

**MUSCULOSKELETAL DISORDERS AND ASSOCIATED FACTORS IN
NURSES AND BANK WORKERS IN SOUTH AFRICA**

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A thesis submitted to the faculty of Health Sciences, University of Witwatersrand, in
fulfilment of the requirements for the degree of Doctor of Philosophy

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DECLARATION

I, Busisiwe Nyantumbu-Mkhize declare that this thesis is my own, unaided work. It is being submitted for the Degree of Doctor of Philosophy at the University of Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.



Signature of candidate

6th day of April 2017 in Johannesburg

DEDICATION

Omniscient

Creator of all living things

My siblings and late parents who have always been sources of inspiration

My husband Themba and family for being pillars of strength

Nyantumbu and Mkhize families for instilling

tenacity

PRESENTATIONS ARISING FROM THIS STUDY

Nyantumbu, B. Kielkowski, D. and Rees, D., 2009. Musculoskeletal disorders in nurses and bank workers in South Africa. In: *Proceedings of the 29th ICOH International Congress on Occupational Health*, Cape Town International Convention Centre, South Africa, 22-27 March, 2009.

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ABSTRACT

Background

Work has long been suspected of being involved in the genesis of musculoskeletal disorders. These disorders have been found to affect a significant proportion of the working population. Certain occupational groups across different industries are at a particular risk of musculoskeletal disorders possibly, due to the nature of their work, including nurses and bank workers. In South Africa, there is a paucity of information regarding musculoskeletal disorder risk factors in these two occupational groups. Additionally, no follow-up studies have been conducted to examine incident (new onset) and persistent pain and socio-cultural factors potentially associated with musculoskeletal pain. The research reported in this thesis was conducted in public hospital nurses and call centre bank workers.

Objectives

- To determine the 12-month prevalences and body site localisation of reported musculoskeletal disorders in South African public hospital nurses and bank workers.
- To characterise the features and consequences of prevalent musculoskeletal disorders in South African public hospital nurses and bank workers.
- To identify the risk factors associated with prevalent musculoskeletal disorders in South African public hospital nurses and bank workers.
- To determine incident and persistent musculoskeletal disorders in South African public hospital nurses.

- To identify the risk factors associated with persistent musculoskeletal disorders in South African public hospital nurses.

Methods

The study had a baseline cross-sectional component which included both nurses and bank workers and a follow-up component ranging from 11.2-13.0 months from baseline which covered nurses. The main data collection tools were the modified CUPID baseline and follow-up questionnaires which were composites of standardised and validated instruments. Since the questionnaires were written in English, the baseline questionnaire was piloted in a suitable group of workers not earmarked for the study, for clarity and comprehension of questions and the time it would take to administer one questionnaire. After making the necessary changes, the baseline questionnaire was administered through interviews to 488 South African workers comprising 252 nurses and 236 bank workers who provided informed consent to participate in the study. Information about demographic characteristics, potential musculoskeletal disorder risk factors and occurrence of musculoskeletal disorders and their associated consequences was collected. At follow-up, 189 nurses (75.3%) who had participated at baseline were successfully re-interviewed about the occurrence of musculoskeletal disorders a month before the follow-up period.

The collected data were cleaned and prepared for analysis. Descriptive statistics were generated followed by the selection of explanatory variables to be included in the multiple logistic regression. These variables were used to build partial models with age group, sex and occupational group. Variables with p-values ≤ 0.2 were

selected for the full models. The full models were run to produce final models which contained variables with p-values < 0.05.

Results

Prevalence and characteristics of musculoskeletal disorders in South African workers, public hospital nurses, and bank workers

The estimated 12-month prevalences (95% CI) of musculoskeletal disorders reported by the South African workers, public hospital nurses, and bank workers were high at 80.5% (77.0%-84.0%), 84.1% (79.5%-88.6%) and 76.7% (71.3%-82.1%), respectively. The most prevalent pain was in the low back (56.9%, 58.2% and 55.5%) and the least prevalent in the elbows (14.3%, 13.2% and 15.7%). More than half (58.6%, 64.9% and 51.4%) of the workers who reported pain in different body sites consulted healthcare providers for pain. Conservative estimates of sick leave days taken by each worker in the past 12 months due to musculoskeletal disorder pain were 2.2, 2.4 and 1.9 days for all workers, nurses and bank workers, respectively.

Risk factors for musculoskeletal disorders in South African workers, public hospital nurses and bank workers

Somatizing tendency

In South African workers, somatizing tendency was associated with the reporting of pain in all body sites considered in the study. The associations with pain in “any” body site ORs (95% CI) 2.23 (1.15-4.31); 3.52 (1.84-6.72) and low back 1.81 (1.07-3.03); 2.72 (1.69-4.40), demonstrated increasing trends when the effect of one and two distressing somatic symptoms was compared to no symptoms, respectively. In public hospital nurses, it was associated with pain in four body sites which included “any” body site 6.58 (1.76-24.47) and knees 2.80 (1.33-5.86) and in bank workers, in

six body sites which included “any” body site 3.17 (1.40-7.19) and low back 2.56 (1.22-5.36) when the effect of two or more distressing somatic symptoms was compared to no symptoms.

Sex

“Women” in South African workers and bank workers was associated with pain in the upper limbs constituted by shoulders 1.83 (1.04-3.37); 1.90 (1.01-3.59) and wrists or hands 2.28 (1.09-4.74); 2.53 (1.11-5.75) compared to men, respectively.

Age group

In South African workers, age groups (40-49 and ≥ 50 years) demonstrated increasing trends with pain in the shoulders 2.23 (1.27-3.90); 2.40 (1.21-4.79) and knees 2.18 (1.16-4.09); 2.50 (1.16-5.38), respectively. In public hospital nurses, age group (40-49 years) was associated with pain in the shoulders 4.70 (1.15-19.10) and age group (≥ 50 years) with pain in “any” body site 2.67 (1.09-6.54). In bank workers, an increasing trend with age groups (40-49 and ≥ 50 years) was demonstrated with pain in the knees 2.91 (1.19-7.10) and 4.04 (1.32-12.38), respectively. The effect of each age group was compared to <30 years age group.

Occupational group

Occupational group (bank workers) was associated with pain in the neck 1.66 (1.04-2.67) but no positive association was found with pain in “any” body site 0.51 (0.27-0.96) compared to nurses.

Incident and persistent musculoskeletal disorders in public hospital nurses

Incident “any” musculoskeletal disorders (95% CI) were estimated at 47.6% (36.5%-58.6%) with incident low back pain affecting the largest percentage of nurses (32.8%) and incident elbow pain (8.5%) the lowest. Persistent “any” musculoskeletal disorders (95% CI) were estimated at 83.7% (76.2%-91.1%) with persistent knee pain affecting most nurses (71.4%) and persistent elbow pain the least number of nurses (36.4%).

