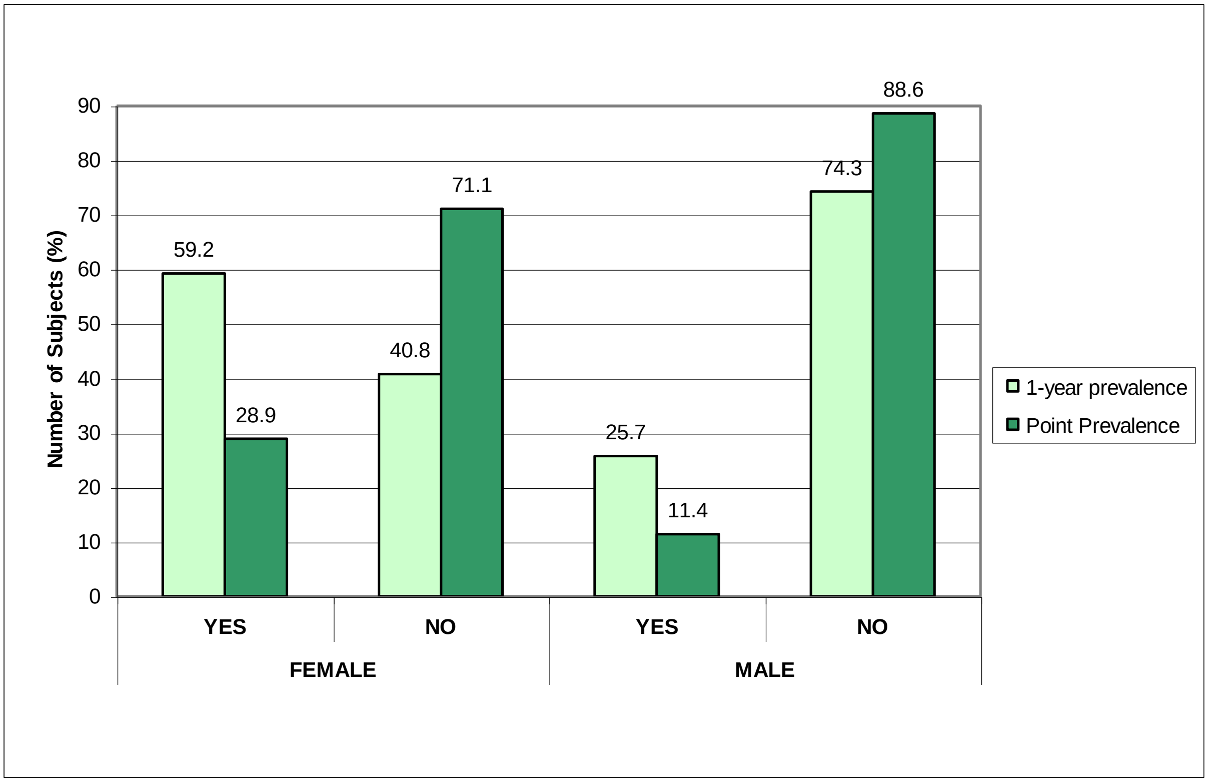


Figure 4.2.5.b. one-year prevalence and point prevalence of shoulder pain according to gender

Figure 4.2.5.b. depicts the one-year prevalence and point prevalence of shoulder pain according to gender in the participant population.

The 1-year prevalence for shoulder pain in females was 59% (45/76). Point prevalence in females was 29% (22/76). 26% (9/35) of males reported shoulder pain in the last year, with a point prevalence of 11.4% (4/35). Both 1-year prevalence and point prevalence of shoulder pain were significantly higher in females.

4.3. Factors associated with severity of neck and shoulder pain

4.3.1. Gender and severity of neck and shoulder pain

4.3.1.a. Gender and severity of neck pain

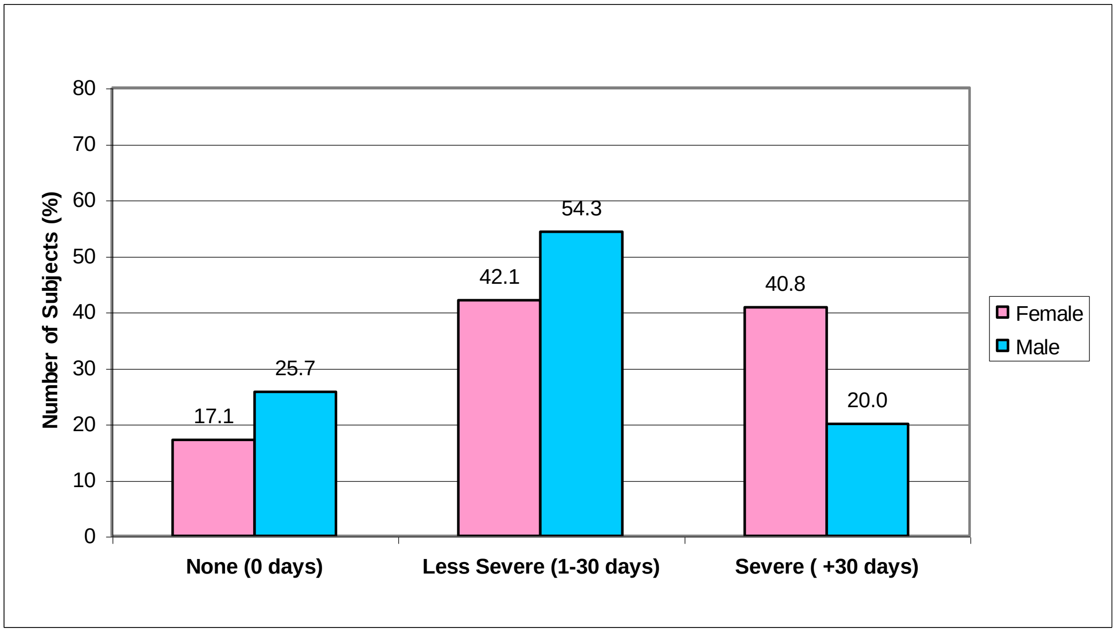


Figure 4.3.1.a. Gender and severity of neck pain

Figure 4.3.1.a. illustrates the severity of neck pain (measured according to frequency of pain experienced in the last 12 months) and gender. A greater proportion of males reported having pain of a less severe nature (54.3%) (19/35) as opposed to females (42.1%) (32/76).

However, in the severe category females showed much greater proportions (40.8%) (31/76) than males (20.0%) (7/35). It can be concluded that female gender is more prone to neck pain of a more frequent/severe nature.

4.3.1.b. Gender and severity of shoulder pain

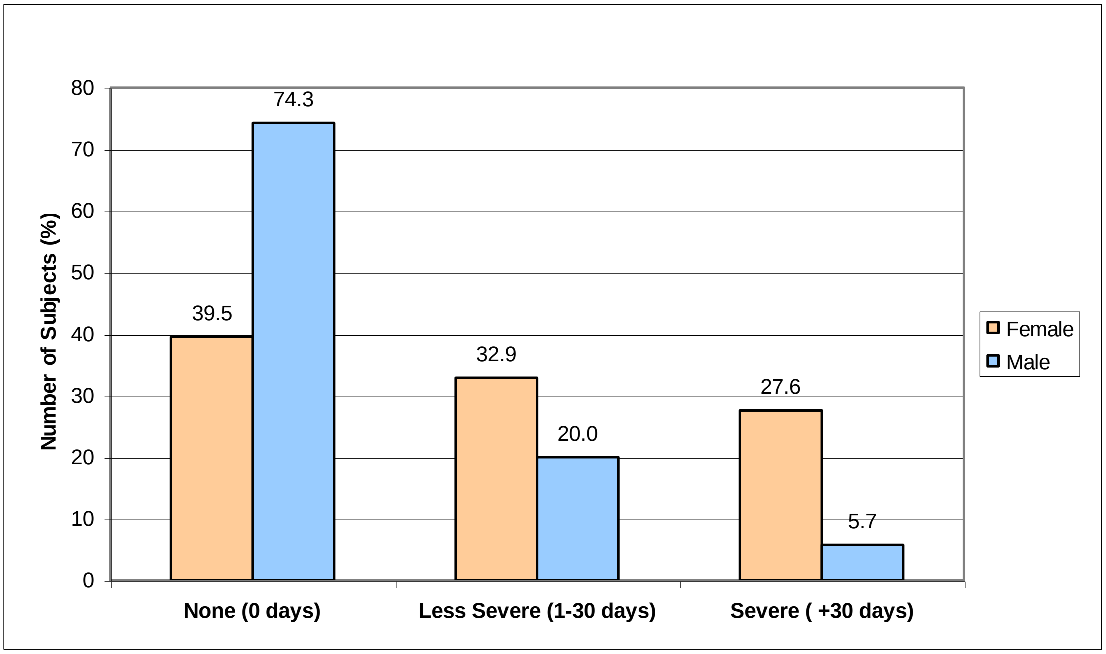


Figure 4.3.1.b. Gender and severity of shoulder pain

Figure 4.3.1.b. depicts the severity of shoulder pain according to gender. 74.3% (26/35) of males did not experience shoulder pain in the last year, nearly half as many females (39.5%) (30/76) had no pain in the last year.

Females exhibited a higher severity of neck pain in the other categories, particularly in the severe category where the percentage for females (27.6%) (21/76) was far greater than that for males of only (5.7%) (2/35).

It can be noted that females are much more prone to getting both neck and shoulder pain of a severe nature. Females appear to be much more prone to shoulder pain than males.

4.3.2. Age and Severity of Neck and Shoulder Pain

4.3.2.a. Age and Severity of Neck Pain

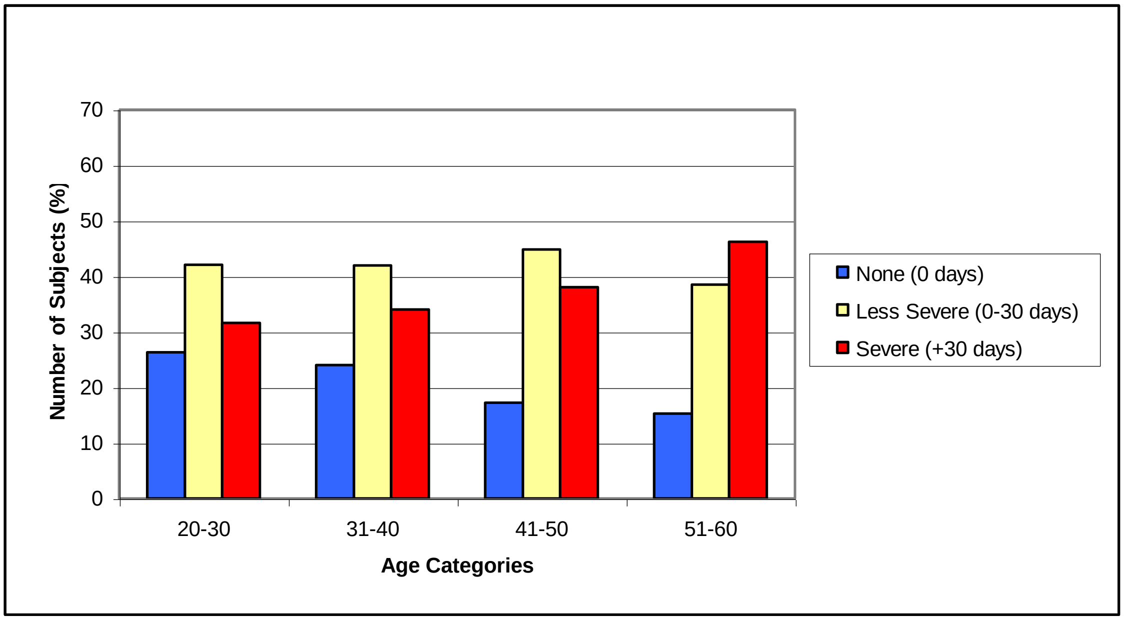


Figure 4.3.2.a. Age and Severity of Neck Pain

Figure 4.3.2.a. represents the proportion of subjects in each age category that experienced neck pain in the last year.

Older age appears to be associated with more severe (frequent) neck trouble (46.2%) (6/13). With only 15.4% (2/13) in this category experiencing no pain in the last year.

In the 20-30 age group 26.3% (5/19) of subjects had no pain and 31.6% (6/19) had severe pain.

Less severe neck pain (0-30 days in the last year) showed greatest proportions in the 41-50 age group with 44.8% (13/29). The proportion of subjects with less severe neck pain was greatest in all categories except the 51-60 group. This indicates that the majority of subjects experience neck pain of between 1-30 days in the year.

4.3.2.b. Age and Severity of Shoulder Pain

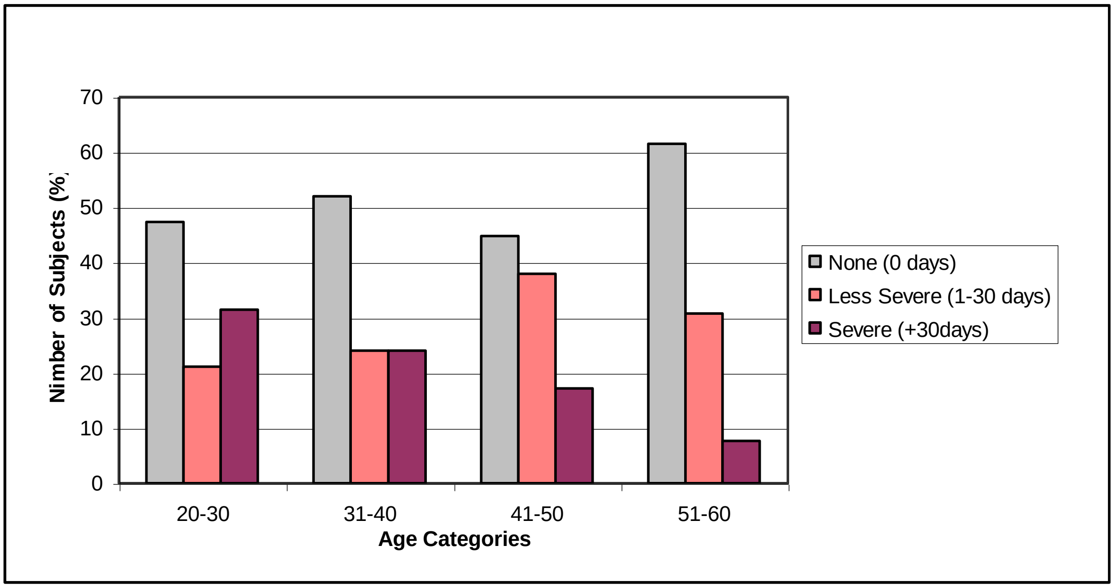


Figure 4.3.2.b. Age and Severity of Shoulder Pain

Figure 4.3.2.b. depicts the association between age and severity of shoulder pain in the last 12 months.

The no pain group shows highest proportions in all categories. In contrast to neck pain, more frequent shoulder pain is experienced in the younger age categories. Having no pain in the last year is associated with the older group (61.5%) (8/13). Only 7.7% (1/13) experienced frequent (severe) pain in this category.

Younger age appears to be associated more with frequent shoulder pain. Older age was associated more with no pain and of a less frequent nature.