Risk factor for persistent musculoskeletal disorders in public hospital nurses

Somatising tendency was associated with persistent pain in “any” body site 7.32 (1.34-39.88) when the effect of two or more distressing somatic symptoms was compared to no symptoms.

Ethnicity

Ethnic group was associated with wrists or hands and low back. In all workers, Nguni and “other” ethnic groups were associated with wrists or hands 1.85 (1.08-3.18); 2.02 (1.09-3.72) and in bank workers 3.75 (1.41-9.97); 2.87 (1.13-7.28), respectively. In nurses, the “other” ethnic group was associated with wrists or hands 2.81 (1.07-7.39). In all workers, “other” ethnic group was associated with low back 1.86 (1.07-3.34) and in bank workers 2.43 (1.16-5.08). The effect of ethnic groups was compared to the Sotho group.

Conclusions

The study found a high burden of musculoskeletal disorders in the two groups of workers studied with pain in the low back being the most prevalent. The large

proportions of workers, who consulted healthcare providers and took time off from work due to musculoskeletal disorders, indicate the negative impact that these disorders may have on the affected workers and their places of work. The main risk factors emerging from this research belong to the individual dimension of musculoskeletal disorder risk factors. This may signal their importance in the development and persistence of these disorders. Furthermore, they may need to be considered in any effort to address musculoskeletal disorders in the groups of workers studied. This study failed to provide convincing evidence of association between ethnicity and musculoskeletal disorders in the groups studied.

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NOMENCLATURE AND ABBREVIATIONS

“Any” pain	Reports of pain in the selected body sites in the study that is, low back, neck, shoulders, elbows, wrists or hands and knees
CC	Call Centre
Call Centre	A work environment in which the main business is conducted via a telephone whilst simultaneously using display screen equipment
CCC	Credit Card Collection
Computer-telephone interactive tasks	Tasks in which computers and telephones are used simultaneously with the objective of developing standardised and continuous actions of marketing or to manage communication with clients, public or government agencies
CTI	Computer-telephone interaction
CUPID	Cultural and Psychological influences on Disability
Ethnicity	Social or cultural heritage that a particular group shares in terms of customs, language, values, religion, social ties and habits passed down from one generation to the next
HLC	Home Loan Collection

Incident pain	Reporting no pain at baseline and reporting pain at follow-up interview in one or a combination of the following body sites: low back, neck, shoulders, elbows, wrists or hands, knees or upper limbs
Job dissatisfaction	Negative emotional reactions and attitudes individuals have towards their job
MSDs	Musculoskeletal disorders
Multi-site pain	Pain occurring at three or more sites
Musculoskeletal disorders	Pain occurring in one or combination of the following body sites: low back, neck, shoulders, elbows, wrists/hands, knees or upper limbs lasting for more than a day either in the past 12 months or past month
Nguni group	Consists of Xhosa and Zulu ethnic groups
NIOH	National Institute for Occupational Health
“Other” group	Consists of Afrikaner, Coloured, Indian, Tsonga and Venda ethnic groups
Persistent pain	Reporting pain at baseline and at follow-up interviews occurring at the following body sites: low back, neck, shoulders, elbows, wrists or hands, knees or upper limbs

SA	South Africa
Sotho group	Consists of Pedi, Sotho and Tswana ethnic groups
South African workers	Combination and analyses of South African public hospital nurses and bank workers data
Somatising tendency	A general elevated awareness of somatic symptoms and tendency to attribute such symptoms to physical illness
Upper limbs	One or a combination of the following body sites: shoulders, elbows and wrists/hands
Workstyle	The way in which the worker performs his or her work tasks in reaction to increased work demands which may contribute to the aetiology, exacerbation and/or maintenance of musculoskeletal disorders.

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Chapter 1: Introduction

1.1 Background

Musculoskeletal disorders (MSDs) entail a wide array of inflammatory and degenerative conditions affecting the muscles, tendons, joints, nerves and blood vessels (Buckle and Devereux, 2002, Punnett and Wegman, 2004). In recent years there has been heightened awareness of, and interest in MSDs as demonstrated by the dramatic increase of research publications in this field. This comes as a backdrop of hundreds of millions of people around the world who are affected by MSDs (Woolf and Pfleger, 2003). Evidence linking MSDs to risk factors at the workplace is accumulating (Armstrong et al., 1993, Bernard, 1997, Barondess et al., 2001, Palmer et al., 2008), thus supporting the observations that MSDs are related to work exposures made by Bernardino Ramazzini more than 300 years ago (Franco and Fusetti, 2004). However, it is widely recognised that the aetiology of MSDs is multifactorial; both work and non-work risk factors, including individual factors, are implicated in their development. As such, socio-cultural factors such as ethnicity are suspected of playing a role in the genesis of MSDs.

MSDs are one of the most common and costly public health problems in Europe and North America (Aptel et al., 2002, Punnett and Wegman, 2004, Larsson et al., 2007). They constitute a major component of occupational diseases in many countries (Armstrong et al., 1996, Kang et al., 2014). In France, about two thirds of all occupational diseases were MSDs of the upper limbs (Aptel et al., 2002). Neck and upper limb MSDs accounted for approximately three quarters of all MSDs seen by rheumatologists in the United Kingdom (Sim et al., 2006). In the United States of America, the prevalence of MSDs of the upper limbs ranges from 20-30%, while MSDs of the neck and upper limbs are responsible for a third of the workers'

compensation costs in private companies, and the estimated annual cost of MSDs ranged from 45 to 54 billion dollars (Staal et al., 2007). Furthermore, about 32% of cases of MSDs involving days away from work were as a result of overexertion and repetitive movements (Bernard, 1997).

MSDs have been identified in many occupational groups across different industries (Yassi, 2000, Franco and Fusetti, 2004). Nurses and workers involved in computer-telephone interactive tasks are among the occupational groups with high prevalences of MSDs (Crawford et al., 2008, Harcombe et al., 2009). The disability associated with MSDs may limit the execution of normal daily life activities and, importantly, the performance of work. Their recurrence and persistence often lead to lost work days (Buckle and Devereux, 2002), work disability (March et al., 2014) and, at worst, early retirement. The observed burden of MSDs worldwide has prompted countries to develop strategies to address MSDs (Yassi, 2000) while others have prioritised research on MSDs to elucidate existing uncertainties (Kang et al., 2014). In South Africa, there is a paucity of information regarding the occurrence of MSDs and their determinants which provides opportunities to design and conduct relevant research to elucidate the burden of MSDs and associated factors.

1.2 Cultural and Psychological Influences on Disability (CUPID) project

The National Institute for Occupational Health in South Africa together with other agencies, was invited by the Lifecourse Epidemiology Unit in the Medical Research Council at Southampton University in the United Kingdom, to participate in the CUPID project. This opened a window of opportunity for the execution of the current study. Eighteen countries, including South Africa, participated in the CUPID project. The project was developed to compare the prevalence and explore the incidence

and persistence of MSDs and associated disability in workers carrying out jobs with similar physical demands in a range of cultural settings. All the CUPID collaborating countries submitted their cleaned data based on set criteria to the CUPID project central coordinating office in Southampton University for collation and analysis as pooled data. Several papers have been published based on these data (Coggon et al., 2012). In other countries, country specific data have been used for higher degrees. In the case of South Africa, the South African data have been used in this thesis.

1.3 Literature review

The literature on MSDs is voluminous, thus only studies that are pertinent to this thesis were reviewed. The review covered MSD studies including CUPID studies focussing on: 1) MSDs in hospital nurses and relevant studies on South African nurses; 2) MSDs in workers performing computer-telephone interactive tasks; and 3) MSDs and ethnicity.

The articles reviewed and presented in this thesis, were searched from Google Scholar, PubMed and Science Direct databases. A combination of search terms indicating the outcome, exposure and target population were used. For instance, the terms “musculoskeletal disorder/s” or “musculoskeletal symptom/s” or “incident pain” or “persistent pain”, and “risk factor/s” or “determinant/s”, and “nurse/s” or “computer-telephone user/s” were used. The publication period of the articles was not specified and only articles written in the English language were utilised in the review.

Additional articles were obtained by searching the reference lists of the retrieved articles. The strategy for the literature search is in appendix A.

1.3.1 MSDs in hospital nurses

Nurses are one of the occupational groups that has been found internationally to experience relatively high prevalences of MSDs (Davis and Kotowski, 2015). The nurses who work in hospital environments in particular have been identified as a group at increased risk of developing MSDs (Carugno et al., 2012). A number of literature reviews have reported high prevalences of MSDs in nurses (Long et al., 2012, Davis and Kotowski, 2015) with the low back area affected more often than other body areas (Lorusso et al., 2007). Various risk factors for MSDs in nurses have been identified (Long et al., 2012, Bernal et al., 2015). Activities such as lifting of heavy loads (Tinubu et al., 2010), lifting of patients, often in awkward and constrained postures, (Carugno et al., 2012, Freimann et al., 2013), and sometimes forceful movements of the upper limbs (Carugno et al., 2012) are routinely performed in nursing. These physical factors, together with psychosocial factors such as job stress, monotonous tasks, high perceived workload, and time pressure have been associated with the development of MSDs in nurses (Smith et al., 2006). MSDs can have a huge impact on the lives of nurses where they suffer chronic pain and disability with considerable cost (Tinubu et al., 2010).

1.3.1.1 Prevalence and body site localisation of MSDs in hospital nurses

In nurses, MSDs at different body locations can be described by prevalence studies. This knowledge can be useful in gauging the size of the problem of MSDs in nurses. It can further be used to assess the health care needs of the nurses (Davis and Kotowski, 2015, Beaglehole et al., 1993). In recent years, there has been an increase in the number of prevalence studies on MSDs in nurses. However, very few systematic literature reviews (Davis and Kotowski, 2015, Long et al., 2012) have been conducted to integrate this information to give a holistic picture of the

prevalence and body site localisation of MSDs in nurses to date. A literature review of studies investigating the prevalence and body site localisation of MSDs in nurses was thus conducted. The reviewed studies are summarised and presented in Table 1.1.

Table 1.1: Summary of studies on the prevalence and body site localisation of musculoskeletal pain in hospital nurses

Study	Study design	Study group (Sample size)	Outcome measure	Prevalence (%)						
				Any	Back and neck		Upper limb		Lower limb	
Botha & Bridger., 1998, South Africa	Cross-sectional	Nurses (100)	Occurrence of pain in the past 12 months		Lower back Mid back Neck/shoulder	63.0 31.0 41.0	Shoulder/arm Hand	24.0 8.8	Legs Feet	23.0 40.0
Trinkoff et al., 2002 America	Cross-sectional	Registered nurses, mainly staff nurses (67.5%), residing in Illinois and New York States (1163)	^a MSD symptom and	72.5	Back Neck	47.0 45.8	Shoulders	35.1		
			^b MSD case in the past year		Back Neck	31.8 24.1	Shoulders	22.2		
Smith et al., 2004a China	Cross-sectional	Registered nurses (282)	MSD complaints (not specified) in the past 12 months	70.0	Low back Upper back Neck	56.0 37.0 45.0	Shoulders	40.0		
Tezel, 2005 Turkey	Cross-sectional	Nursing staff (120)	^c MSD complaints and	90.0	Back Neck	69.0 46.0	Shoulders	54.0		
			^d Chronic MSD complaints in the past 6 months		Back Neck	41.0 25.0	Shoulders	33.0		
Alexopolous et al., 2006 Greece and Netherlands	Cross-sectional	Greek nurses (351) Dutch nurses (129) and caregivers (264)	MSD complaints and		Back Neck	75.0 47.0	Shoulders	37.0		
			Chronic MSD complaints in the past 12 months		Back Neck	62.0 39.0	Shoulders	41.0		
Choobineh et al., 2006 Iran	Cross-sectional	Nurses (641)	MSD complaints (not specified) in the past 12 months	84.4	Low back Upper back Neck	54.9 46.4 36.4	Shoulders Elbows Wrists/hands	39.8 17.9 39.3	Thighs Knees Legs/feet	29.3 48.4 52.1

^aPain, numbness, tingling aching, stiffness or burning.

^bRelevant symptom with relevant duration, frequency and intensity.

^cAche, complaints or discomfort for at least a few hours.

^dAche, complaints or discomfort almost everyday in the past 6 months with presence of at least three months.

Table 1.1: Summary of studies on the prevalence and body site localisation of musculoskeletal pain in hospital nurses cont'd

Study	Study design	Study group (Sample size)	Outcome measure	Prevalence (%)						
				Any	Back and neck		Upper limb		Lower limb	
Smith et al., 2006 Japan	Cross-sectional	Nurses (844)	MSD (not specified) in the past 12 months	85.5	Low back Upper back Neck	73.9 1.3 54.7	Shoulders	71.9		
Tinubu et al., 2010 Nigeria	Cross-sectional	Nurses (118)	Work-related MSD in the past 12 months	78.0	Low back Upper back Neck	44.1 16.8 28.0	Shoulders Elbows Wrists/hands	12.6 7.1 16.2	Hips/thighs Knees Ankles/feet	3.4 22.4 10.2
Carugno et al., 2012 Brazil and Italy	Cross-sectional	Brazilian nurses (193)	MSDs (not specified) in the past month		<u>Brazilian nurses</u>	45.1 40.4	Shoulders	41.5		
		Italian nurses (558)			<u>Italian nurses</u>					
Freimann et al., 2013 Estonia	Cross-sectional	Nurses (221)	Pain in the past 12 months	84.0	Low back Neck	56.1 52.0	Shoulders Elbow Wrists/hands	21.3 11.3 27.1	Knees	32.6
Madiba et al., 2013 South Africa	Cross-sectional	Nurses (125)	MSD pain in the past 12 months	84.0	Low back Upper back Neck	58.0 16.0 20.0	Shoulders Arms	21.0 10.0		
Surawera et al., 2013 Australia	Cross-sectional	Nurses (1111)	MSD pain in the past 12 months and				Wrists/hands	22.5		
			1 month				Wrists/hands	15.3		
Attar, 2014 Saudi Arabia	Cross-sectional	Nurses (200)	^e Work-related MSD in the past 12 months	85.0	Low back Mid back Neck	65.7 5.0 20.0	Shoulders Elbows Wrists/hands	29.0 3.0 10.0	Hips/thighs Knees Ankles/feet	16.5 21.0 41.5

^ePain, numbness, tingling, aching, stiffness and burning.