4.4. Disability due to neck and shoulder pain

4.4.a. Disability Due to Neck Pain

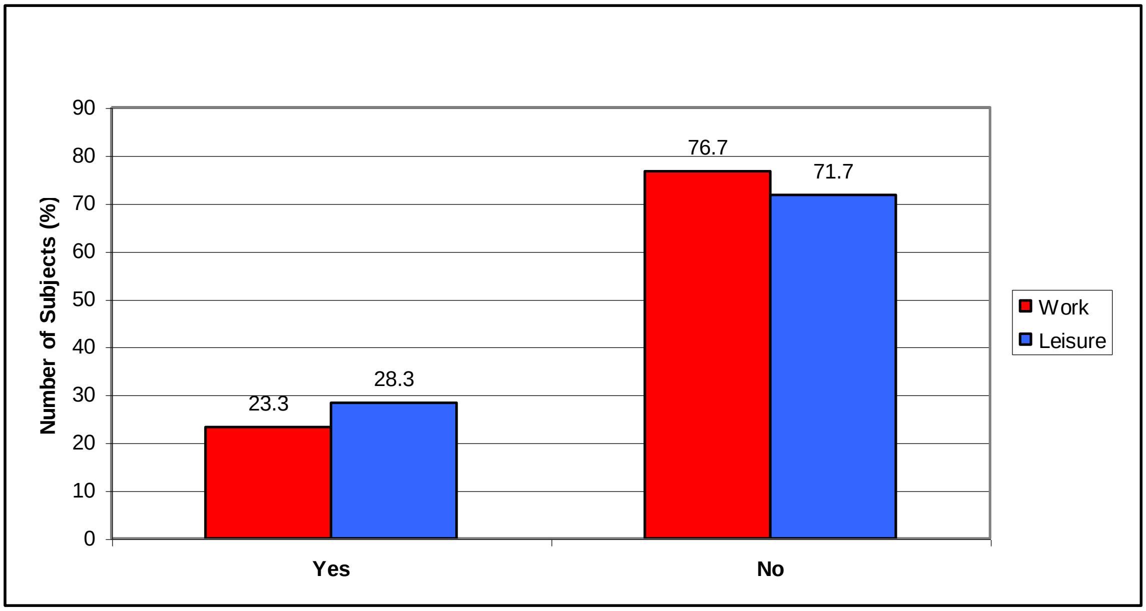


Figure 4.4.a. The effect of neck pain on daily activity

Figure 4.4.a. illustrates the effect of neck pain on daily activity. The reduction in activity at work and leisure, 23.3% and 28.3% of subjects respectively are comparable, however more people tend to reduce leisure time as a result of neck pain.

Many of those that reported neck pain believe that their condition does not affect their activity in the work place (76.7%).

4.4.b. Disability Due to Shoulder Pain

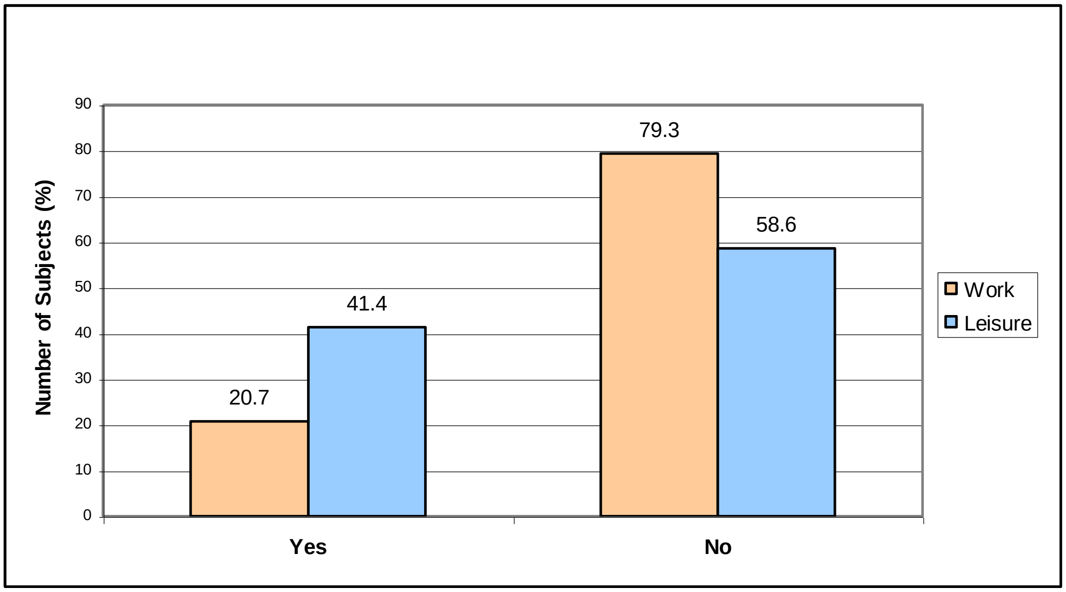


Figure 4.4.b. The effect of shoulder pain on daily activity

Figure 4.4.b. depicts that 20.7% of subjects reported that shoulder pain reduced their activity at work, however, 41.4% (nearly twice as many) reported a reduction in leisure activity.

4.5. Healthcare consultation for neck and shoulder pain

4.5.1. Source of treatment for neck and shoulder pain

Table 4.5.1. Source of treatment for neck and shoulder pain

Treatment source	Number of visits	(%)
Chiropractor	35	20.2
General Practitioner	20	11.6
Hospital	1	0.6
Masseuse	23	13.3
Neurologist	0	0
Neurosurgeon	2	1.2
Orthopaedic	2	1.2
Pharmacist	24	13.9
Physiotherapist	66	38.2

The above table represents the source of past and present treatment for neck and shoulder pain. It shows that the greatest source of treatment among the participant population was physiotherapists with 38.2% of consultations. Chiropractic consultations are represented by 20.2%. Pharmacists (13.9%), massage therapists (13.3%) and general practitioners (11.6%) make up the next three proportions of consultations.

1.16% of visits were to orthopaedic and neurosurgeons.

4.5.2. Level of care seeking

Of those that reported neck and shoulder pain, 52.8% (n=47) and 46.6% (n=27) consulted a health care practitioner respectively. Approximately only half of those that reported pain consulted a professional.

4.6. Observation recording results

Table 4.6. Comparison of desktop and laptop set-up as per observation recording

Observation Results		Incorrect set-up (%)	
		DESK TOP	LAP TOP
Screen	Directly behind keyboard	4.3%	0.0%
	Low position/ user looks slightly down to screen	75.2%	56.0%
	Distance (0.5m approx/arms length)	46.2%	11.1%
Keyboard	Directly in front of screen	2.2%	0.0%
	Distance (10-40cm from torso)	58.1%	3.7%
	Height (approx. elbow height, shoulders relaxed)	84.9%	77.8%
	Wrist support	88.2%	96.3%
Mouse	Distance (10-40cm from torso)	49.5%	14.8%
	Height (approx. elbow height, shoulders relaxed)	80.6%	81.5%
	Close to keyboard (accessibility)	18.3%	0.0%
Seat	Height (37-51cm, allows feet rest comfort 90 @ knee)	5.4%	7.4%
	Depth (38-42cm)	1.1%	0.0%
	Back rest curvature contour present (lumbar thoracic cervical)	6.5%	0.0%
	Overall manoeuvrability (allows free motion)	67.7%	66.7%
	Back rest inclination (adjustable 95-120°)	69.9%	66.7%

	Use of back rest	52.7%	51.9%
	Arm rests (support-elbows)	74.2%	77.8%
Postural factors	Subject moves around (does not keep fixed posture)	41.9%	44.4%
	Repetitive neck flexion (looking at keys)	49.5%	59.3%
	Excessive maintained upper thoracic kyphosis	33.3%	44.4%
	Subject looks relaxed generally	14.0%	4.0%
	Shoulders arms relaxed whilst keying (arms too high/low)	77.4%	70.3%
Other	General work station organization	17.2%	14.8%
	Flexibility of work station (subject can move/ realign/change components to custom)	44.4%	73.1%
	Air-conditioned environment: position of vent in relation to user.	16.1%	22.2%
	Mean Score:	43.2%	37.4%

Table 4.6 Shows the results of the observation recording and gives a comparison of differences in desktop and laptop set-up. The results show the percentage of incorrect set-up as per computer type.

Tables' 4.6.1. and 4.6.2. below represent a summary of common and differing incorrect trends and type of computer.

Table 4.6.1. Common incorrect trends to both desktop and laptop workstation

Workstation Component	Incorrect set-up %	
	Desktop	Laptop
Screen height	75.2%	56.0%
Keyboard height	84.9%	77.8%
Wrist support	88.2%	96.3%
Mouse height	80.6%	81.5%
Seat overall manoeuvrability (allows free motion)	67.7%	66.7%
Seat back rest inclination (adjustable 95-120°)	69.9%	66.7%
Use of back rest	52.7%	51.9%
Arm rests (support-elbows)	74.2%	77.8%
Shoulders arms relaxed whilst keying (arms too high/low)	77.4%	70.3%

Table 4.6.2. Differing trends in laptop and desktop workstation

Workstation Component	Incorrect set-up %	
	Desktop	Laptop
Low position/ user looks slightly down to screen	75.2%	56.0%
Screen distance (0.5m approx/arms length)	46.2%	11.1%
Keyboard distance (10-40cm from torso)	58.1%	3.7%
Mouse distance (10-40cm from torso)	49.5%	14.8%
Mouse close to keyboard (accessibility)	18.3%	0.0%
Repetitive neck flexion (looking at keys)	49.5%	59.3%
Excessive maintained upper thoracic kyphosis	33.3%	44.4%
Flexibility of work station (subject can move/ realign/change components to custom)	73.3%	44.4%

4.7. Working environment and work related health perceptions

Table 4.7. Working environment and work related health perceptions

NO.	STATEMENT	Strongly Agree	Agree	Disagree	Strongly Disagree
1	I am a skilled typist (do not need to look at the keys)	21.6%	30.6%	39.6%	8.2%
2	I use the mouse as much as I use the keyboard	23.4%	54.1%	21.6%	0.9%
3	I feel relaxed whilst typing at the computer	14.4%	64.0%	19.8%	1.8%
4	I feel the need to wriggle my neck/shoulders whilst typing	22.5%	43.2%	33.4%	0.9%
5	I feel that my daily work has a negative effect on my health	4.5%	42.4%	49.5%	3.6%
6	I am aware of the consequences of poor posture in the work place	22.5%	71.2%	6.3%	0%
7	My desk is user friendly and organised	15.3%	66.7%	14.4%	3.6%
8	I feel physically comfortable at the workstation	8.1%	69.4%	20.7%	1.8%
9	I am able to leave my workstation when I feel like it	36.0%	54.0%	9.1%	0.9%
10	My chair is comfortable and allows for changes in posture	10.8%	53.2%	24.3%	11.7%
11	My surrounding environment makes work more pleasurable	16.2%	64.0%	16.2%	3.6%

Table 4.7. above represents various statements about computer skill, workstation factors, the working environment and employee related health perceptions.

It can be noted that 52.2% agreed that they were proficient typists, whilst 47.7% disagreed. This represents a relatively large proportion of employees that lack touch typing skill. 77.5% reported that they use the mouse as much as the keyboard, 22.5% did not. The majority of participants (78.4%) felt relaxed whilst typing at the computer. 65.8% felt that they needed to wriggle their neck and shoulders whilst typing, 34.2% did not.

A large percentage of participants (46.8%) perceived their work to have a negative effect on their health, whilst 53.2% did not agree with this statement. Most participants (93.7%) agreed that they were aware of the consequences of poor postural habits.
82% of subjects agreed that their desk was user friendly and organised. 64% disagreed with the statement that their chair was comfortable and allowed for postural changes.

77.5% felt physically comfortable at their workstations, most employees (90.1%) agreed they are able to leave their workstations when they felt like it, whilst 80.2% felt that their surrounding environment makes work pleasurable.

4.8. Psychosocial factors

Table 4.8. Psychosocial factors

NO.	STATEMENT	Strongly Agree	Agree	Disagree	Strongly Disagree
1	Do you regard your work as interesting and stimulating?	27.9%	58.6%	10.8%	2.7%
2	Do you find your job Monotonous?	5.4%	27.9%	45.9%	20.8%
3	Are you told if you do a good job?	13.5%	66.7%	19.8%	0.0%
4	Is there good contact and cooperation between yourself and your supervisors?	29.7%	64.0%	6.3%	0.0%
5	Is there a friendly spirit of cooperation between yourself and your supervisors?	43.2%	54.1%	2.7%	0.0%
6	Do you get help and support if you run into difficulties in your work?	34.2%	55.9%	9.9%	0.0%
7	Are you able to influence your working conditions?	9.1%	55.8%	29.7%	5.4%
8	Are you given too much to do?	8.1%	36.0%	52.3%	3.6%
9	Are the demands of your work too great for you?	3.6%	24.3%	63.1%	9.0%
10	Do you feel anxiety about the possibility of your working situation being changed by reorganisation?	22.5%	37.8%	32.4%	7.3%
11	Do you feel anxiety about learning new techniques?	1.8%	11.7%	58.6%	27.9%

The above table 4.8 represents a series of questions relating to psychosocial aspects of the working environment.

Most of the subjects (86.5%) found their work interesting and stimulating. 66.7% disagreed with the question “do you find your job monotonous?” The majority of employees (80.2%) were told when they did a good job, 93.7% and 97.3% felt that there was good contact and cooperation, as well as a friendly spirit of cooperation with their supervisors respectively. 90.1% reported that they did get help and support when they ran into difficulties in their work.

64.9% believed that they were able to influence their working conditions, whilst 35.1% did not feel this. A relatively large proportion (44.1%) felt that they were given too much to do. 27.9% said that the demands of their work were too great for them.

60.4% of the subjects felt anxious about their working situation being changed by reorganisation. Only 13.5% were anxious about learning new techniques.

4.9. Results of special statistical analysis

In the analyses carried out in sections 4.9.1, 4.9.4.6.4 and 4.9.5 the information obtained from all 120 users was used. In all the other analyses the 9 users who reported that they had neck and / or shoulder pain that was unrelated to working on a computer were excluded.

4.9.1. Analysis of Observation

4.9.1.1. Analysis of overall Observation score

A one (1) was recorded when the setup under observation was incorrect and a zero (0) when it was correct. The total score (TS) is the sum of the numbers for the 25 different setups i.e. the number of incorrect setups. A summary of the scores is shown in table 1.

Table 4.9.1.1. Frequency distribution of the total score

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5	1	.8	.8	.8
	6	4	3.3	3.3	4.2
	7	7	5.8	5.8	10.0
	8	10	8.3	8.3	18.3
	9	17	14.2	14.2	32.5
	10	20	16.7	16.7	49.2
	11	18	15.0	15.0	64.2
	12	20	16.7	16.7	80.8
	13	11	9.2	9.2	90.0
	14	5	4.2	4.2	94.2
	15	3	2.5	2.5	96.7
	16	4	3.3	3.3	100.0
	Total	120	100.0	100.0	

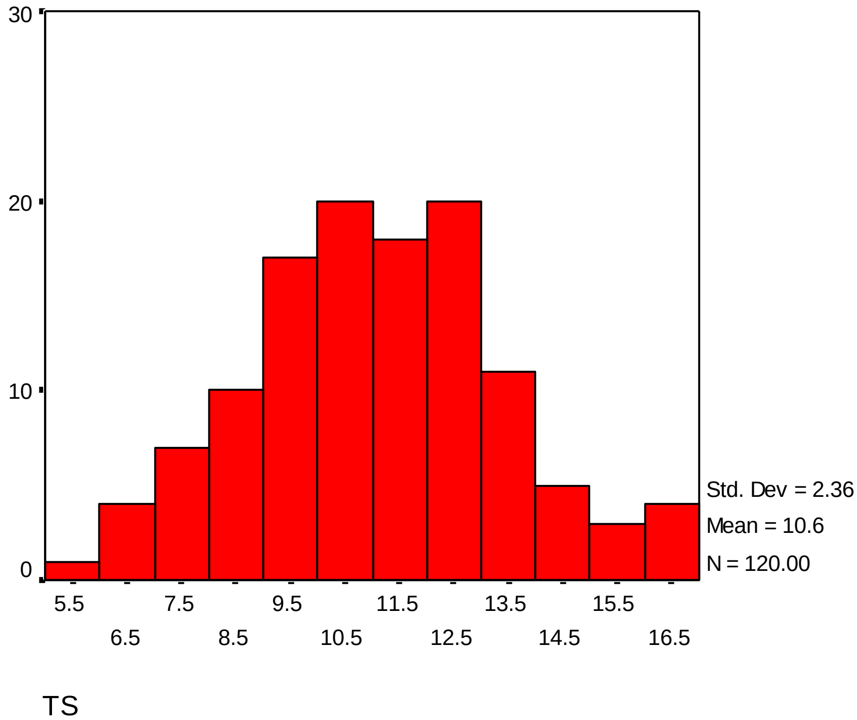


Figure 4.9.1.1 Histogram of total score

The total score appears to follow a bell-shaped distribution with a mean of 10.6.

A mean score of 10.6 would indicate that the majority of computer users in the sample population have an average of 10.6 incorrect setup components per workstation.