Table 1.1: Summary of studies on the prevalence and body site localisation of musculoskeletal pain in hospital nurses cont'd

Study	Study design	Study group (Sample size)	Outcome measure	Prevalence (%)							
				Any	Back and neck		Upper limb		Lower limb		
Munabi et al., 2014 Uganda	Cross-sectional	Nurses (755) from 5 hospitals (A-E)	†MSD in the past 12 months	80.8	<u>Hospital A</u>						
				Low back	45.6	Shoulders	27.9	Hips/thighs	15.2		
				Upper back	22.8	Elbows	11.5	Knees	21.8		
				Neck	25.9	Wrists/hands	16.5	Ankles/feet	25.0		
				<u>Hospital B</u>							
				Low back	55.9	Shoulders	25.3	Hips/thighs	21.9		
				Upper back	34.2	Elbows	16.1	Knees	37.6		
				Neck	25.8	Wrists/hands	27.7	Ankles/feet	38.6		
				<u>Hospital C</u>							
				Low back	61.6	Shoulders	28.5	Hips/thighs	33.1		
				Upper back	39.3	Elbows	11.0	Knees	34.0		
				Neck	33.3	Wrists/hands	29.7	Ankles/feet	30.4		
				<u>Hospital D</u>							
				Low Back	79.3	Shoulders	45.9	Hips/thighs	45.4		
				Upper back	43.6	Elbows	23.5	Knees	54.6		
Neck	46.8	Wrists/hands	36.8	Ankles/feet	44.7						
<u>Hospital E</u>											
Low back	61.0	Shoulders	34.0	Hips/thighs	21.2						
Upper back	34.0	Elbows	14.1	Knees	32.5						
Neck	41.4	Wrists/hands	29.5	Ankles/feet	44.1						

†Ache, pain, discomfort or numbness.

The findings of the review indicate that the 12-month prevalence of MSD symptoms in nurses was the period prevalence most frequently used by the reviewed studies which were all cross-sectional. The reporting of symptoms in any body location had 12-month prevalences that ranged from 70.0%-85.5% (Trinkoff et al., 2002, Smith et al., 2004b, Choobineh et al., 2006, Smith et al., 2006, Tinubu et al., 2010, Freimann et al., 2013, Madiba et al., 2013, Attar, 2014, Munabi et al., 2014). Most studies (8) had investigated the back, neck and shoulders with one study including the knees. Five studies investigated the back, upper limbs and lower limbs. The remaining study investigated wrists or hands. Low back symptoms were the most commonly reported MSDs by the nurses, with the prevalences ranging from 44.1%-79.3%. The prevalences of neck symptoms were from 20.0%-52.0% and shoulder symptoms 12.6%-71.9%. Other body sites less frequently investigated showed prevalences of 3.0%-23.5% for elbows, 8.8%-39.3% for wrists or hands, 21.0%-54.6% for knees and 10.2%-52.1% for ankles or feet.

The results of the review showed that hospital nurses report high prevalences of MSD symptoms which occurred in different body sites. The low back was the body site that was most frequently affected. This was followed by the shoulders, neck, knees, ankles or feet and wrists or hands. The elbows were less frequently affected compared to the other body sites. Variation in the prevalences presented by the different studies was observed. This variation can be partly attributed to heterogeneity of studies regarding MSD definitions, and this finding concurs with the findings of other reviews (Long et al., 2012, Davis and Kotowski, 2015).

1.3.1.2 Features and functional consequences of MSDs in hospital nurses

The features and functional consequences of MSDs in nurses have been reported in a number of studies investigating the occurrence of MSDs in nurses (Trinkoff et al., 2002, Munabi et al., 2014). They are based on pain which is the main symptom of MSDs (Buckle and Devereux, 2002). Pain can occur in more than one body site, giving rise to multi-site pain which is a feature of MSDs (Mehrdad et al., 2010).

Duration is a feature which is used to decide whether the pain is acute, chronic or persistent (Vargas-Prada et al., 2013). It has been used with other features such as frequency and intensity to determine the severity of pain (Trinkoff et al., 2002).

Depending on the severity of pain, the nurses may use different ways to try and alleviate the pain. In the literature, it has been reported that nurses self medicate, miss work, seek healthcare, modify work, or change jobs (Trinkoff et al., 2002). In some instances, disability sets in and the nurses lose their work ability and become relegated from the labour market (Menzel et al., 2004). All of these represent the functional consequences of MSDs in the nurses.

An American study amongst registered nurses examined MSDs in the past 12 months in relation to functional consequences and found that nurses classified as MSD cases (nurses reporting relevant symptoms, duration, frequency and intensity) reported high prevalences of all functional consequences examined in the study compared to nurses classified as MSD *symptoms*. In general, the odds of reporting functional consequences (consulting health care providers, modifying work, use of medication missing work and inadequate sleep) were higher in MSD cases compared to MSD *symptoms* (Trinkoff et al., 2002).

MSDs caused close to a third of nurses to seek healthcare by visiting a physician, a fifth to use physiotherapy services and close to a fifth to take sick leave in the past 12 months, in a study examining the relationship between perceived demands and MSDs in Iranian nurses (Choobineh et al., 2006). In another study (Tinubu et al., 2010) to determine the prevalence of MSDs and associated job risk factors in Nigerian nurses, 5% of the nurses had changed their jobs, close to a third had treated themselves or sought treatment from other health practitioners, and a third, on average, had modified their tasks due to MSDs. A comparative study (Alexopoulos et al., 2006) to investigate national differences between Greek and Dutch nurses with respect to MSDs and its consequences found higher percentages of nurses in both countries who had taken sick leave because of low back pain as compared to other body sites. Similarly, in both countries, a high percentage (close to half) of nurses with MSDs had sought medical care for low back pain in the past 12 months. Lastly, an Australian study (Surawera et al., 2013) to assess the risk factors for wrist or hand pain in nurses, found that 43.0% of those who reported wrist or hand pain had sought medical advice and more than a tenth had taken time off from work in the past 12 months due to wrist or hand pain. These studies reinforce the negative impact that MSDs impose on nurses' lives.

1.3.1.3 Risk factors for MSDs in hospital nurses

Epidemiological studies have been instrumental in the identification of risk factors for MSDs in nurses (Bernal et al., 2015, Lorusso et al., 2007, Sherehiy et al., 2004). These risk factors can be organised into categories based on their place of origin (Armstrong et al., 1996). The two main categories are workplace risk factors and non-workplace usually referred to as individual risk factors. In the absence of the

pathophysiological mechanism for MSDs, the National Research Council and the Institute of Medicine of the National Academy of Sciences in the United States of America (Barondess et al., 2001) adopted a conceptual model which distinguishes the two categories of risk factors. The model is presented with permission (Appendix B) in Figure 1.1 and postulates the possible involvement and influence of these risk

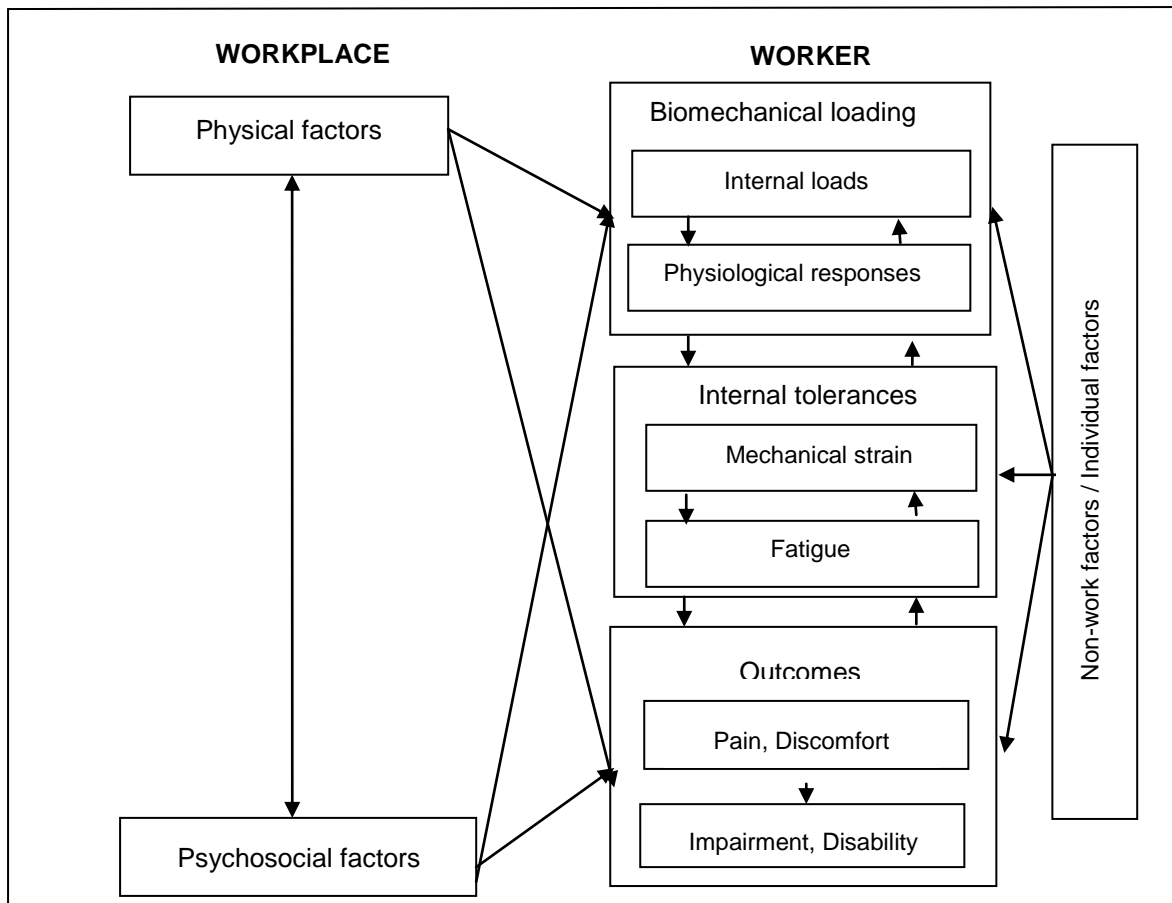


Figure 1.1: Conceptual model of the possible involvement of MSD risk factors in the genesis of MSDs (Adapted with permission from the National Academy Press)

factors in the development of MSDs. The model is constituted by the workplace which can be taken to be the hospital and the worker represents nurses who possess individual characteristics. Thus, the hospital environment and nursing job become the generators of factors which put the nurses at risk of MSDs. These workplace risk factors can be differentiated into physical and psychosocial work risk

factors. Physical workplace risk factors may include various patient handling tasks and other activities involved in nursing. Psychosocial workplace risk factors cover work organisational factors such as job demand and control, social support, job satisfaction, shift work et cetera.

Nurses' individual risk factors are multidimensional with physical factors, including household activities and fitness level; and social aspects of life outside of the workplace, such as smoking habits and educational level; biological characteristics, including age, sex and body mass index; and, psychological characteristics comprising attitudes, values and coping mechanisms. All of these factors have been associated with MSD risk (Marras et al., 2009).

The National Academy of Sciences' conceptual model suggests that workplace physical risk factors operate through biomechanical loading to initiate the development of MSDs (Buckle and Devereux, 2002). The physical risk factors generate internal forces which act on the tissues to create internal loads. The internal loads may cause physiological responses such as a decrease in blood supply. The physiological response, depending on internal tolerances, may lead to mechanical strain, fatigue and MSD outcomes. On the other hand, psychosocial factors may generate psychological stress which may induce a series of reactions, resulting in the release of hormonal substances which can cause muscle tension. This increases the biomechanical load imposed on the muscles and processes similar to those initiated by physical risk factors may ensue (Aptel et al., 2002, Wahlström, 2005). The individual factors may have a mediating role where the effect of the workplace risk factors may depend on various factors that are characteristic of the individual (Feuerstein et al., 2004).

1.3.1.3.1 Risk factors for prevalent MSDs in hospital nurses

Prevalent MSDs are those present at, or during, a specified period of time in a defined at risk population (Hales and Bernard, 1996). The literature on MSDs in nurses is dominated by studies examining prevalent MSDs and their associated risk factors (Smith et al., 2004a, Alexopoulos et al., 2006, Choobineh et al., 2006, Smith et al., 2006, Carugno et al., 2012, Freimann et al., 2013, Attar, 2014, Munabi et al., 2014). As it is difficult for one study to consider all suspected risk factors for MSDs, integrating the information from different studies may be a solution (da Costa and Vieira, 2010). Recent reviews of risk factors for prevalent MSDs in nurses have combined nurses with other healthcare professionals and selected a limited scope of MSDs (Lorusso et al., 2007, Long et al., 2012) and risk factors (Bernal et al., 2015). Consequently, a literature review of studies examining the relationship between prevalent MSDs in hospital nurses and associated risk factors was conducted based on the studies summarised and presented in Table 1.2.