4.9.1.2. Comparison between desktop and laptop set-up and postural factors

Tables' 4.9.1.2.a to 4.9.1.2.g show frequency distributions for the number of incorrect setups for each of the 8 categories on the checklist. In the analyses CTYPE 1 refers to a desktop computer and CTYPE 2 to a laptop.

Table 4.9.1.2.a Screen

Count

		SC				Total
		0	1	2	3	
CTYPE	1	15	40	36	2	93
	2	12	12	3	0	27
Total		27	52	39	2	120

Chi-Square = 12.951 with p-value = 0.005

Table 4.9.1.2.b Keyboard

Count

		KB					Total
		0	1	2	3	4	
CTYPE	1	3	10	34	45	1	93
	2	0	7	19	1	0	27
Total		3	17	53	46	1	120

Chi-Square = 20.877 with p-value = 0.000

Table 4.9.1.2.c Mouse

Count

		MS				Total
		0	1	2	3	
CTYPE	1	12	33	39	9	93
	2	5	18	4	0	27
Total		17	51	43	9	120

Chi-Square = 12.161 with p-value = 0.007

Table 4.9.1.2.d Seat

Count

		SE						Total
		0	1	2	3	4	5	
CTYPE	1	8	7	17	32	24	5	93
	2	1	4	7	6	8	1	27
Total		9	11	24	38	32	6	120

Chi-Square = 3.707 with p-value = 0.592

Table 4.9.1.2.e Postural factors

Count

		PF						Total
		0	1	2	3	4	5	
CTYPE	1	2	21	42	21	5	2	93
	2	0	2	18	6	1	0	27
Total		2	23	60	27	6	2	120

Chi-Square = 5.729 with p-value = 0.334

Table 4.9.1.2.f Work organization

Count

		WO		Total
		0	1	
CTYPE	1	77	16	93
	2	23	4	27
Total		100	20	120

Chi-Square = 0.086 with p-value = 0.769

Table 4.9.1.2.g Flexibility

Count

		FX		Total
		0	1	
CTYPE	1	25	68	93
	2	15	12	27
Total		40	80	120

Chi-Square = 7.742 with p-value = 0.005

There is no difference in the pattern of the scores of the computer types for seat, postural factors, and work organization. There are significant differences in patterns for screen (Chi-Square = 12.951 with p-value = 0.005), keyboard (Chi-Square = 20.877 with p-value = 0.000), mouse (Chi-Square = 12.161 with p-value = 0.007) and flexibility (Chi-Square = 7.742 with p-value = 0.005). These differences appear to be due to the higher average number of incorrect setups for desktop than for laptop computers. The average proportion of incorrect setups for each of the 8 categories and computer types is shown in the next table.

Table 4.9.1.2.h Average proportion of incorrect set-ups for categories and computer type

	Screen	Keyboard	Mouse	Seat	Postural	Work org.	Flexibility
C1	0.423	0.583	0.495	0.396	0.426	0.172	0.731
Rank C1	5	2	3	6	4	7	1
C2	0.222	0.444	0.321	0.386	0.444	0.148	0.444
Rank C2	6	1	5	4	1	8	1

C1 – desktop C2 - laptop

Rank 1 – highest proportion of incorrect aspects Rank 8 – lowest proportion

4.9.2. Associations between incorrect workstation set-up and neck and shoulder pain

Tables' 4.9.2.a to 4.9.2.k show cross-classifications between severity of neck and shoulder pain and some of the observation components. Associations between incorrect setup and severity of neck and shoulder pain in the last 12 months are shown.

Severity is categorized according to number of days pain or discomfort is experienced in the last 12 months.

None	0 days
Less Severe	1-30 days
Severe	> 31 days

Table 4.9.2.a Low position (variable SC2) versus severity of neck pain (DURN1)

Count

		DURN1			Total
		None	Less severe	Severe	
SC2	Correct	9	14	9	32
	Incorrect	13	37	29	79
Total		22	51	38	111

Chi-Square = 2.102 with p-value = 0.350

Table 4.9.2.b Keyboard distance (variable KB2) versus severity of neck pain

Count

		DURN1			Total
		None	Less severe	Severe	
KB2	Correct	13	26	20	59
	Incorrect	9	25	18	52
Total		22	51	38	111

Chi-Square = 0.412 with p-value = 0.814

Table 4.9.2.c Keyboard distance (variable KB2) versus severity of shoulder pain (DURS1)

Count

		DURS1			Total
		None	Less severe	Severe	
KB2	Correct	33	17	9	59
	Incorrect	23	15	14	52
Total		56	32	23	111

Chi-Square = 2.566 with p-value = 0.277

Table 4.9.2.d Keyboard height (variable KB3) versus severity of neck pain

Count

		DURN1			Total
		None	Less severe	Severe	
KB3	Correct	4	9	6	19
	Incorrect	18	42	32	92
Total		22	51	38	111

Chi-Square = 0.075 with p-value = 0.963

Table 4.9.2.e Keyboard height (variable KB3) versus severity of shoulder pain

Count

		DURS1			Total
		None	Less severe	Severe	
KB3	Correct	13	2	4	19
	Incorrect	43	30	19	92
Total		56	32	23	111

Chi-Square = 4.132 with p-value = 0.127

Table 4.9.2.f Mouse distance (variable MS1) versus severity of shoulder pain

Count

		DURS1			Total
		None	Less severe	Severe	
MS1	Correct	36	19	12	67
	Incorrect	20	13	11	44
Total		56	32	23	111

Chi-Square = 1.018 with p-value = 0.601

Table 4.9.2.g Mouse height (variable MS2) versus severity of shoulder pain

Count

		DURS1			Total
		None	Less severe	Severe	
MS2	Correct	13	1	8	22
	Incorrect	43	31	15	89
Total		56	32	23	111

Chi-Square = 9.259** with p-value = 0.010

Table 4.9.2.h Free motion (variable SE4) versus severity of neck pain

Count

		DURN1			Total
		None	Less severe	Severe	
SE4	Correct	13	14	8	35
	Incorrect	9	37	30	76
Total		22	51	38	111

Chi-Square = 10.066** with p-value = 0.007

Table 4.9.2.i Free motion (variable SE4) versus severity of shoulder pain

Count

		DURS1			Total
		None	Less severe	Severe	
SE4	Correct	23	8	4	35
	Incorrect	33	24	19	76
Total		56	32	23	111

Chi-Square = 5.123* with p-value = 0.077

Table 4.9.2.j Neck flexion (variable PF2) versus severity of neck pain

Count

		DURN1			Total
		None	Less severe	Severe	
PF2	Correct	13	26	17	56
	Incorrect	9	25	21	55
Total		22	51	38	111

Chi-Square = 2.390 with p-value = 0.664

Table 4.9.2.k Shoulder relaxation (variable PF5) versus severity of shoulder pain

Count

		DURS1			Total
		None	Less severe	Severe	
PF5	Correct	15	7	4	26
	Incorrect	41	25	19	85
Total		56	32	23	111

Chi-Square = 0.862 with p-value = 0.650

Chi-Square values marked with an asterisks (* or **) indicate significant associations. A summary of the significant associations found in tables 4.15 to 4.25

Table 4.9.2.l Summary of significant associations between incorrect set-ups and severity of neck and shoulder pain

Setup	N/SP	Explanation
Mouse height (ms2)	Shoulder	Incorrect mouse height has higher proportion of less severe or severe shoulder problems.
Free motion (se4)	Neck	Not allowing sufficient free motion results in higher proportion of less severe or severe neck problems.
Free motion (se4)	Shoulder	Not allowing sufficient free motion results in higher proportion of less severe or severe shoulder problems.

Note: Free motion defined is the ability of the users chair to allow postural changes whilst operating the computer.

4.9.3. Individual risk factors associated with severity of neck and shoulder pain

4.9.3.1. Gender and severity of neck and shoulder pain

Severity was categorized according to frequency or the number of days pain or discomfort was experienced in the last 12 months.

None	0 days
Less Severe	1-30 days
Severe	$>$ 31 days

Table 4.9.3.1.a Gender versus severity of neck pain

Count

		DURN1			Total
		None	Less severe	Severe	
GEN	Female	13	32	31	76
	Male	9	19	7	35
Total		22	51	38	111

Chi-Square = 4.695 with p-value = 0.096

Table 4.9.3.1.b Gender versus severity of shoulder pain

Count

		DURS1			Total
		None	Less severe	Severe	
GEN	Female	30	25	21	76
	Male	26	7	2	35
Total		56	32	23	111

Chi-Square = 12.694** with p-value = 0.002

There is no significant association between gender and neck pain. Shoulder pain is more severe among females than among males.The p-value (0.096) for gender and severity of neck pain is greater than 0.05, and therefore H_O is not rejected and there is not sufficient evidence to suggest that the two variables chosen are dependant. The p-value for gender and severity of shoulder pain is less than 0.05. H_O is rejected and therefore there is sufficient evidence to suggest that the two variables are dependent.

4.9.3.2. Age and severity of neck and shoulder pain

Table 4.9.3.2.a Age versus severity of neck pain

Count

		DURN1			Total
		None	Less severe	Severe	
AGE	20-30	4	9	6	19
	31-40	10	24	16	50
	41-50	5	13	10	28
	50+	3	5	6	14
Total		22	51	38	111

Chi-Square = 0.897 with p-value = 0.989

Table 4.9.3.2.b Age versus severity of shoulder pain

Count

		DURS1			Total
		None	Less severe	Severe	
AGE	20-30	9	4	6	19
	31-40	27	12	11	50
	41-50	12	12	4	28
	50+	8	4	2	14
Total		56	32	23	111

Chi-Square = 5.279 with p-value = 0.508

There appears to be no association between age and severity of neck or shoulder pain.

The p-value for age and severity of neck pain (0.989) and shoulder pain (0.508) are greater than 0.05, and therefore Ho is not rejected and there is not sufficient evidence to suggest that the two variables chosen are dependent.

4.9.3.3. Exercise frequency, length, intensity and severity of neck and shoulder pain

Table 4.9.3.3.a Exercise frequency versus severity of neck pain

The EXCF value is the number of times per week that the respondent does exercise.

Count

		DURN1			Total
		None	Less severe	Severe	
EXCF	0	11	24	20	55
	1-3	2	12	8	22
	4-6	7	10	9	26
	7-9	2	5	1	8
Total		22	51	38	111

Chi-Square = 4.468 with p-value = 0.614

Table 4.9.3.3.b Exercise frequency versus severity of shoulder pain

Count

		DURS1			Total
		None	Less severe	Severe	
EXCF	0	26	13	16	55
	1-3	13	7	2	22
	4-6	14	9	3	26
	7-9	3	3	2	8
Total		56	32	23	111

Chi-Square = 6.279 with p-value = 0.393

Table 4.9.3.3.c Exercise length versus severity of neck pain

The EXCL values 0, 1-25, 26-50, 51-75 and 75+ refer to minutes of exercise per session.

Count

		DURN1			Total
		None	Less severe	Severe	
EXCL	0	11	24	20	55
	1-25	1	2	2	5
	26-50	4	7	2	13
	51-75	4	13	11	28
	75+	2	5	3	10
Total		22	51	38	111

Chi-Square = 3.268 with p-value = 0.916

Table 4.9.3.3.d Exercise length versus severity of shoulder pain

Count

		DURS1			Total
		None	Less severe	Severe	
EXCL	0	26	13	16	55
	1-25	2	2	1	5
	26-50	7	5	1	13
	51-75	17	9	2	28
	75+	4	3	3	10
Total		56	32	23	111

Chi-Square = 8.142 with p-value = 0.420

Table 4.9.3.3.e Exercise intensity versus severity of neck pain

The EXCL values of 0, 1, 2 and 3 refer to none, light, moderate and intense respectively.

Count

		DURN1			Total
		None	Less severe	Severe	
EXCI	0	11	24	20	55
	1	3	12	9	24
	2	5	10	7	22
	3	3	5	2	10
Total		22	51	38	111

Chi-Square = 2.230 with p-value = 0.897

Table 4.9.3.3.f Exercise intensity versus severity of shoulder pain

Count

		DURS1			
		None	Less severe	Severe	Total
EXCI	0	26	13	16	55
	1	11	10	3	24
	2	14	6	2	22
	3	5	3	2	10
Total		56	32	23	111

Chi-Square = 6.961 with p-value = 0.324

There appears to be no association between exercise frequency, length or intensity and the severity of neck or shoulder pain. The p-values for frequency, length or intensity of exercise and severity of neck and shoulder pain are greater than 0.05, and therefore Ho is not rejected and there is not sufficient evidence to suggest that the two variables chosen are dependent.

4.9.3.4. Smoking and severity of neck and shoulder pain

Table 4.9.3.4.a Smoking versus severity of neck pain

Count

		DURN1			Total
		None	Less severe	Severe	
SMK	Smoker	4	14	5	23
	Non smoker	18	37	33	88
Total		22	51	38	111

Chi-Square = 2.816 with p-value = 0.245

Table 4.9.3.4.b Smoking versus severity of shoulder pain

Count

		DURS1			Total
		None	Less severe	Severe	
SMK	Smoker	14	4	5	23
	Non smoker	42	28	18	88
Total		56	32	23	111

Chi-Square = 1.955 with p-value = 0.376

There appears to be no association between smoking and severity of neck or shoulder pain. The p-value for smoking and severity of neck pain (0.245) and shoulder pain (0.376) are greater than 0.05, and therefore H_O is not rejected and there is not sufficient evidence to suggest that the two variables chosen are dependent.

4.9.4. Physical and work related factors

4.9.4.1. Length of employment and severity of neck and shoulder pain

Table 4.9.4.1.a Length of employment versus severity of neck pain

Categories for length of employment (LEMP) are in completed years (1-3,4-6yrs etc)

Count

		DURN1			Total
		None	Less severe	Severe	
LEMP	1-3	4	9	3	16
	4-6	3	11	10	24
	7-9	5	8	9	22
	10-12	6	10	5	21
	13-15	3	6	7	16
	15+	1	7	4	12
Total		22	51	38	111

Chi-Square = 6.937 with p-value = 0.731

Table 4.9.4.1.b Length of employment versus severity of shoulder pain

Count

		DURS1			Total
		None	Less severe	Severe	
LEMP	1-3	8	4	4	16
	4-6	14	4	6	24
	7-9	13	4	5	22
	10-12	8	11	2	21
	13-15	7	5	4	16
	15+	6	4	2	12
Total		56	32	23	111

Chi-Square = 9.639 with p-value = 0.473

There appears to be no association between length of employment and the severity of neck or shoulder pain. The p-value for length of employment and severity of neck (0.731) and shoulder pain (0.473) are greater than 0.05, and therefore Ho is not rejected and there is not sufficient evidence to suggest that the two variables chosen are dependent.

4.9.4.2. Computer type (laptop or desktop) and neck and shoulder pain

Table 4.9.4.2.a Computer type versus severity of neck pain

Count

		DURN1			Total
		None	Less severe	Severe	
CTYPE	Desktop	15	42	30	87
	Laptop	7	9	8	24
Total		22	51	38	111

Chi-Square = 1.832 with p-value = 0.400

Table 4.9.4.2.b Computer type versus severity of shoulder pain

Count

		DURS1			Total
		None	Less severe	Severe	
CTYPE	Desktop	40	27	20	87
	Laptop	16	5	3	24
Total		56	32	23	111

Chi-Square = 3.274 with p-value = 0.195

There appears to be no association between computer type and severity of neck or shoulder pain. The p-value for computer type and severity of neck (0.400) and shoulder pain (0.195) are greater than 0.05, and therefore H_O is not rejected and there is not sufficient evidence to suggest that the two variables chosen are dependent.

4.9.4.3. Hours per day at computer and neck and shoulder pain

Table 4.9.4.3.a Hours per day at computer versus severity of neck pain

Categories 3-4, 5-6,7-8 refer to number of hours spent at a computer per day

Count

		DURN1			
		None	Less severe	Severe	Total
HRS	3-4	4	6	4	14
	5-6	8	27	18	53
	7-8	10	18	16	44
Total		22	51	38	111

Chi-Square = 2.076 with p-value = 0.722

Table 4.9.4.3.b Hours per day at computer versus severity of shoulder pain

Count

		DURS1			
		None	Less severe	Severe	Total
HRS	3-4	10	3	1	14
	5-6	28	16	9	53
	7-8	18	13	13	44
Total		56	32	23	111

Chi-Square = 5.639 with p-value = 0.228

There appears to be no association between hours per day at the computer and severity of neck or shoulder pain. The p-value for hours at the computer per day and severity of neck pain (0.722) and shoulder pain (0.228) are greater than 0.05, and therefore H_O is not rejected and there is not sufficient evidence to suggest that the two variables chosen are dependent.

4.9.4.4. Time worked before taking a break and severity of neck and shoulder pain

Table 4.9.4.4.a Time worked before break versus severity of neck pain

Categories 1/2-1, 2-3,4-5 refer to the number of hours spent at the workstation before taking a break.

Count

		DURN1			
		None	Less severe	Severe	Total
TBR	½-1	3	14	4	21
	2-3	10	18	14	42
	4-5	4	13	14	31
	5+	5	6	6	17
Total		22	51	38	111

Chi-Square = 7.289 with p-value = 0.295

Table 4.9.4.4.b Time worked before break versus severity of shoulder pain

Count

		DURS1			
		None	Less severe	Severe	Total
TBR	½-1	12	6	3	21
	2-3	23	11	8	42
	4-5	11	9	11	31
	5+	10	6	1	17
Total		56	32	23	111

Chi-Square = 7.846 with p-value = 0.250

There appears to be no association between time worked before break and severity of neck or shoulder pain. The p-value time worked before taking a break and severity of neck pain (0.722) and shoulder pain (0.228) are greater than 0.05, and therefore H_O is not rejected and there is not sufficient evidence to suggest that the two variables chosen are dependent.

4.9.4.5. Working environment factors

4.9.4.5.1. Work environment score – neck

The results of a T-Test for the equality of the mean work environment score with and without neck pain are shown below.

Mean score (neck pain group) = 24.83
Mean score (no neck pain group) = 23.73
T = 1.760 with a p-value = 0.088

There is no significant difference between the mean scores for the "neck pain" and "no neck pain" groups.

4.9.4.5.2. Work environment score – shoulder

The results of a T-Test for the equality of the mean work environment score with and without shoulder pain are shown below.

Mean score (shoulder pain group) = 24.67
Mean score (no neck pain group) = 24.01
T = 0.886 with a p-value = 0.377

There is no significant difference between the mean scores for the "shoulder pain" and "no shoulder pain" groups.

4.9.4.5.3 Effect of two specific working environment factors on severity of neck and shoulder pain

Tables represent only those factors found to be significant, the results are summarized in table 4.9.4.5.3.d.

Table 4.9.4.5.3.a Severity of neck pain versus skill as a typist

Categories 1-4 represent; 1-strongly agree, 2-agree, 3-disagree, 4-strongly disagree in response to the statement; "I am a skilled typist (I do not need to look at the keys)"

Count

		DURN1			
		None	Less severe	Severe	Total
SKT	1	5	9	10	24
	2	8	14	12	34
	3	4	25	15	44
	4	5	3	1	9
Total		22	51	38	111

Table 4.9.4.5.3.b Severity of neck pain versus negative work perception

Categories 1-4 represent; 1-strongly agree, 2-agree, 3-disagree, 4-strongly disagree in response to the statement; "I feel that my daily work has a negative effect on my health"

Count

		DURN1			
		None	Less severe	Severe	Total
DWN	1	1	3	0	4
	2	15	24	16	55
	3	6	24	17	47
	4	0	0	5	5
Total		22	51	38	111

Table 4.9.4.5.3.c Severity of shoulder pain versus negative work perception

Categories 1-4 represent; 1-strongly agree, 2-agree, 3-disagree, 4-strongly disagree in response to the statement; “I feel that my daily work has a negative effect on my health”

Count

		DURS1			Total
		None	Less severe	Severe	
DWN	1	3	1	0	4
	2	31	17	7	55
	3	22	13	12	47
	4	0	1	4	5
Total		56	32	23	111

Table 4.9.4.5.3.d Summary of results between severity of neck and shoulder pain and specific work environment factors

	Skilled typist	Daily work negative health
DURN 1(neck)	12.392*(0.054)	15.293* (0.018)
DURS 1(shoulder)	6.806 (0.339)	15.295* (0.018)

The significant associations are between severity of neck pain (DURN 1) and skill as a typist (SKT), severity of neck pain and daily work having a negative effect on health (DWN) and severity of shoulder pain (DURS 1) and daily work having a negative effect on health.

From table 17a it can be seen that the more the skill as a typist, the more severe the neck pain. From tables 17b and 17c it can be seen that the more severe the neck/shoulder pain, the stronger the respondent agrees with the “daily work having a negative effect on health” statement.

4.9.5. Psychosocial factors

4.9.5.1. Mean psychosocial score and severity of neck pain

The results of a one-way ANOVA (analysis of variance) test for the equality of the means for the psychosocial scores (PSS) for the 3 severity groups of neck pain are shown below.

Table 4.9.5.1.a ANOVA table and means of PSS for neck severity pain groups

PSS

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	19.463	2	9.732	.698	.500
Within Groups	1504.771	108	13.933		
Total	1524.234	110			

Table 4.9.5.1.b PSS means for neck severity pain groups

Duncan

DURN1	N	Subset for alpha = .05
		1
None	22	22.45
Less severe	51	22.63
Severe	38	23.45
Sig.		.314

There is no significant difference between the mean scores for the severity groups.

4.9.5.2. Mean psychosocial score and severity of shoulder pain

The results of a one-way ANOVA (analysis of variance) test for the equality of the means for the psychosocial scores (PSS) for the 3 severity groups of shoulder pain are shown below.

Table 4.9.5.2.a ANOVA table and means of PSS for shoulder severity pain groups

PSS

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	68.956	2	34.478	2.559	.082
Within Groups	1455.279	108	13.475		
Total	1524.234	110			

Table 4.9.5.2.b PSS means for shoulder severity pain groups

Duncan

DURS1	N	Subset for alpha = .05
		1
None	56	22.13
Less severe	23	23.26
Severe	32	23.91
Sig.		.067

There is some evidence (p=0.067) to suggest that the mean score for those with no shoulder pain is less than the mean score for those with less severe or severe shoulder pain.

4.9.5.3. Effect of three specific psychosocial factors on severity of neck and shoulder pain

Table 4.9.4.5.3.a represents the only psychosocial factor found to be significantly associated with neck and shoulder pain; some of the results are summarized in table 4.9.5.3.b.

Table 4.9.5.3.a Too much to do versus shoulder pain

		DURS1			
		None	Less severe	Severe	Total
MDO	1	2	1	1	4
	2	36	14	8	58
	3	18	13	9	40
	4	0	4	5	9
Total		56	32	23	111

Table 4.9.5.3.b Results of tests for association between severity of neck and shoulder pain and specific psychosocial factors

	Influence conditions	**Too much to do**	**Anxiety about change**
DURN 1(neck)	5.342 (0.501)	6.631 (0.356)	3.755 (0.710)
DURS 1(shoulder)	4.449 (0.616)	14.450* (0.025)	3.825 (0.700)

The figure without brackets is the Chi-Square statistic value. The figure in brackets is the p-value.

The only of the above associations that is significant is that between having “too much to do” and severity of shoulder problems. From table 15 below it can be seen that those with less severe or severe shoulder pain agree more strongly about having too much to do than those with no shoulder pain.

4.9.5.4. Psychosocial environment scores

Table 4.9.5.4 Classification of psychosocial environment scores

Score	Number	Percentage
13-20	35	29
21-28	79	66
29 or more	6	5

The psychosocial environment appears to be below par in most of the cases e.g. only 30% of the individuals work in what can be termed "a good psychosocial environment" i.e. a score of 20 or less. The mean score is 22.85.

4.9.6. Relationships between neck and shoulder pain

4.9.6.1 Severity

The severity of neck and shoulder pain was classified as none, less severe pain (0 to 30 days) and severe (30 days or more). The table below shows the frequencies for each of the categories.

Table 4.9.6.1. Severity of neck and shoulder pain

Neck / Shoulder	None	Less severe	Severe	Total
None	17	4	2	23
Less severe	27	24	4	55
Severe	17	5	20	42
Total	61	33	26	120

Chi-Square = 33.207 with p-value = 0.000

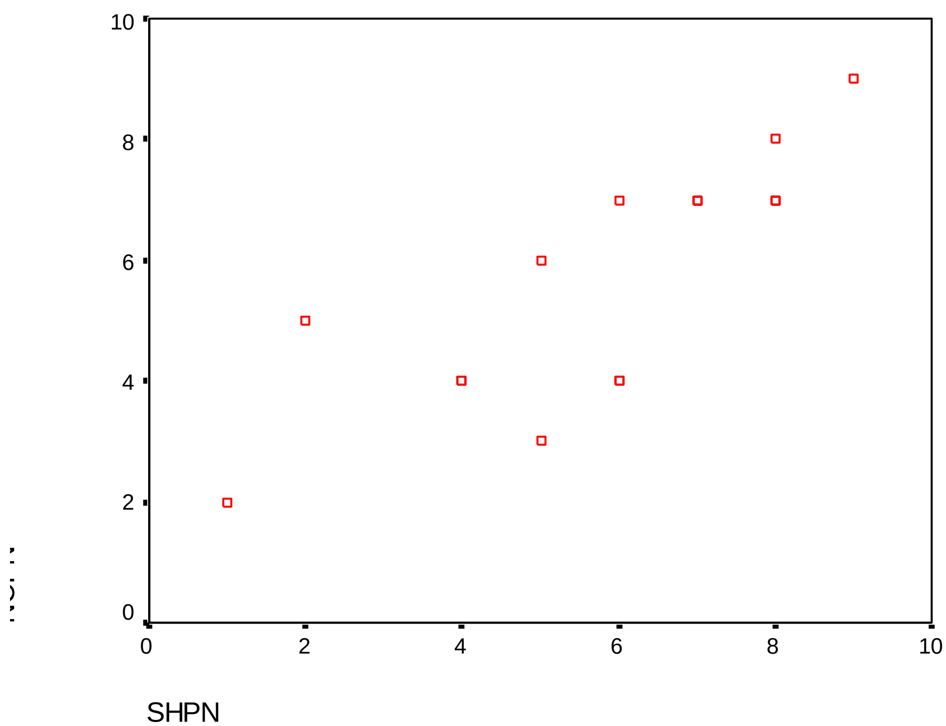
From the above table it can be seen that

1 Neck pain occurs more frequently than shoulder pain e.g. more than 50% of the respondents have no shoulder pain while less than 20% have no neck pain, 22% of the respondents have severe shoulder pain while 35% have severe neck pain.

2 There is a strong association between neck and shoulder pain i.e. severe pain in the one often goes together with severe pain in the other.

4.9.6.2. Pain ratings

A scatter plot of the 15 pairs of pain ratings for neck and shoulder pain is shown in Figure 21. From the graph it can be seen that there is a reasonably strong positive correlation (correlation coefficient = 0.808) between the shoulder and neck pain ratings. This means that as the one pain rating increases so does the other one. This agrees with the finding stated under point 2 in section 7.1.



NCPN – neck pain rating SHPN – shoulder pain rating

Figure 4.9.6.2 Pain ratings for neck and shoulder

4.9.7. Absenteeism as a result of neck and shoulder pain

Table 4.9.7 Time lost at work due to neck and shoulder pain

Neck / Shoulder	None	1-7 days	8-30 days	Total
None	103	0	1	104
1-7 days	9	6	0	15
8-30 days	0	0	1	1
Total	112	6	2	120

From the above table it can be seen that:

- In 5% of the cases time is lost due to both neck and shoulder pain.
- In 7.5% of the cases time is lost due to neck pain only.
- Time is rarely is lost due to shoulder pain only (1 out of 120) or for more than 7 days

4.9.8. Changing jobs as a result of neck and shoulder pain

1 of the respondents reported that neck pain had resulted in a job change.
None of the subjects reported changing jobs as a result of shoulder pain.

4.9.9. Effect of neck and shoulder pain on activity (figures 4.4 a and b)

Table 4.9.9.a Neck pain interference

Work / Leisure	Yes	No
Yes	28	0
No	6	86

Table 4.9.9.b Shoulder pain interference

Work / Leisure	Yes	No
Yes	12	0
No	12	96

From the above tables it can be seen that:

- Neck pain interferes more with work/leisure than shoulder pain.
- There are instances where neck/shoulder pain interferes with leisure but not with work, but no instances where the opposite is true. The difference might be due to the fact that an individual has a choice about leisure activities (and might abstain if it is painful), but often has no choice about work to be done.

4.9.10. Location of shoulder pain

Table 4.9.10 Location of shoulder pain

Location	Number
Right shoulder	20
Left shoulder	15
Both shoulders	24

The numbers seems to be evenly spread over the different locations. A Kruskal-Wallis test for the difference between the pain ratings in the 3 different locations shows that the ratings have approximately the same magnitude (Chi-Square = 2.307 with a p-value of 0.316).

4.10. Conclusion

The following tables summarise the results of this study

Table 4.10.a Summary of incidence and prevalence

Incidence/prevalence	Neck	Shoulder
Lifetime Incidence	80.2%	52.3%
1-year prevalence	76.6%	49.5%
Point prevalence	38.7%	23.4%

Table 4.10.b The prevalence of neck and shoulder pain according to gender

Prevalence according to gender	Female		Male	
	1-year	Point	1-year	Point
Neck Pain	79.0%	43.4%	68.6%	28.6%
Shoulder Pain	59.2%	28.9%	25.7%	11.4%

Table 4.10.c Frequency of pain according to 1-year prevalence

Frequency (12 months)	Neck	Shoulder
0 days	23.4%	50.5%
1-7 days	18.9%	12.6%
8-30 days	23.4%	16.2%
>30 days but not every day	28.8%	16.2%
Every day	5.5%	4.5%

Table 4.10.d Effect of neck and shoulder pain on activity

Effect on activity	Neck	Shoulder
Work	23.3%	20.7%
Leisure	28.3%	41.4%

Table 4.10.e Summary of special statistical analysis- Factors associated with neck and shoulder pain (*some relationship ** significant)

Factor Grouping	Factor		NP p-value	SP p-value
Individual	Gender (female)		0.096*	0.002**
Work related	Set-up factors:	Mouse height		0.010**
		Chair free motion	0.007**	0.077**
	Work environment	Proficient typing skill	0.054**	
	Work perception	Negative work perception	0.018**	0.018**
Psychosocial	Overall psychosocial score			0.067*
	Specific factor	Having too much to do		0.025**

Chapter 5 - Discussion

5.0. Introduction

The aims of this chapter are as follows:

- To Interpret and discuss of the findings of this study
- To Integrate and compare these findings with other studies
- To discuss the limitations of this study

5.1. The demographic data

5.1.1. Gender distribution (Table 4.1.3)

In this study 68.5% (n=76) of the subjects were female, 31.5% were male (n=35). This gender distribution differs from that of Owens and Patterson (2000) in their study of 170 non-secretarial computer users in various worksites, where the gender distribution was 44.1% (n=75) female to 55.9% (n=95) male.

The proportion of females to males in this study may give some indication of gender distribution in the corporate banking workplace.

5.1.3. Ethnic distribution (Table 4.1.4)

The ethnic distribution was unbalanced in this investigation with only 5 coloured and 6 black, the remainder was made up of Indians (41) and whites (68). This makes it difficult to draw strong conclusions regarding the association between ethnicity and neck and shoulder disorders. A review of the literature does not reveal any studies that have investigated this association.

5.1.4. Age distribution (Figure 4.1.2)

The inclusion criteria for this study allowed for any age ≥ 20 years. This was based on the fact that most individuals with at least one year of work experience are 20 years or older. Palmer et al. (2001) specified a range of 16-64 years in a national survey on the use of keyboards and symptoms in the neck and upper limb. Other studies (Sauter et al.1991 and Owens and Patterson, 2000) did not define an age range; subjects were included on the basis 3 months to 1 year of work experience respectively.

A large percentage of participants in this study were between the ages of 31 to 40 (45%), 26% were in the 41 to 50 age group, followed by 17% in the 20 to 30 and 13% in the 51 to 60 categories. These results are similar to those found by Sauter et al. (1991), Holmström et al. (1992) and Owens and Patterson (2000), where mean age was found to be 35.9, 39.5 and 31.5 years respectively.