Table 1.2: Summary of studies on risk factors for prevalent musculoskeletal disorders in hospital nurses

Study	Study design	Study group; sample size (response rate)	Data collection tool	Outcome measure	Association		
					Outcome/ explanatory variable	Point estimate (95% CI)	
Lagerström et al., 1996, Sweden	Cross-sectional	Nursing personnel; 688 (84%)	Self-administered questionnaire about individual factors, psychosocial and physical work factors and musculoskeletal symptoms	Ongoing musculoskeletal symptoms of neck, low back, shoulders, hands and knees: categorised by a ten point scale (0-9) whereas 0=no symptoms; 1-9 symptoms; ≥6= severe symptoms	<u>Neck symptoms</u>	<u>1-9</u>	<u>≥6</u>
					Age	1.31 (1.14-1.52);	
					Low physical fitness	1.42 (1.00-2.02);	1.68 (1.09-2.59)
					Low work commitment	1.65 (1.07-2.54)	
					Low social support	2.03 (1.28-3.16)	
					High work demand		1.82 (1.14-2.92)
					Age x type of ward		1.48 (1.02-2.14)
					<u>Shoulder symptoms</u>		
					Age	1.23 (1.08-1.42);	1.22 (1.02-1.46)
					Low physical fitness	1.75 (1.25-2.49);	2.22 (1.47-3.36)
					High work demand		1.65 (1.05-2.59)
					Low work control	1.73 (1.13-2.67)	
					<u>Low back symptoms</u>		
					Low physical fitness	1.79 (1.26-2.54);	1.60 (1.04-2.46)
					Work category (RN vs AN)	1.70 (1.13-2.56)	
					Low social support	1.80 (1.13-2.83)	
					<u>Hand symptoms</u>		
					Age	1.42 (1.19-8.28)	
Type of ward		2.84 (1.25-6.49)					
Lack of stimulation	1.62 (1.09-2.39)						
<u>Knee symptoms</u>							
Age	1.28 (1.12-1.47);	1.46 (1.11-1.92)					
High body mass index		3.16 (1.69-5.87)					
Ando et al., 2000 Japan	Cross-sectional	Nurses; 344 (90%)	Self-administered questionnaire about demographic details, severity of work loads, self estimated risk factors for fatigue and musculoskeletal symptoms in the past month.	Occurrence of pain in the low back, neck, shoulder and arm in the past month.	<u>Low back pain</u> Demographic details; Actual tasks; Estimated risk factors for fatigue	95% CI of Rate Ratios (RR) included 1 in all the explanatory variables	
					<u>Neck, shoulder and arm pain</u> Demographic details; Actual tasks; Estimated risk factors for fatigue	95% CI of Rate Ratios (RR) included 1 in all the explanatory variables	

Table 1.2: Summary of studies on risk factors for prevalent musculoskeletal disorders in hospital nurses cont'd

Study	Study design	Study group; sample size (response rate)	Data collection tool	Outcome measure	Association	
					Outcome/ explanatory variable	Point estimate (95% CI)
Alexopoulos et al., 2003, Greece	Cross-sectional	Nursing personnel, 351 (90%)	Self-administered questionnaire about the nurses, job and employment history, individual characteristics, physical and psychosocial risk factors at work, general health status and musculoskeletal complaints.	Musculoskeletal complaints of the back, neck and shoulder in the past 12 months which have continued for a few hours.	<u>Low back</u> Strenuous back postures Moderate perceived general health <u>Shoulder pain</u> Age >40 years Manual material handling Strenuous shoulder movements Moderate perceived general health <u>Neck pain</u> Strenuous back postures Moderate perceived general health	1.85 (1.02-3.35) 4.33 (2.31-8.10) 3.58 (1.86-6.89) 1.95 (1.06-3.60) 1.87 (1.06-3.30) 2.89 (1.70-4.92) 1.88 (1.17-3.02) 2.76 (1.72-4.44)
Trinkoff et al., 2003, America	Cross-sectional	Nurses, 1163 (74%)	Postal questionnaire asking about physical demands, job characteristics and health and well-being	Having a relevant symptom in the past 12 months (pain, numbness, tingling, aching, stiffness or burning) that lasted ≥1 week or occurred at least monthly with at least moderate pain on average (MSD case) in the neck, shoulder and back	<u>Neck MSD case</u> <i>Physical demands scale</i> Moderate High Other dependents (Yes) Psychological demands <i>Physical demands</i> Hospital nurses only (High) <i>Staff nurses only</i> Moderate High <u>Shoulder MSD case</u> <i>Physical demands scale</i> Moderate High Age Gender (Female)	 2.15 (1.34-3.48) 4.98 (2.68-9.26) 2.33 (1.29-4.22) 1.07 (1.01-1.14) 4.38 (1.75-10.99) 2.89 (1.36-6.15) 9.05 (3.60-22.72) 2.40 (1.43-4.01) 6.13 (3.14-11.98) 1.04 (1.01-1.06) 9.36 (1.15-76.35)

Table 1.2: Summary of studies on risk factors for prevalent musculoskeletal disorders in hospital nurses cont'd

Study	Study design	Study group; sample size (response rate)	Data collection tool	Outcome measure	Association	
					Outcome/ explanatory variable	Point estimate (95% CI)
					Other dependents (Yes) <i>Physical demands</i> Hospital nurses only (High) Staff nurses only Moderate High <u>Back MSD case</u> <i>Physical demands scale</i> Moderate High Other dependents (Yes) BMI Psychological demands <i>Physical demands</i> Hospital nurses only (High) <i>Staff nurses only</i> Moderate High	2.06 (1.11-3.81) 4.99 (1.84-13.57) 3.58 (1.58-8.11) 11.99 (4.41-32.65) 2.60 (1.65-4.11) 5.30 (2.89-9.71) 2.61 (1.49-4.59) 1.06 (1.02-1.11) 1.10 (1.03-1.16) 5.46 (2.24-13.31) 3.51 (1.72-7.18) 9.39 (3.88-22.71)
Smith et al., 2004b, China	Cross-sectional	Nurses, 180 (84.1%)	Self-administered questionnaire about demographic details, occupational factors and occurrence of musculoskeletal disorders.	MSDs of the neck, shoulders, upper back, lower back, elbows, wrists, upper legs, knees and ankles or feet in the past 12 months.	<u>Any MSDs</u> Alcohol (occasional) Period pain (usually) Mental pressure (excessive) Department (Gynaecology)	0.1 (0.01-0.4) 23.8 (4.3-189.1) 10.5 (2.2-67.5) 0.1 (0.01-0.7)
Smith et al., 2005, Korea	Cross-sectional	Nurses, 330 (97.9%)	Self-administered questionnaire about demographic details, occupational risk factors, musculoskeletal symptoms and adverse sequelae.	MSDs (neck, shoulders, upper back, elbows, forearms, hands or wrists, lower back, upper legs, knees, lower legs, feet)	<u>Any MSDs</u> Manually handling patients Periodic depression <i>Affected daily life</i> Neck Shoulder Hand/wrists	7.2 (1.2-42.3) 3.3 (1.3-8.3) 2.2 (1.1-4.1) 2.4 (1.2-5.2) 3.8 (2.0-7.8)