5.2. Details of incidence, prevalence, severity and frequency of neck and shoulder pain

5.2.1. Lifetime incidence of neck and shoulder pain (Table 4.2.1)

The lifetime incidence of neck pain in the participant population (n=111) was 80.2% (n=89), which excludes those subjects with existing or pre-existing neck disorders related to specific medical diagnosis and unrelated to work. General population studies show less inflated figures.

Côté et al. (1998) found the lifetime prevalence of neck pain to be 66.7% in Saskatchewan adults. Lau et al. (1996) found the lifetime prevalence of neck pain in Hong Kong Chinese to be 31% in men and 27% in women.

The lifetime incidence of neck pain in the present study is high and emphasises the need for investigation into the working environment.

Our study indicated the lifetime incidence for shoulder pain in the participant population (n=111) was 52.3% (n=58), which excludes those subjects with existing or pre-existing neck disorders related to specific medical diagnosis and unrelated to work. A review of the literature indicates that there appear to be few studies conducted on shoulder pain in the general population with regard to the epidemiology of shoulder disorders.

5.2.2. Prevalence of neck and shoulder pain (Figures 4.2.2.a, 4.2.2.b, 4.2.5a and 4.2.5.b)

The one-year prevalence of neck pain in the sample population (n=111) was 76.6% (n=85) and the point prevalence (subjects that reported pain on the day of the interview) was 38.7% (n=43). These findings are comparable to those of Kamwendo et al. (1991) who found the one-year prevalence of neck pain to be 63% (n=420) with a week prevalence of 33% in medical secretaries.

Lau et al. (2002) reported different one-year prevalence figures for neck pain in university academic staff with a rate of 46.7%. Small population size and potential sampling error were, however, suggested as limitations to their study.

The results of Bergqvist et al. (1995:a) concur with the current study; they found one-year prevalence of neck and shoulder pain (defined as one entity) to be 61.5% (n=247). Owens and Patterson (2000) reported one-month prevalence rates of combined neck and shoulder pain to be as high as 65%.

The one-year prevalence of shoulder pain in the sample population (n=111) was 49.5% (n=55) with a point prevalence of 23.4% (n=26). These results are comparatively lower than those of Kamwendo et al. (1991) who found one-year prevalence of shoulder pain to be 62% with a week prevalence rate of 34%.

The current study reported point prevalence rates for neck pain of 43.4% and 28.6% for females and males respectively (Figure 4.2.5.a). These figures are considerably higher than those found by Palmer et al. (2001) who reported week prevalence rates of 22.9% and 14.8% respectively between genders in a large sample of regular keyboard users.

Palmer et al. (2001) also reported shoulder pain week prevalence to be 21.2% and 16.4%, female to male. These rates are comparable to those of the present study where rates were reported at 28.9% and 11.4% (Figure 4.2.5.b). There appears to be considerable variation in neck and shoulder pain prevalence between gender groups.

This study shows that the prevalence of neck pain is higher in terms of one-year and point prevalence than that reported in other studies. It would appear that the participant group (financial management/advisory staffs) are at relatively greater risk of neck injury. With regard to shoulder pain the results of the present study are comparable to other studies conducted. The results of Kamwendo et al. (1991) indicate that medical secretaries are a relatively high-risk group for shoulder pain. It should also be noted that there is variation in terms of prevalence reporting from day to week to month to year, whilst other studies report neck and shoulder pain together. Lack of uniformity with regard to the literature may account in part for discrepancy in findings.

5.2.3. Frequency of neck and shoulder pain (Figure 4.2.4.a and b)

Frequency of neck and shoulder pain in the current study was measured according to the number of days that pain was experienced in the previous year.

The highest percentage of subjects who experienced neck pain (Figure 4.2.4.a) was in the “more than 30 days but not every day” category with 28.8%. Only 5.5% of subjects reported that they had pain every day.

Equal number of subjects (16.2%) reported having shoulder pain (Figure 4.2.4.b) in the “8-30 days” and “more than 30 days but not every day” categories. 4.5% reported constant pain in the shoulders.

The results of the present study with regard to neck pain are similar to those reported by Kamwendo et al. (1991), whose study found that 32% of medical secretaries reported pain only occasionally, whilst 15% reported pain almost constantly. Sauter et al. (1991) reported that constant neck pain was experienced in 27% of data entry workers, which is comparatively higher than both of the above-mentioned studies.

Frequency of shoulder pain reported in the current study was considerably lower than that reported by Kamwendo et al. (1991) where occasional shoulder pain was experienced by 29% and almost constant pain was experienced by 17%.

There appears to be variation in defining frequency of pain, however the results of this study would indicate that few of the participants experienced constant neck and shoulder pain. Other studies show greater proportions of subjects with constant pain.

The frequency scale used in this study may also present a limitation as defining pain between the two last categories, namely “more than 30 days but not every day” and “every day” in the previous year may be a little crude. Experiencing pain every second day in a year would amount to a much greater frequency than pain experienced only 40 days in 365.

5.2.4. Severity of neck and shoulder pain (Figure 4.2.3)

The severity of neck and shoulder pain (Figure 4.2.3) was measured using a point severity Visual Analogue Scale (VAS) on the day of the interview. Average point severity according to this scale for neck pain was 4.78, which was slightly less than that for shoulder pain at 5.04.

This study did not use the VAS scale to interpret relationship of variables on neck and shoulder pain. This was achieved by modification of frequency scale that related to the number of days pain was experienced in the last 12 months. Three categories were devised, that of “no pain/discomfort”, “pain/discomfort; 0-30 days” and “pain/discomfort; ≥ 31days”. See Table 5.5 below.

Table 5.5. A scale of severity according to frequency of pain experienced in the last 12 months

None	0 days
Less Severe	1-30 days
Severe	≥ 31 days

According to this scale no neck pain was experienced by 19.8% (22/111), less severe by 45.9% (51/111) and severe by 34.3% (38/111).

50.5% (56/111) reported having no shoulder pain, 28.8% (32/111) reported having less severe and 20.7% (23/111) had severe.

Owens and Patterson (2000) used a scale that related to pain, stiffness or soreness during the previous month, a score was calculated based on frequency, duration and severity of neck and shoulder pain. Kamwendo et al. (1991) used a scale of pain experienced "often", "sometimes" and "seldom" to measure severity of neck and shoulder pain/discomfort. Chiu et al. (2002), on the other hand measured severity of neck pain according to the Northwick Park Neck Pain Questionnaire. This consisted of nine questions to measure the severity and functional limitation caused by neck pain.

Definitions and measurement of severity vary considerably; this too complicates the integration and comparison of results.

5.3. Healthcare consultation for neck and shoulder disorders

52.8% and 46.6% respectively consulted a health care practitioner for neck and shoulder complaints i.e. only approximately half of those with pain or discomfort. Two possible conclusions can be drawn from this, one being that the severity of pain experienced does not necessitate medical or other intervention, or two that a lack of time and/or convenience results in lack of treatment sought for the complaint. Most probably a combination of these factors exists. Level of care seeking in this study was comparatively higher than that reported by Chiu et al. (2002), where only 27% of university academic staff received treatment for neck complaints.

Those that did receive treatment (Table 4.5.1) consulted mainly physiotherapists (38%) and chiropractors (20%) followed by pharmacists (14%), massage therapists (13%) and general practitioners (11.6), 2.3% of consultations were to orthopaedic and neurosurgeons. Chiu et al. (2002) found that the majority of their respondents (60%) in Hong Kong received treatment from medical doctors (general practitioner or specialist not specified). Other studies do not specify the type of care seeking. Other studies do not specify the type of care seeking. In contrast to the above, and in the South African context, this study found that more people consulted physiotherapists and chiropractors for these problems as opposed to general practitioners.

5.4. Risk factors associated with severity of neck and shoulder pain

5.4.1. Individual factors

a. Gender and severity of neck and shoulder pain (Tables 4.9.3.1.a-b, Figures 4.3.1 a-b)

Figure 4.3.1.a illustrates the association between gender and severity of neck pain; it would appear that females report neck pain of a more severe nature than males, 40.8% as opposed to 20.0% respectively. Males tend to report neck pain of a less severe nature. The results of the Chi-Square test (Chi-Square = 4.695 with p-value = 0.096) show that there is no significant association between gender and neck trouble. However this p- value is close to being significant.

Figure 4.3.1.b depicts the association between shoulder pain and gender; there is clearly a difference in shoulder pain severity reported between females (27.6%) and males (5.7%) in the severe category as well as in the less severe category 32.9% and 20.0% respectively. The results of the Chi-Square test (Chi-Square = 12.694 with p-value = 0.002) show that there is a significant association between gender and shoulder pain severity. Bergqvist et al. (1995:a) also reported significant disparity in shoulder diagnoses with 14.7% in women and 3.3% in men.

This association with regard to neck and shoulder pain is well documented in the literature (Bergqvist et al., 1995:a, Côté et al., 1998 Owens and Patterson, 2000, Palmer et al., 2001, and Chiu et al. 2002). As discussed earlier in the literature review, these differences between sexes may be due to the fact that greater proportions of women work in high-risk environments (secretarial and administrative work), there may be further differentiation with regard to type of work, task variety, and hours spent without breaks. The role of women in the home may equally have an impact on symptom development. Other considerations are socialisation and cultural differences with regard to symptom reporting (Owens and Patterson, 2000 and Gerr et al., 2002).

The findings of this study concur with those of Bergqvist et al. (1995:a) particularly with reference to shoulder disorders, and highlight the disparity between sexes. These authors conclude further that the role of women at home and particularly those with young children are a greater risk group. The concept of a “double shift” on women’s musculoskeletal problems is discussed. Barnekow-Berkvist et al. (1998) adds that women in higher socio-economic class and well educated women in jobs with greater decision latitude will perceive high responsibility stress due to the combination of work related stress and stress related responsibilities from the family. The current study however did not differentiate between women with children and others, but the clear difference between genders particularly with reference to shoulder pain is clear.

b. Age and severity of neck and shoulder pain (Figures 4.3.2.a-b and Tables 4.9.3.2.a-b)

The current study (Table 4.9.3.2.a) did not show that age was significantly associated with neck pain (Chi-Square = 0.897 with p-value = 0.989) this finding concurs with Chiu et al. (2002).

This can be explained in part using the health based decision model (Krause et al., 1997), which states that younger employees may be healthier than senior employees, they may choose to stay at work even when neck pain is provoked and will stop work only when the pain becomes intolerable. Older staff may be less healthy and more concerned for their health. They may stop work before the onset of neck pain, therefore more subjects with neck pain and a higher severity of neck pain may be found in younger employees. This can be further explained by the healthy worker effect i.e. that employees with severely debilitating neck pain that could be in the older age groups have left work as a result of the disability caused by neck pain (Bergqvist et al., 1995:b).

Other studies show significant associations between age and neck and shoulder disorders (Kamwendo et al., 1991; Holmström et al., 1992; Bergqvist et al., 1995:a; Fredriksson et al., 2000; Owens and Patterson, 2000 and Gerr et al., 2002).

With regard to shoulder pain (Table 4.9.3.2.b), the current study did not demonstrate association between age and gender (Chi-Square = 5.279 with p-value = 0.508). Kamwendo et al. (1991), however did find an association between age and shoulder pain.

c. Exercise and severity of neck and shoulder pain (Tables 4.9.3.3.a-f)

No association was found between exercise frequency, length or intensity and the severity of neck or shoulder Pain. This differs from the findings of Holmström et al. (1992) and Pietri-Taleb et al. (1994) where the latter found exercise to have a protective effect on neck trouble. Holmström et al. (1992) established that a lack of activity in spare time was associated with neck and shoulder trouble.

d. Smoking and severity of neck and shoulder pain (Tables 4.4.9.3.4.a and b)

The results of the Chi-Squared test indicated no association between smoking and severity of neck and shoulder pain (Chi-Square = 2.816 with p-value = 0.245 and Chi-Square = 1.955 with p-value = 0.376 respectively).

These findings concur with those of Holmström et al. (1992) and Pietri-Taleb et al. (1994) who found weak associations with smoking and neck pain.

If one were to compare the results of studies on lower back pain and those of the current study (if we assume that non-specific neck/shoulder pain and lower back pain are close to each other with regard to their pathophysiology) then it is important to note the strong associations found between smoking and lower back pain (Leboeuf-Yde et al. 1996) and lack of association with regard to neck/shoulder pain.

5.4.2. Physical and work related factors

a. Length of employment and severity of neck and shoulder pain (Tables 4.9.4.1.a-b)

No significant association was found between length of employment and neck and shoulder pain (Chi-Square = 6.937 with p-value = 0.731 and Chi-Square = 9.639 with p-value = 0.473 respectively). This lack of association opposes the findings of Kamwendo et al. (1991) who found a strong association between length of employment and neck and shoulder pain. It should be noted that this study used a relatively small population sample and a lack of significance in findings may be related to this.

b. Computer type and severity of neck and shoulder pain (Tables 4.9.4.2.a-b)

The current study did not demonstrate any association between type of computer used and severity of neck and shoulder pain (Chi-Square = 1.832 with p-value = 0.400 and Chi-Square = 3.274 with p-value = 0.195).

Szeto and Lee (2002) found that laptop computers induce a more flexed spinal posture, with resulting greater discomfort to the neck and upper back. The results of this study do not support this.

c. Hours per day at computer and severity of neck and shoulder pain (Tables 4.9.4.3.a-b)

The results of the Chi-Square Test indicated no significant association between hours per day at a computer and severity of neck and shoulder pain Chi-Square = 2.076 with p-value = 0.722 Chi-Square = 5.639 with p-value = 0.228, this is supported by the findings of Kamwendo et al. (1991) where frequency of neck pain recorded as seldom, sometimes and often, showed weak association to length of computer processing per day. However these authors did find an association between shoulder pain and computer processing for more than 5 hours per day.

Other studies contradict these findings; Chiu et al. (2002) establish that computer work of greater than or equal to 4.25 hours per day was a risk factor for development of neck pain. Bergqvist et al. (1995:b) had similar results; they found that more than 20 hours of data entry per week was a risk factor for neck/shoulder discomfort. Such findings are supported by the greater body literature in that prolonged static postures are a significant risk factor for the development of musculoskeletal disorders.

A lack of association in the current study may be related to the fact that the majority of employees (88%, n=97) worked at a computer for more than 5 hours per day; this may be one of the factors responsible for the high prevalence rates particularly for neck pain in this study.

d. Time worked before taking a break and severity of neck and shoulder pain (Tables 4.9.4.4.a-b)

The results of the Chi-Square Test did not reveal a significant association between periods of computer use without a rest/break opportunity and severity of neck and shoulder pain (Chi-Square = 7.289 with p-value = 0.295 and Chi-Square = 7.846 with p-value = 0.250). This would suggest that limited rest/break opportunity does not have an effect on neck and shoulder pain, this assumption is not consistent with the literature, where this factor appears to play a significant role (Bergqvist et al., 1995:a, Owens and Patterson, 2000, Chiu et al., 2002).

Such disparity in the findings of this study as compared to the other related literature may be related to the determination and definition of periods of computer use. In addition the small sample size in this study may equally have had an effect on results.

e. Working environment and work related health perceptions

The overall score for the questions pertaining to the working environment and work related health perceptions were tested against the neck pain and no neck pain group. The result of the Independent T-Test for equality of mean working environment score showed no association between the neck pain and no neck pain groups (T=1.760 with a p-value = 0.088).

The result of the Independent T-Test for equality of mean working environment score showed no association between the shoulder pain and no shoulder pain groups (T=0.886 with a p-value = 0.377).

It should be noted that the questions in this section covered a wide range of issues and therefore the overall score may not give a clear measurement of what would be termed a poor working environment.

Selected questions were tested severity of neck and shoulder pain (Tables 4.9.4.5.3.a-c represent only the associations found to be significant in the Chi-Square analysis. Table 4.9.4.5.3.d summarises the results).