Table 1.2: Summary of studies on risk factors for prevalent musculoskeletal disorders in hospital nurses cont'd

Study	Study design	Study group; sample size (response rate)	Data collection tool	Outcome measure	Association	
					Outcome/ explanatory variable	Point estimate (95% CI)
				in the past 12 months; if nurses' daily lives were affected and if treatment was required.	<i>Needed medical treatment</i> Lower back Hand/wrists	2.5 (1.2-5.6) 2.3 (1.3-4.2)
Choobineh et al., 2010, Iran	Cross-sectional	Nurses, 375 (80%)	Self-administered questionnaire about demographic details, perceived job demands, additional nurse specific physical demands and musculoskeletal symptoms in the past 12 months	Musculoskeletal symptoms (ache, pain and or discomfort) of the neck, shoulders, elbows, wrists or hands, upper back, lower back, hips or thighs, knees and ankles or feet in the past 12 months.	<u>Neck</u> Pull/push heavy objects Shift work <u>Shoulders</u> Lifting or lowering objects Conflicting demands Shift work Gender (Female) <u>Elbows</u> Lifting or lowering objects <u>Wrists/hands</u> Repetitive motions Waiting on work from other people or departments Gender (Female) <u>Upper back</u> Pull/push heavy objects Not enough time to get the job done Shift work <u>Lower back</u> Working while bent or twisted at the waist BMI Gender (Female) <u>Hips/thighs</u> Waiting on work from other people or departments	5.35 (1.50-19.12) 2.54 (1.33-5.01) 3.04 (1.65-5.59) 1.68 (1.04-2.73) 3.26 (1.59-6.67) 1.17 (1.03-2.81) 2.63 (1.06-6.53) 2.88 (1.31-6.31) 2.13 (1.30-3.48) 2.14 (1.36-3.64) 6.16 (1.31-29.02) 2.25 (1.26-4.01) 2.29 (1.09-4.85) 2.04 (1.09-5.31) 2.12 (1.16-3.88) 1.71 (1.04-2.80) 2.01 (1.15-3.49)

Table 1.2: Summary of studies on risk factors for prevalent musculoskeletal disorders in hospital nurses cont'd

Study	Study design	Study group; sample size (response rate)	Data collection tool	Outcome measure	Association	
					Outcome/ explanatory variable	Point estimate (95% CI)
					Not enough time to get the job done <u>Knees</u> Often moving/lifting very heavy loads Waiting on work from other people or departments Shift work <u>Ankles/feet</u> Lifting/lowering objects to/from floor Waiting on work from other people or departments Gender (Female)	1.85 (1.03-3.36) 7.24 (1.54-34.14) 2.30 (1.36-3.90) 3.38 (1.57-7.25) 4.97 (1.73-14.29) 2.14 (1.32-3.47) 2.03 (1.24-3.30)
Mehrdad et al., 2010, Iran	Cross-sectional	Nurses, 317 (91%)	Self-administered questionnaire about demographic details, work-related psychosocial factors and musculoskeletal symptoms.	Musculoskeletal symptoms in each body site (neck, shoulder, elbow, wrists or hands, upper back, low back, hips or thighs, knees, ankles or feet); Musculoskeletal symptoms in >3 body sites; and musculoskeletal symptoms in 4 regions: 1 (neck, shoulder, upper back) 2 (elbow, wrists or hands) 3 (low back) 4(hips or thighs, knees, ankles and feet) in the past 12 months (data for the regions are not presented in this table)	<u>Neck</u> ªAdjusted ªOrganizational <u>Shoulders</u> Organizational <u>Wrists or hands</u> Adjusted Organizational <u>Upper back</u> Adjusted ªTask ªIndividual <u>Knees</u> Individual	ªMiddle ªHigh 2.18 (1.16-4.08); 2.36 (1.01-5.57) 2.21 (1.22-3.98); 2.50 (1.21-5.19) 1.79 (1.01-3.17) 1.93 (1.02 -3.65);2.42 (1.01-5.82) 1.83 (1.01-3.31);2.34 (1.12-4.91) 2.51 (1.06-5.94) 2.86 (1.10-7.44) 1.88 (1.08-3.27) 2.27 (1.19-4.33)

					<u>Ankles or feet</u> Adjusted Task Individual Organizational <u>>3 body sites</u> Adjusted Organizational	2.99 (1.24-7.24) 6.49 (2.29-18.37) 1.79 (1.02-3.12) 2.73 (1.29-5.75) 1.88 (1.03-3.47); 3.20 (1.32-7.80) 1.81 (1.02-3.20); 2.69 (1.29-5.63)
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^aStress level in relation to low stress

^bHigh stress in relation to low stress

^cOverall stress adjusted for potential confounders

^dStress due to social and organizational factors

^eStress due to task factors

^fStress due to individual factors

All of the studies reviewed except one (Lagerström et al., 1996) used 12-month period prevalence of MSD symptoms and validated instruments such as the Borg Scale (Borg, 1982) and Job Content Questionnaire (Karasek et al., 1998) to measure exposure, and the Standardised Nordic Questionnaire (SNQ) (Kuorinka et al., 1987) to measure the outcome. Half of the studies examined MSD symptoms in all body sites presented in the SNQ. The other half examined MSD symptoms in the lower back, neck and shoulders, except that one also included the arm and another the knees.

The risk factors reported to be associated with MSD symptoms in the lower back and neck (spine), shoulders and wrists or hands (upper limb) and knees (lower limb) are presented in sections that follow. The nomenclature used in the National Academy of Sciences conceptual model (2001) to categorise risk factors as physical, psychosocial and individual is used.