Participants were asked to respond to the statement “I am a skilled typist (I do not need to look at the keys)”. Those who agreed with this statement could be termed proficient typists; those that disagreed would be participants that needed to look at the keyboard in order to find the keys. It is interesting to note that there was a significant association between typists that were proficient and severity of neck pain (Chi-Square =12.392 with p value = 0.054). i.e. those that could touch type had a greater severity of neck and shoulder pain. This association could be explained on the basis that touch typists spend more time in a period of prolonged static posture whilst typing, i.e. they do not move the neck for prolonged periods whilst typing. It is well documented that prolonged static postures lead to the development of muscular discomfort (Rempel et al., 1992; Tayyari and Smith, 1997:175 and Kroemer and Kroemer, 2001:65).

The results of this study would appear to contradict the theory that repeated and prolonged neck flexion may lead to the development of neck disorders (Tayyari and Smith, 1997:371). Owens and Patterson (2000) hypothesised that computer skill, or lack thereof may be a potential risk factor on the basis that poor typing skill can lead to repetitive neck flexion to find keys, leading to neck discomfort. However these authors did not find an association between poor typing skill and neck discomfort.

Although the findings of the current study contradict the theory of repetitive neck flexion causing discomfort, the scale of measurement was objectively crude. Further investigation is warranted in this area to determine the effect of static posture as opposed to repetitive movement in the development of disorders.

Participants were also asked to respond to the statement “I feel that my daily work has a negative effect on my health”.

A significant association was found between those who agreed with this statement and the severity of both neck and shoulder pain (Chi-Square=15.293 with p=0.018 and Chi-Square=15.295 with p=0.018 respectively). Those that had a negative perception of their working environment reported more severe neck and shoulder pain.

This association is clear for both shoulder and neck pain groups, and it would appear that negative perceptions of job nature and/or environment lead to a greater risk of development of disorders. It may also be important to add that those participants who hold this perception may be more inclined to report a greater severity of neck and shoulder pain with the prospect that complaining about the work place may lead in some way to reward or improvement of the workplace or task.

This is in part supported by the findings of Holmström et al. (1992) and Siivola et al. (2004) where psychosomatic symptoms were reported as prominent risk factors associated with neck and shoulder trouble.

5.4.3. Workstation set-up as a factor associated with neck and shoulder pain

a. Overall workstation score (Figure and Table 4.9.1.1)

In this study, the workstation score was normally distributed with a mean of 10.6 and a standard deviation of 2.36. It could thus be argued that this indicates that the majority of workstations are in need of rectification. These findings are similar to Owens and Patterson (2000) where a similar observational workstation scoring method was used. Using an overall score of 12 to represent the worst possible set-up, these authors found the mean score to be 5. The present study's finding of 10.6 out of a total of 25 is comparable. These findings illustrate the need for postural, educational and workstation design intervention.

b. Specific workstation component observational trends

Common trends observed as incorrect for both laptop and desktop users were noted the results of these are tabulated in table 4.6.1.

Many of the workstations were adjusted incorrectly for keyboard and mouse height, that is the keyboard or mouse were too high according to standards recommended by more recent texts (Kroemer and Kroemer 2001:82 and Tayyari and Smith, 1997:371). In keeping with this, it was noted that many of the users' arms were too high whilst keying (that is shoulders/arms were not relaxed) and that this may in turn result in shortening of the trapezius muscle for sustained periods, leading to muscular discomfort (Travell and Simons', 1999).

It was also noted that the majority of subjects did not use wrist rests. These devices are commonly used to prevent the development of Carpal Tunnel Syndrome (CTS) and other discomforts in the hand/wrist/forearm regions (Kroemer and Kroemer 2001:111-113). Although these are not directly related to neck/shoulder disorders, such ergonomic devices are recommended to facilitate comfort whilst computing. It is therefore still important to note that in this study the majority of computer users did not have access to wrist rests.

Another component that appeared to be in need of ergonomic intervention were the chairs. Although they appeared to comply with current ergonomic standards, many of them had lost their ability to be adjusted suitably for different individuals. Backrests lacked adjustability and armrests were often absent and did not provide facility for adjustment to different bodily proportions.

c. Differing trends between desktop and laptop users

The Chi-Square Test was conducted to show associations between desktop and laptop set-up (Tables 4.9.1.2.a-g).

Screen height differed between the two computer types (Chi-Square = 12.951 with p-value = 0.005). The laptop user screen was lower and therefore was marked down more as a correct height, in keeping with the literature which recommends that users should look down at the screen, i.e. a relatively greater degree of neck flexion is desirable. (Bergqvist et al., 1995:a; Ankrum and Nemeth, 2000 and Kroemer and Kroemer, 2001:101). Desktop users in this study tended to have the screen in a relatively high position. It was often placed on top of the CPU so that the user looked up to the screen inducing neck extension rather than the desired flexion. Findings in previous studies show that such high monitor placement resulted in neck discomfort (Bergqvist et al., 1995:a and Ankrum and Nemeth, 2000).

Differences between computer types were also noted for screen (Chi-Square = 12.951 with p-value = 0.005), keyboard (Chi-Square = 20.877 with p-value = 0.000) and mouse (Chi-Square = 12.161 with p-value = 0.007) distance. Such differences were attributed to compact design of the laptop i.e. components are interlinked and cannot be separated, keyboard, mouse and screen. Such lack of adjustability (Chi-Square = 7.742 with p-value = 0.005) differs from the desktop in that components are separate and can be arranged to suit the user. Laptop users scored more correctly for these components, as according to the literature, keyboard, mouse and screen should be within close proximity and accessible to the user. However this lack of adjustability in terms of the laptop does not allow for changes in component layout to suit differing body proportions. Such adjustability is recommended to allow for changes in posture (Kroemer and Kroemer, 2001:100). Therefore one of the limitations of the current study is that, although the laptop scores more correctly in terms of ergonomic standards with regard to these elements, its lack of adjustability may result in the user maintaining a fixed posture with inability to rearrange components to custom.

Szeto and Lee (2002) reported that laptop use induced a more flexed spinal posture and keyboard skills were reduced whilst operating these computers as a result of the small size of the computer. This was noted in the current study in that laptop users tended to look at the keys more frequently and assumed a more maintained upper thoracic kyphosis posture whilst operating these computers.

d. Associations between specific incorrect workstation set-up and severity of neck and shoulder pain

Tables' 4.9.2.a-k show the results of the Chi-Squared analysis of some workstation set-up components on severity of neck and shoulder pain.

d.i. Screen height and severity of neck and shoulder pain

This study did not show any association between neck pain and screen height (Chi-Square = 2.102 with p-value = 0.350). This lack of association differed from the findings of Ankrum and Nemeth (2000) where high screen placement was shown to have an effect on neck discomfort. The lack of association in this study may well be attributed to the small sample size.

d.ii. Keyboard distance and height and severity of neck and shoulder pain

No association was found for incorrect keyboard distance and height and neck and shoulder pain, contradicting the findings of Bergqvist et al. (1995:a) where incorrect keyboard height was found to have an association with severity of neck and shoulder pain. Lack of association here, too, may be related to small sample size.

d.iii. Mouse distance and height and severity of neck and shoulder pain

No association was found between mouse height and distance and severity of neck pain. However there was an association between mouse height and severity of shoulder pain (Chi-Square = 9.259 with p-value = 0.010). This would appear to concur with the findings of Bergqvist et al. (1991) where keyboard height was associated with neck and shoulder discomfort. Mouse and keyboard height would be the same and may therefore have a similar effect on the shoulder.

d.iv. Chair free motion and severity of neck and shoulder pain

The current study found association between a lack of chair adjustability and flexibility and neck and shoulder pain (Chi-Square = 10.066 with p-value = 0.007 and Chi-Square = 5.123 with p-value = 0.077 respectively). This would suggest that a lack of free motion and regular change in posture is related to the severity of neck and shoulder pain. This is in keeping with the theory that static postures contribute to the development of disorders (Holmstrom et al., 1992; Rempel et al., 1992 and Tayyari and Smith, 1997:175). This also concurs with Kroemer and Kroemer (2001:83) where the concept of free motion and the ability of the user to change and realign components to custom is recommended. These authors further state that the seat should be designed for relaxed and upright sitting, for leaning backward and forward and for getting in and out.

Many of the chairs observed in this study did not allow for adequate postural changes and lacked adjustability.

e. Other observational workstation factors

The observational checklist did not accommodate for other factors that may be important contributors to neck and shoulder disorders.

A common set-up observed was that many of the computer users were working from source documents on the desk between the user's torso and keyboard. The resulting posture was one of repetitive neck flexion when capturing information from these documents. To overcome such a set-up document holders have been used, these are placed next to the screen at eye level. However many of the participants in this study felt that these would not be useful as they were mainly working from large files for relatively short periods and these would be too bulky to place on a document holder and would constantly have to be changed. Such problems should be looked into further for solutions.

5.4.4. Psychosocial factors

a. Mean psychosocial score and severity of neck and shoulder pain

Tables 4.9.5.1.a-b and 4.9.5.2.a-b show the results of one-way ANOVA (analysis of variance) Test for the equality of means of psychosocial score for the three severity groups for neck and shoulder pain.

There does not appear to be any difference between a psychosocial score of none, severe and less severe neck pain groups for neck pain (p=0.314). However, for shoulder pain there appears to be some evidence that overall psychosocial score (p=0.067) is different for the three pain groups, although this p-value is not significant.

The results of this study correlate to the findings of Chiu et al. (2002), where psychosocial factors were shown to have a low association with severity of neck pain in university academic staff.

The findings of this study and those found by Chiu et al. (2002) differ from previous studies where poor psychosocial factors were cited as risk factors for neck pain. Kamwendo et al. (1991) and Holmström et al. (1992) reported associations between psychosocial factors and neck and shoulder pain. Pietri-Taleb et al. (1994) conclude in their study on the role of personality characteristics and psychological distress in neck trouble among workingmen, that aside form occupation, the most prominent factors associated with the occurrence of neck trouble were psychological.

Chiu et al. (2002) suggest that the reasons for low correlation in their study may be attributed to the fact that a large portion of subjects tended to choose the middle range of score (score 2 and 3) and that the narrow range of score (1-4) may limit the choice of subjects. Small sample size was also cited as a possible limitation. The limitations of the current study are comparable to this, as scoring and sample size were similar. Although correlation was found to be low in these studies a “good” psychosocial environment is still recommended.

b. The role of three specific psychosocial factors on severity of neck and shoulder pain.

This study further set out to define the role of certain psychosocial factors in the development of work related neck and shoulder disorders. Specific factors were drawn from the literature in relation to their emphasis in previous studies as follows;

Lack of appraisal from superiors and lack of job control have been shown to have a significant association on neck and shoulder pain (Kamwendo et al., 1991). Carayon (1993) found a similar relationship with regard to lack of job control, but also emphasise the importance of career and future concerns as being a noteworthy contributor to these disorders. Ariëns et al. (2001) reported associations with regard to high quantitative job demands but also found low co-worker support to play a significant role.

The results of some specific psychosocial factors on the severity of neck and shoulder pain are shown in table 4.9.5.3.b. The only significant association found in this study was that of having too much to do and shoulder pain (p=0.025). Ariens et al. (2001) establish a similar association in a study of high quantitative job demands and low co-worker support as risk factors for neck pain.

No association was found in the present study with regard to the ability to influence one's working conditions as found by Kamwendo et al. (1991) and Carayon (1993) or the influence of future change and reorganisation as established by Carayon (1993).

c. Overall psychosocial working environment score (Table 4.9.5.4)

Overall psychosocial score was calculated according to the classification defined by Kamwendo et al. (1991) and Chiu et al. (2002). In this study only 30% of subjects scored in what was classified as a good psychosocial environment, the remainder fell into the poor psychosocial category. Although the results of this study did not find any association between neck and shoulder disorders, there should be further improvement within this corporation in terms of workload, job demands, job satisfaction and control over work (Chiu et al., 2002).

It is also important to note that in this study that many of the participants (60.4%) felt anxious about their working situation being changed by reorganisation.

There was considerable anxiety over job security due to the fact that this corporation was undergoing organisational changes and restructuring. Many of those interviewed were in the process of being retrenched or were unsure if they were to lose their jobs in the near future. Although we did not find this factor to be associated with neck/shoulder pain directly, it is none the less to be considered as a potential contributor to the high proportion of subjects with neck and shoulder complaints.

It is also interesting that many of the subjects, when asked whether they had neck pain previously or currently replied with the answer “what do you mean; stress?” It would appear from such a reply that some people associate stress and neck pain as being one in the same thing. Chiu et al. (2002) reported that university academic staff perceived stress to be an important contributor to neck pain.

5.5. Disability associated with neck and shoulder pain (Figures 4.4.a-b)

Figure 4.4.a depicts the effect of neck pain on daily functional activity at leisure and in the workplace. The reduction in activity at work and leisure, 23.30% and 28.33% of subjects respectively, are comparable. However it is interesting to note that more people tend to reduce leisure time as a result of neck pain.

Participants were also asked whether neck pain had prevented them from doing their normal work. 13.5% (15/111) reported that they had been off from work between 1 and 7 days in the last 12 months and only one person (1/111) reported having taken between 8 and 30 days off.

With regard to shoulder pain (Figure 4.4.b) 20.69% of subjects reported that shoulder pain reduced their activity at work, however, 41.37% (nearly twice as many) reported a reduction in leisure activity. Leisure activity may be reduced more because there is a choice. Only 5.4% (6/111) of subjects reported that they were absent from work for 1 to 7 days, and 1.8% (2/111) reported having been off work for 8 to 30 days.

The findings of this study are comparable to those of Holmström et al. (1992), where according to their definition considerable neck and shoulder pain was experienced in 12% of construction workers: that is, these subjects had to take time off work as a result of neck and shoulder discomfort.

Neck pain appears to have a more constant debilitating effect at work and at leisure; it would also appear to have a greater effect on productivity and absenteeism in the work place. The effect of shoulder pain does not appear to limit activity in the workplace, although those that report shoulder pain seem to limit their activity to a greater extent when at leisure. These results would indicate that neck pain is more debilitating than shoulder pain. These results are similar to those reported by Kamwendo et al. (1991) where neck and shoulder pain had prevented daily activity at home and at leisure in 13% of subjects.

Other studies do not define limitation of activity as clearly. Disability as a result of neck and shoulder pain should be investigated and clarified further.

5.6. Relationship between neck and shoulder pain

Due to structural and functional links, neck and shoulder complaints are often reported and researched as one entity but the results of this study found that neck pain was experienced more frequently than shoulder pain, i.e. the one-year prevalence of neck pain in the sample population was 76.6%, whilst that for shoulder pain was 49.5%.

Table 4.9.6.1 shows the relationship between severity of neck and shoulder pain. The results of this study found that although shoulder pain was not experienced as often as neck pain, there is a strong association (Chi-Square=33.207 with p=0.000) between severe pain in one with the other i.e. severe pain in one region is often associated with severe pain in the other (Figure 4.9.6.2 depicts this association).

The results of this study differ in this respect from those found by Kamwendo (1991) where neck and shoulder pain prevalence were reported in almost equal percentages of 63% and 62% respectively.

Bergqvist et al. (1995:a) and Owens and Patterson (2000) reported neck and shoulder disorders as a combined entity (neck/shoulder pain) from subjective questionnaire findings. However Bergqvist et al. (1995:a) differentiated neck from shoulder disorders objectively where subjects were diagnosed professionally as having Tension Neck Syndrome (TNS), cervical disorders and shoulder disorders. Although the overall prevalence for these disorders was much lower than in the current study, the results were comparable in that shoulder disorders as a separate entity were diagnosed considerably less than TNS and cervical disorders.

Although findings differ between studies it would appear that neck pain is experienced more frequently than shoulder pain. It is also evident that there are strong links between the two regions as those that experience intense or severe discomfort in one region often experience severe discomfort in the other.

5.7. Limitations of this study

Questionnaires were completed part in interview and part self-administered format. This may be viewed as problematic because this type of data collection may lead to bias on the part of the researcher that is information that the researcher was trying to extract from the participants. However, this collection process enabled questionnaires to be completed fully and accurately and within time limits given to the researcher.

The questionnaire was designed to cover a broad range of issues and factors related to neck and shoulder disorders. To investigate certain factors more comprehensively further questioning and more objectively defined options could have produced more definitive conclusions.

The observation method and check list used could also be viewed as limited as, once again, many factors were taken into consideration during this process and the method of capturing information was on the basis of a simplified scoring method that may not have objectively captured the relevant information. Scoring was conducted by the researcher, and this too may have introduced bias into the study.

Another limitation of this study was the method of sampling, that is, the sample was unstratified in terms of age, gender and ethnic group, this making conclusion from statistical analysis difficult regarding these demographic characteristics.

The cross-sectional design of this study makes it susceptible to survivor bias, that is the study assessed prevalent rather than incident cases i.e. it did not take into account the people that may have left the job as a result of neck/shoulder disorders. This is also known as the “healthy worker effect” whereby the study only takes into account those that are still able to work (Bergqvist et al., 1995:b).

Another limitation of cross sectional research is that risk factors and outcome are measured at the same time. This results in difficulty distinguishing cause and effect. Causal relationships are therefore hard to establish (Ariëns et al., 2001).

Although this study does give some indication of the disability related to neck and shoulder disorders, the results are largely based on subjective interpretations of related pain and disability. More objective review of symptoms should be evaluated by clinical assessment, as in other studies (Bergqvist et al., 1995:b and Gerr et al., 2000).

In all, this study may have set out to achieve too much and in so doing the role of important and influential factors may not have become clear. There are many issues and factors that need to be considered and this makes the research process difficult in defining the more important factors.

5.8. Conclusion

The results of this study as discussed in this chapter illustrate the nature and complexity of factors involved in the development of work related musculoskeletal disorders. Integration of these findings with other related studies support the multifactorial approach to disorder manifestation. The effect of individual, working and psychosocial factors are reiterated here. The findings of this study show that these disorders have an effect on working productivity and absenteeism within the selected working environment.

Lack of effect of some of the more established risks may well be due to sample size. Overall study conclusions and recommendations follow in chapter six.

Chapter 6- Conclusions and Recommendations

6.0. Introduction

This chapter will highlight the principal findings of this study and how they related to the greater body of literature. Recommendations will be made according to these findings so that future research can develop better ways of establishing causality and intervention strategies within this field.

6.1. Conclusions

The lifetime incidence of neck pain in the selected population (financial management/advisory staffs) was 80.2%; this is higher than the findings of studies of neck pain in the general population. The one-year prevalence of neck and shoulder pain was 77% and 49% with a point prevalence of 39% and 23% respectively. These high percentages are generally in keeping with the findings of previous research that showing the prevalence of neck and shoulder disorders to be high in computer users. It was noted that neck pain was experienced more than shoulder pain, which differs from other studies where neck and shoulder pain were reported almost equally. Constant neck and shoulder pain was experienced 5.5% and 4.5% of participants.

The findings of this study suggest that neck pain has a more debilitating effect than shoulder pain, more respondents reported reducing activity at leisure than at work for both neck and shoulder pain. It was interesting to note that many more of those who reported shoulder pain felt that it had more of an effect on leisure activity. Neck pain had a greater effect on absenteeism in the workplace: 13.5% reported having taken up to 7 days off in the last year. Shoulder pain did not appear to have as great an impact on productivity and absenteeism in the workplace. In keeping with these differences, neck pain was experienced more frequently than shoulder pain with 34.3% and 20.7% experiencing pain greater than 30 days in the last year. Although shoulder pain was reported less than neck pain, a clear association between the severity of neck and shoulder pain was established i.e. severe pain in one region was associated with severe pain in the other region. Further investigation is warranted to determine the functional and developmental links between the two regions.

Level of care seeking was generally low for neck and shoulder complaints. Of those reporting neck and shoulder pain, 52.8% and 46.6% respectively consulted a health care practitioner. Those that did receive treatment consulted mainly physiotherapists and chiropractors followed by pharmacists, massage therapists and general practitioners, 2.3% of consultations were to orthopaedic and neurosurgeons.

This study found distinct differences in prevalence of neck and shoulder pain between gender, females reported neck and shoulder pain more than males. Gender (being female) was associated with severity of shoulder pain, although this association was not found for neck pain severity. The results of this study generally support the greater body of literature that reports gender as a risk factor for neck and shoulder pain. Further investigation is warranted to determine aetiological differences between genders and areas of investigation should focus on biological, social and cultural and activity based models. Age was not associated with severity of neck and shoulder disorders and this finding differed from the results established by many other authors who reported this association. Smoking was not associated with neck and shoulder pain and this finding is in keeping with some of the literature. There still however appears to be some conflict in this area and this advocates the need for further investigation. Exercise in this study was not shown to be preventative in symptom development, which generally contradicts the findings of other studies.

Subjects who claimed to be skilled typists were associated with a greater severity of neck pain and this finding partially contradicts the literature that states that repetitive neck flexion to find the keys whilst typing may result in a greater degree of neck discomfort. Contrary to this, but still in keeping with the literature, static postures, (as would be the case when subjects type continuously without looking at keys) result in facilitation and development of musculoskeletal disorders. Further investigation is warranted to determine the role of static posture and repetitive movement in development and progression of disorders.

Overall psychosocial working environment score was not associated with neck pain, although there did appear to be a weak association with shoulder pain. However, as a single factor, high quantitative job demands were associated with shoulder disorders. No association was found between lack of job control, lack of appraisal from superiors and career and future concerns and neck and shoulder pain. The role of psychosocial factors as contributors to work related musculoskeletal disorders is well established, and although this study did not find strong evidence in this area, the role of these factors is still supported.

The observational component of this study found that many of the participant workstations and postures were in need of rectification. That is, the mean workstation/posture score of 10.6 incorrect set-ups out of a total of 25 per workstation indicates the need for improvement (intervention in the form of workstation layout and postural advice is necessary).

Individual workstation components associated with the severity of neck and shoulder pain were mouse height and shoulder pain, and chair flexibility was associated with both neck and shoulder pain. No association was found for keyboard distance and height, mouse distance and screen height. Although the current study did not establish these associations, it was noted that many of the computer users had an incorrect set-up with regard to these factors. Further investigation is warranted into these areas to determine their role in the development of disorders.

This study also demonstrated the difference between desktop and laptop set-up, but did not show any association between computer type and neck and shoulder pain. It was interesting to note that the laptop generally scored better in terms of ergonomic standards as compared to the desktop. Although this was found to be the case, it should also be noted that the laptop induced a more flexed spinal posture and subjects tended to look at the keys more whilst using this machine. Such habits may not be advantageous in the use of these machines. This area is still unclear and should be further investigated.

6.2. Recommendations

- The sampling technique in this study may not fully represent the subject/participant population. Future studies should use a stratified random sampling technique.

- This study utilised one corporate banking environment to collect the data; other studies should select participants from various different sites in order to more effectively establish findings of this study.

- Future studies should be conducted with much larger sample sizes to determine clear associations and draw more definitive conclusions.

- Comparisons in the findings of this study and future studies should be conducted; it is thus important that they be of similar design and utilise the similar objective measurement tools. Definitions of incidence, prevalence and severity according to this study should be the same in future studies. This will facilitate valid and more compatible results.

- Gender as a risk factor for neck and shoulder disorders should be investigated to determine pathophysiological/biomechanical/sociocultural/psychosocial differences.

- Future studies should focus on more defined areas of the working environment, such as the workstation set-up and posture and more objective measurement tools should be utilised such as video or still photography in order to more accurately measure distances, angles and patterns of work.

- Further investigation is warranted to determine the effect of psychosocial factors as well as employee related health concerns and perceptions.

- It is recommended that future investigation should focus on the aetiological links and associations between neck and shoulder regions. The results of this study suggest that neck pain is more common than shoulder pain, but also establish the association between the two regions in terms of severity; therefore the question is raised as to what causes pain in both regions as opposed to only one region.

- Further research is warranted to establish intervention strategies, such as postural and ergonomic advice. This will ultimately aid in the development and progression of disorders.

- Longitudinal study designs should be conducted to determine the role of the healthy worker effect i.e. studies should be conducted over years to monitor the effect of employees changing jobs as a result of these disorders.

- The disability associated with neck and shoulder disorders should be further investigated in order to determine its economic and health care impact.

- The lack of general population surveys with regard to neck and shoulder disorders within the local context is critical and will give greater understanding in terms of comparison to work related studies such as this one.

6.3. Summary and conclusive remarks

In summary, non-secretarial computer users (financial management/advisory staffs) are a high risk group for job related neck and shoulder pain, supporting the findings of previous research that has consistently found a high incidence of neck and shoulder disorders in computer users.

The findings of this study maintain the role of a multidimensional approach to work related musculoskeletal disorders of the neck and shoulder. The role individual factors, work related health perceptions, psychosocial factors, computer skills and workstation set-up and design are supported by this study. Work-related factors such as length of employment, working hours, rest/break opportunities and computer type were not associated with neck and shoulder pain as established in other studies.

Although high percentages reported experiencing pain, many did not appear to be functionally disabled as a result. However there are clear signs that in a substantial number of cases pain resulted in decreased activity both at home and in the workplace, with some subjects reporting that they took time off work as a result of pain and discomfort. These findings are noteworthy as they portray a picture not only in terms of the disability associated with musculoskeletal disorders but must also raise some concern for the effect they have on productivity and employee wellness within organisations such as the one in this study. If one were to assume that pain or discomfort are a precursor to more serious injury, then the high prevalence and reporting of pain should be taken seriously.

Intervention strategies in the form of education programmes, which focus on postural advice, correct work habits; wellness and workstation design should be integrated into large organisations to improve employee satisfaction and well being in the workplace.

This ultimately will result in greater productivity and efficiency i.e. employee wellness. Whilst conducting this survey, the researcher found that many of the subjects interviewed felt that it would be of great benefit to incorporate services such as chiropractic, massage and physiotherapy practice into the structure of the corporation. The pressure of modern lifestyle generally does not allow for time for consultations away from the workplace, therefore integration of health care practice into working organisations would be greatly beneficial.

References

Andersen, J, Kaergaard, A, Frost, P, Thomsen, J, Bonde, J, Fallentin, N, Borg, V, and Mikkelsen, S. 2002. Physical, psychosocial, and individual risk factors for neck and shoulder pain with pressure tenderness in the muscles among workers performing monotonous, repetitive work. Spine. **27**:660-667

Ankrum, D, Hansen, E and Nemeth, K. 1995. The vertical horopter and the angle of view. Work With Display Units 94. Elsevier Science: 131-136.

a) Ariëns, G, Bongers, P, Hoogendoorn, W, Houtman, I, van der Wal, G and van Mechelen, W. 2001. High quantitative job demands and low coworker support as risk factors for neck pain. Spine. **26**: 1896-1903.

b) Ariëns, G, van Mechelen, W, Bongers, P, Bouter , L, and van der Wal, G. 2001. Psychosocial risk factors for neck pain: a systematic review. American Journal of Industrial Medicine. **39**: 180-193.

Armstrong, T, Buckle, P, Fine, L, Hagberg, M, Jonsson, B, Kilbom, A, Kourinka, I, Silverstein, B, Sjogaard, G and Viikari-Juntura, E. 1993. A conceptual model for work-related neck and upper-limb musculoskeletal disorders. Scandinavian Journal of Work and Environmental Health. **19**(2):73-84.

Ashton-Miller, J. 1999. Response of muscle and tendon to injury and overuse. Work-Related Musculoskeletal Disorders: Report, Workshop Summary, and Workshop Papers. http://www.nap.edu/openbook/0309063973/html/73/html, The National Academy of Sciences.

Barnekow-Berkvist, M, Hedberg, GE, Janlert, U and Jansson, E. 1998. Determinants of self reported neck-shoulder and lower back symptoms in a general population. Spine. **23**(2): 235-243.

Bennet, J. 2004. Personal communication. Industrial psychologist. BOE corporate. Durban.

a) Bergqvist, U, Wolgast, E, Nilsson, B and Voss, M. 1995. Musculoskeletal disorders among visual display terminal workers: individual, ergonomic, and work organisational factors. Ergonomics. **38**(4): 763-776.

b) Bergqvist, U, Wolgast, E, Nilsson, B and Voss, M. 1995. The influence of VDT work on musculoskeletal disorders. Ergonomics. **36**(4): 754-762.

Bernard R.H., 2000. Social Research Methods. California:Sage.

Bland, J. 1994. Disorders of the Cervical Spine-Diagnosis and Medical Management. 2nd Edition. Philadelphia: W.B. Saunders Company.

Bovim, G, Schrader, H, and Sand, T. 1994. Neck pain in the general population. Spine. **19**(12): 1307-1309.

Carayon, P.1993. Job design and job stress in office workers. Ergonomics. **36**(5): 463-477.

Cats-Baril, W and Frymoyer, J.1991. The economics of spinal disorders. The Adult Spine .7. P.85-104. Frymoyer, J. Ed., New York: Raven Press.

Chiu, T, Ku, W, Lee, M, Sum, W, Wan, M, Wong, C and Yuen, C. 2002. A study on the prevalence of and risk factors for neck pain among university academic staff in Hong Kong. Journal of Occupational Rehabilitation. **12**(2): 77-91.

Côté, P, Cassidy, D and Carroll, L. 1998. The Saskatchewan health and back pain survey. The Prevalence of neck pain and related disability in Saskatchewan adults. Spine. **23**(15): 1689-1698.

Dainoff, M. 1999. Ergonomics of seating and chairs. The Occupational Ergonomics Handbook 97. P.1761-1778. Karwowski, W, Marras, W. Eds., USA: CRC Press. 2065p.

Dong-Chul, S, Blair, E. 2003. Ergonomics rulemaking: Dissecting OSHA's cost benefit analysis offers insight for future rulemaking. Professional Safety. **48**(4): 37-43.

Drews, E.R. 1995. A Study of Demographic and Epidemiologial Factors of Private Chiropractic Practices and a Chiropractic Teaching Clinic. M. Dip. C. Dissertation, Technikon Natal, Durban

Evans, O and Patterson, K. 2000. Predictors of neck and shoulder complaints in non-secretarial computer users. International Journal of Industrial Ergonomics. **26**(3): 357-365.

Fredriksson, K, Alfredsson, L, Bildt, C, Thorbjörnsson, Punnett, L, Toomingas, A, Torgén, M, and Kilbom, A. 2000. Risk factors for neck and shoulder disorders: a nested case-control study covering a 24-year period. American Journal of Industrial Medicine. **38**: 516-528.

Gerr, F, Marcus, M, Ensor, C, Kleinbaum, D, Cohen, S, Edwards, A, Gentry, E, Ortiz, D, Monteilh, C. 2002. A prospective study of computer users: I. Study design and incidence of musculoskeletal symptoms and disorders. American Journal of Industrial Medicine. **41**: 221-235.

Greico, A and Molteni, G. 1999. Seating and posture in VDT work. The Occupational Ergonomics Handbook 98. P.1779-1791. Karwowski, W, Marras, W. Eds., USA: CRC Press. 2065p.

Hasvold, T and Johnsen, R. 1993. Headache and neck or shoulder pain - frequent and disabling complaints in the general population. Scandinavian Journal of Primary Health Care. **11**: 219-224.

Hill, J, Lewis, M, Papageorgiou, A, Dziedzic, K and Croft, P. 2004. Predicting persistent neck pain: a one-year follow-up of a population cohort. Spine. **29**(15): 1648-1654.

Holmström, E, Lindell, J and Moritz, U. 1992. Low back and neck/shoulder pain in construction workers: occupational workload and psychosocial risk factors. Part 2: relationship to neck and shoulder pain. Spine. **17**(6): 672-677.

James, C, Harburn, K and Kramer, J. 1997. Cumulative trauma disorders in the upper extremities: reliability of the postural and repetitive risk factors index. Archives of Physical Medicine and Rehabilitation. **78**: 860-865.

Krause, N, Ragland, D, Greiner, B, Fisher, J, Holman, B and Selvin, S. 1997. Physical workload and ergonomic factors associated with prevalence of back and neck pain in urban transit operators. Spine. **22**(18): 2117-2127.

Kroemer, H and Kroemer, A. 2001. Office Ergonomics. New York: Taylor and Francis Group.

Kuorinka, I, Jonsson, B, Kilbom, A, Vinterberg, H, Biering-Sorensen, F, Andersson, G and Jorgensen, K. 1987. Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. Applied Ergonomics. **18**(3): 233-237.

Lau, EMC, Sham, A and Wong, K. 1996. The prevalence of and risk factors for neck pain in Hong Kong Chinese. Journal of Public Health Medicine. **18**(4): 396-399.

Leboeuf Yde, C, Yashin, A and Lauritzen, T. 1996. Does smoking cause lower back pain? Results from a population based study. Journal of Manipulative and Physiological Therapeutics. **19**(2): 99-108.

Lee, P. 1994. The economic impact of musculoskeletal disorders. Quality of Life Research. **3**(1): S85-S91.

Mäkelä, M, Heliövaara, M, Sievers, K, Impivaara, O, Knekt, P and Aromaa, A. 1991. Prevalence, determinants, and consequences of chronic neck pain in Finland. American Journal of Epidemiology. **134**(11): 1356-1367.

Palmer, K, Cooper, C, Walker-Bone, K, Syddall, H and Coggon, D. 2001. Use of keyboards and symptoms in the neck and upper arm: evidence from a national survey. Occupational Medicine. **51**(6): 392-395.

Pietri-Taleb, F, Riihimaki, H, Viikan-Juntura, E and Lindstrom, K. 1994. Longitudinal study on the role of personality characteristics and psychological distress in neck trouble among working men. Pain. **58**:261-267.

Rempel, D, Harrison, R and Barnhart, S. 1992. Work related cumulative trauma disorders of the upper extremity . Journal of the American Medical Association. **267**: 838-842.

Sauter, S, Schleifer, L, Knutson, S. 1991. Work posture, workstation design, and musculoskeletal discomfort in a VDT data entry task. Human Factors. **33**(2): 151-167.

Siivola, S, Levoska, S, Latvala, K, Hoskio, E, Vanharanta, H, Keinänen-Kiukaanniemi, S. 2004. Predictive factors for neck and shoulder pain: a longitudinal study in young adults. Spine. **29**(15): 1662-1669.

Sommer, B and Sommer, R. 1997. A Practical Guide to Behavioural Research. New York: Oxford University Press.

SPSS (version 11.5) SPSS Inc, 444N. Michigan Avenue, Chicago, Illinois, USA

Street, S, Kramer, J, Harburn, K, Hansen, R, MacDermid, J. 2003. Changes in postural risk and general health associated with a participatory ergonomics education programme used by heavy video display terminal users: A pilot study. Journal of Hand therapy. **16**(1): 1-13.

Szeto, G and Lee, R. 2002. An ergonomic evaluation comparing desktop, notebook, and subnotebook computers. Archives of Physical Medicine and Rehabilitation. **83**: 527-532.

Tayyari, F, Smith, J. 1997. Occupational Ergonomics: Principles and Applications. Volume 3: Manufacturing Systems Engineering Series. London. Kluwer Academic Publishers. 452p.

Travell, J, Simons, G, Simons, J. 1999. Myofascial Pain and Dysfunction: The Trigger Point Manual. 2nd Edition. Volume 1. Baltimore. Lippincott Williams & Wilkins.

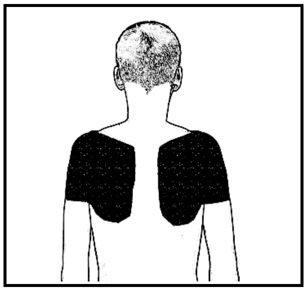
Viikan-Juntura, ERA. 1997. The scientific basis for making guidelines and standards to prevent work related musculoskeletal disorders. Ergonomics. **40**(10): 1097-1117.

Viikan-Juntura, E. 1999. Occupational risk factors for shoulder disorders. The Occupational Ergonomics Handbook 45. P.833-849. Karwowski, W, Marras, W. Eds., USA: CRC Press. 2065p.

Wells, R. 1999. The integrated analysis of upper extremity disorders. The Occupational Ergonomics Handbook 43. P.775-794. Karwowski, W, Marras, W. Eds., USA: CRC Press. 2065p.

Winkel, J and Westgaard, R. 1992. Occupational and individual risk factors for shoulder-neck complaints: Part II-The scientific basis (literature review) for the guide. International Journal of Industrial Ergonomics. **10**:85-104

Section 5: SHOULDER HISTORY



SHOULDER.
How to answer thequestionnaire:
By **Shoulder trouble** this is meant as **ache**, **pain** or **discomfort** as per the **shaded area** in the diagram. Please concentrate on this area, ignoring any trouble you may have in adjacent parts of the body.There is a separate questionaaire for neck trouble. Please answer by putting a cross in **the appropriate box. One cross** for each question. You maybe in doubt as to how to answer but please do your best anyway.

24) Have you **ever** had any **shoulder trouble** (**ache, pain or discomfort**)?

Yes	[01]	
No	[02]	

If you have answered NO to question 24., do not answer 25 to 33.

25) Do you have **shoulder trouble** (**ache, pain or discomfort**) **now**?

Yes	[01]	
No	[02]	

If YES to 25, then:
On a scale of 0-10 please rate the severity **of your neck pain now?**

0 ______________________________ **10**

25i) **0** represents **no pain** at all.
10 represents the **worst pain imaginable**.

26) Have you been **diagnosed** by a health care professional for condition which you think may contribute to shoulder pain?

Yes	[01]	
No	[02]	

If **yes** to the above **(26)**, then:
26i) What is this condition?
26ii) How long have you been diagnosed with this condition: ______ Years ______ Months

27) Have you **ever** had to change **jobs** / **duties** because of **shoulder trouble?**

Yes	[01]	
No	[02]	

28) Have you had s**houlder trouble** during the last **12 months**?

No	[01]	
Yes in my RIGHT shoulder	[02]	
Yes in my LEFT shoulder	[03]	
Yes in BOTH shoulders	[04]	

If you have answered no to question 28., do not answer questions 29 to 33.

29) What is the **total** length of time you have had **shoulder trouble** during the **last 12 months**?

0 days	[01]	
1 - 7 days	[02]	
8 - 30 days	[03]	
More than 30 days but not every day	[04]	
Every day	[05]	

30) Has **shoulder trouble** caused you to **reduce** your activity during the **last 12 months**?

30i) Work activity (at home or away from home)?

Yes	[01]	
No	[02]	

30ii) Leisure activity?

Yes	[01]	
No	[02]	

31) What is the **total** length of time that **shoulder trouble** has prevented you from doing your normal work during the **last 12 months**.

0 days	[01]	
1 - 7 days	[02]	
8 - 30 days	[03]	
More than 30 days	[04]	

32) Have you had **shoulder trouble** at any time in the **last 7 days**?

Yes	[01]	
No	[02]	

33) Have you received any **treatment** for your **shoulder trouble**?

Yes	[01]	
No	[02]	

If YES to 33: Where have you received **treatment** for **shoulder trouble**?

Acupuncturist	[01]		Neurosurgoen	[09]	
Ayruveda	[02]		Orthopaedic	[10]	
Biokinetisist	[03]		Pharmacist	[11]	
Chiropractor	[04]		Physiotherapist	[12]	
General practitioner	[05]		Reflexologist	[13]	
Homoeopath	[06]		State Hospital	[14]	
Masseuse	[07]		Traditional Healer	[15]	
Neurologist	[08]		Other	[16]	

Observation Template **APPENDIX B**

POSTURAL FACTORS	Subject moves around (does not keep fixed posture)		
	Repetitive neck flexion (looking at keys)		
	Excessive maintained upper thoracic kyphosis		
	Subject looks relaxed generally		
	Shoulders arms relaxed whilst keying (arms too high/low)		
OTHER	General work station organization		
	Flexibility of work station (subject can move/ realign/change components to custom)		
	Air-conditioned environment: position of vent in relation to user.		
	SCORE		
Notes:			

Observation Template **APPENDIX B**

Observation check list		**Correct**	**Incorrect**
SCREEN	Directly behind keyboard		
	Low position/ user looks slightly down to screen		
	Distance (0.5m approx/arms length)		
KEYBOARD	Directly infront of screen		
	Distance (10-40cm from torso)		
	Height (approx. elbow height, shoulders relaxed)		
	Wrist support		
MOUSE	Distance (10-40cm from torso)		
	Height (approx. elbow height, shoulders relaxed)		
	Close to keyboard (accessibility)		
SEAT	Height (37-51cm, allows feet rest comfort 90 @ knee)		
	Depth (38-42cm)		
	Back rest curvature contour present (lumbar thoracic cervical)		
	Overall maneuverability (allows free motion)		
	Back rest inclination (adjustable 95-120°)		
	Use of back rest		
	Arm rests (support-elbows)		

APPENDIX C

Letter of information for focus group 15/04/2004

Thank you for making it here today

The title of my research project is:

An observer-based investigation into the contributing factors associated with work related musculoskeletal disorders of the neck and shoulder in non-secretarial computer users.

The Purpose of the study
My study will involve 100+ financial advisory and banking administrative staff working for the same corporate, the purpose of which is to **determine those factors that play an influential role in the development of work related musculoskeletal disorders, particularly of the neck and shoulder region.**

The study will be divided into two parts:
1). Employees of the corporate under study will be required to **complete a questionnaire**, in interview format by the researcher.
2). The researcher will **observe employees in their environment** to ascertain patterns of working posture, and workstation set-up and organisation.

The **purpose if this meeting** is to **validate the questionnaire** that is to be used in the study. The Majority of the questions used have been extracted from ergonomic studies overseas, however the purpose of this group is to **adapt the questionnaire to suit the environment** under which the study is to be conducted. (Corporate-banking environment).
Your participation is much appreciated and it is assured that your comments and contributions will remain confidential. You are at any point permitted to disagree, however if this is the case, please give your reasons for this, as it will assist in the research process. The results of this focus group will only be used for research purposes.

The material discussed in this meeting must be kept confidential.

The Questionnaire that will be validated today is made up of five sections:

- **Employee Demographics**:
- **Working History**:
- **Working Environment**:
- **Psychosocial Factors**:
- **Neck and Shoulder Pain History**:

Please note: there are quite a few questions to get through.

Thank you again for your time and interest in my study!

Nigel Peek

APPENDIX D

Focus Group

Informed Consent

Date: 2004-02-22

Title of research project: An investigation into the contributing factors associated with work related musculoskeletal disorders of the neck and shoulder in non-secretarial computer users in a selected corporate banking environment

Name of supervisor: Dr. C. Myburgh (031-2042923)

Name of Research Student: Nigel Peek (031-2042205)

Name of Institution: Durban Institute of Technology

Please circle the appropriate answer:

1. Have you read the participant information sheet? YES/NO
2. Have you had opportunity to ask questions regarding this study? YES/NO
3. Have you received satisfactory answers to your questions? YES/NO
4. Have you had an opportunity to discuss this study? YES/NO
5. Have you received enough information about this study? YES/NO
6. To whom have you spoken regarding this study? ________________________
7. Do you understand the implications of your involvement in this study? YES/NO
8. Do you understand that you are free to withdraw from this study at any time without having to give a reason, and without affecting your future health care? YES/NO
9. Do you agree to voluntarily participate in this study? YES/NO

IF YOU HAVE ANSWERED NO TO ANY OF THE ABOVE, PLEASE OBTAIN THE NECESSARY INFORMATION FROM THE RESEARCHER AND / OR SUPERVISOR BEFORE SIGNING. THANK YOU.

RESEARCH STUDENT: Name______________________. Signature________________.
(block letters)

PLEASE PRINT IN BLOCK LETTERS

Name:	Signature.	Occupation.	Contact no.
1.			
2.			
3.			
4.			
5.			
6.			

APPENDIX E

CONFIDENTIALITY STATEMENT
This form needs to be completed by every member of the focus group prior to commencement of the focus group meeting.

Declaration

As a member of this committee I agree to abide by the following conditions:

1. All information contained in the research documents and any information discussed during the focus group meeting will be kept private and confidential. This is especially binding to any information that may identify any of the participants in the research process.

2. The patient files have already been coded and will be kept anonymous, no identification of isolated patient cases will be allowed in the focus group.

3. None of the information shall be communicated to any other individual or organization outside the specific focus group as to the decisions of the focus group.

4. The information of this focus group will be made public in terms of a journal publication, which will in no way identify any participants of this research.

Once this form has been read and agreed to, please fill in the appropriated information on the attached sheet and sign to acknowledge agreement.

Code of Conduct

1. All information contained in the research documents and any information discussed during the focus group meeting will be kept private and confidential. This is especially binding to any information that may identify any of the participants in the research process.

2. None of the information shall be communicated to any other individual or organization outside the specific focus group as to the decisions of the focus group.

3. The information of this focus group will be made public in terms of a journal publication, which will in no way identify any participants of this research.

	Member's full name	**Occupation**	**Signature**	**Contact details**
1				
2				
3				
4				
5				
6				

APPENDIX F

LETTER OF INFORMATION

Dear Participant,

Welcome to my study. Thank you for your interest.

The title of my research project is: An observer-based investigation into the contributing factors associated with work related musculoskeletal disorders of the neck and shoulder in non-secretarial computer users.

Name of supervisor: **Dr. C. Myburgh(031-2042923)**
Name of Research Student: **Nigel Peek (031-2042205)**
Name of Institution: **Durban Institute of Technology**

The Purpose of the study
My study will involve 100 financial advisory and banking administrative staff working for the same corporate, the purpose of which is to **determine those factors that play an influential role in the development of work related muscular and skeletal disorders, particularly of the neck and shoulder region.**

Procedure
You will be asked to **complete a questionnaire** about your working environment and health- related concerns. The average amount of time required to complete the questionnaire will be **15-20 minutes.**

You may also be asked to participate in an **observation**, but this will be entirely **voluntary**. It will involve a short observation (a maximum of 30 minutes) of you in your working environment. I will try to interfere as little as possible with your work routine.

My research will **not focus on individual cases** but aims at **exposing general trends**. Please be assured that your **personal particulars will remain anonymous** in both the questionnaire and my observation.

Benefits:
The results of this study will be put forward to the human resources department and management of your corporate. Your participation will help **in highlighting the extent of work-related disorders in your field of work**, and this will ultimately assist your firm in **developing new ways of preventing these problems**, and creating a safer and more comfortable environment for you.

Confidentiality:
All the information obtained from the questionnaire will be dealt with only by my supervisor and myself in order to produce the relevant results. This information will then be destroyed.

Remuneration:

Participation in this study will be entirely voluntary. You are free to leave the research at any time.

If you need to discuss any further matters, please feel free to contact my supervisor (**Dr C. Myburgh** on **2043923**) Or **Mr Vikesh Singh** at the Faculty of Health Sciences (Durban Institute of Technology), research and ethics committee on **2042701**

Thank you very much for your participation and co-operation.

Yours Sincerely

Nigel Peek Dr. C. Myburgh
(Chiropractic Intern) (Supervisor)

APPENDIX G

Informed Consent

Date: 2004-02-22

Title of research project: An investigation into the contributing factors associated with work related musculoskeletal disorders of the neck and shoulder in non-secretarial computer users in a selected corporate banking environment

Name of supervisor: Dr. C. Myburgh (031-2042923)

Name of Research Student: Nigel Peek (031-2042205)

Name of Institution: Durban Institute of Technology

Please circle the appropriate answer:

1. Have you read the participant information sheet? YES/NO
2. Have you had opportunity to ask questions regarding this study? YES/NO
3. Have you received satisfactory answers to your questions? YES/NO
4. Have you had an opportunity to discuss this study? YES/NO
5. Have you received enough information about this study? YES/NO
6. To whom have you spoken regarding this study? **NIGEL PEEK**
7. Do you understand the implications of your involvement in this study? YES/NO
8. Do you understand that you are free to withdraw from this study at any time without having to give a reason, and without affecting your future health care? YES/NO
9. Do you agree to voluntarily participate in this study? YES/NO

IF YOU HAVE ANSWERED NO TO ANY OF THE ABOVE, PLEASE OBTAIN THE NECESSARY INFORMATION FROM THE RESEARCHER AND / OR SUPERVISOR BEFORE SIGNING. THANK YOU.

PLEASE PRINT IN BLOCK LETTERS

DATE……………………….

PARTICIPANT NAME ______________________ SIGNATURE_________________

WITNESS NAME ______________________ SIGNATURE___________________

RESEARCHER NAME _________________ SIGNATURE___________________