1.3.1.3.1.1 Physical, psychosocial and individual risk factors for prevalent MSDs of the spine in hospital nurses

The physical risk factors associated with prevalent MSD symptoms of the low back and neck that were identified in the reviewed studies were work category (Lagerström et al., 1996), awkward back posture (Alexopoulos et al., 2003a, Choobineh et al., 2010), department (Smith et al., 2004a) and manual handling (Smith et al., 2005, Choobineh et al., 2010). Work category was associated with low back symptoms in the study by Lagerström (1996), where auxiliary nurses were at a higher risk of developing low back symptoms than registered nurses. It was suggested that this could be due to auxiliary nurses performing physically more strenuous tasks than registered nurses. In the same study, an interaction between age and type of ward was associated with neck symptoms. The effect indicated that,

with increasing age, nurses working in a medical or geriatric ward were at an increased risk of developing neck symptoms than nurses working in other wards. It is worth noting that the studies conducted by Smith (2004a, 2005) examined the relationship between risk factors and MSD symptoms in “any” body site.

The psychosocial risk factors related to both low back and neck MSD symptoms were found to be low social support, high physical and psychological demands and shift work (Lagerström et al., 1996, Trinkoff et al., 2003, Smith et al., 2004a, Smith et al., 2005, Choobineh et al., 2010). High work demands were associated with neck symptoms in a study by Lagerström (1996), and the study by Smith (2004b) showed an association between excessive mental pressure and MSD symptoms at "any" body site. However, a study by Smith (2005) did not show an association between high mental pressure and MSD symptoms at "any" body site.

Finally, the individual risk factors found to be associated with MSD symptoms of the low back and neck in the nurses included low physical fitness, moderate perceived general health, high body mass index (BMI), alcohol, female gender and shift work (Lagerström et al., 1996, Alexopoulos et al., 2003b, Trinkoff et al., 2003, Smith et al., 2004a, Choobineh et al., 2010) In the studies of Trinkoff (2003) and Choobineh (2006), BMI was associated with low back symptoms.

1.3.1.3.1.2 Physical, psychosocial and individual risk factors for prevalent MSDs of the upper limb in hospital nurses

The upper limb includes the shoulders and wrists or hands. In the reviewed studies, the risk factors identified as being associated with MSD symptoms of the shoulders were manual handling and strenuous shoulder movements (Alexopoulos et al., 2003a). MSD symptoms in the wrists or hands were associated with repetitive

movements (Choobineh et al., 2010) and type of ward (Lagerström et al., 1996). The latter study suggested that the nurses reporting severe hand symptoms were working in physically strenuous wards or were exposed to high force from handling hospital equipment.

Physical demands (Trinkoff et al., 2003, Lagerström et al., 1996) and psychosocial stress levels (Mehrdad et al., 2010) were associated with shoulder and wrist or hand symptoms. For the shoulders, the individual risk factors were increased age (Lagerström et al., 1996, Alexopoulos et al., 2003b, Trinkoff et al., 2003), low physical fitness (Lagerström et al., 1996), moderate perceived general health (Alexopoulos et al., 2003a), and gender (Trinkoff et al., 2003, Choobineh et al., 2010). Symptoms of the hands were related to age (Lagerström et al., 1996).

1.3.1.3.1.3 Physical, psychosocial and individual risk factors for prevalent MSDs of the lower limb in hospital nurses

In the lower limb, only the knees were considered. The physical, psychosocial and individual risk factors that were identified were manual handling (Choobineh et al., 2010), psychosocial stress levels (Mehrdad et al., 2010), increased age and high BMI (Lagerström et al., 1996).

Two of the studies (Smith et al., 2005, Trinkoff et al., 2003), showed that over and above the identification of risk factors for MSD symptoms in nurses, identification of MSD consequences is also important. In the Trinkoff (2003) study, up to 11.0% of nurses had changed their jobs due to MSD symptoms. The nurses in the Smith (2005) study, had had their daily lives affected and had to take treatment for the symptoms.

1.3.1.3.2 Risk factors for incident and persistent MSDs in hospital nurses

Incident and persistent MSDs in nurses are indicative of the course taken by MSDs in their development (Maul et al., 2003). Investigations of incident and persistent MSDs in nurses utilise cross-sectional studies with baseline and follow-up components (Smedley et al., 1997, Maul et al., 2003). At baseline, there would be two groups of nurses: those with no MSD symptoms and those with MSD symptoms. At follow-up, in a proportion of nurses in the latter group the symptoms would persist (persistent MSDs), while in another proportion of nurses the symptoms would resolve. In the group with no symptoms, a proportion of them would develop new symptoms (incident MSDs), while the others would remain free from symptoms. It has been suggested that the risk factors for incident MSDs differ from those for persistent MSDs in nurses (Sadeghian et al., 2013) which is an issue that needs to be clarified.

The literature investigating risk factors for incident and persistent MSDs in nurses was reviewed. A summary of the reviewed studies is presented in Table 1.3. These studies can be categorised into those dealing with incident MSDs in nurses and those dealing with both incident and persistent MSDs in nurses and other occupational groups. The former studies covered up to three body sites while the latter covered up to 10 and used combinations of body sites to get information about multi-site pain for pain occurring at more than one site, and defined pain as disabling for pain that made it difficult or impossible to do everyday life activities such as dressing.

The findings of the studies on nurses show that incident MSDs were predicted by job strain (combination of high mental demands and low decision latitude) and perceived physical exertion (Josephson et al., 1997), past history of MSD symptoms, patient

handling tasks and low mood (Smedley et al., 1997, 2003), work schedule characteristics (Trinkoff et al., 2006) and occupational stress (Bonzini et al., 2015). In the study by Josephson et al., (1997), it was found that, although job strain and perceived physical exertion predicted incident pain, when both were combined the risk increased. The two studies by Smedley et al., (1997, 2003), found that incident low back and neck or shoulder pain were predicted by past history of symptoms and the risk increased with longer duration of symptoms and decreasing interval since last episode. Furthermore, low mood predicted low back pain, leading to sickness absence. The same work day factors including working more than 13 hours in a day and working on days off, predicted incident pain in all body sites selected in the study (Trinkoff et al., 2006). Finally, Bonzini et al., (2015) found that high incident stress predicted low back and neck or shoulder pain in nurses with low stress at baseline. The associations of high stress at baseline and incident pain were weak. The findings of this study show that occupational stress is not only a predictor of incident MSDs but is also a consequence of incident MSDs.

The risk factors predicting incident and persistent MSDs in studies that included nurses and other occupational groups encompassed predictors of incident MSDs, namely receiving incentives at work, job dissatisfaction, poor mental health (Sadeghian et al., 2013), somatising tendency, and adverse beliefs about prognosis (Vargas-Prada et al., 2013). The predictors of persistent MSDs consisted of strenuous work activities, and adverse beliefs about work causation of MSDs (Solidaki et al., 2012), prognosis (Vargas-Prada et al., 2013), and somatising tendency (Solidaki et al., 2012, Vargas-Prada et al., 2013). The office workers were at a higher risk for incident neck and shoulder pain than nurses which was attributed

to the use of computers by the office workers (Sadeghian et al., 2013). In this study, there were no associations with persistent MSDs.

Few studies on incident and persistent MSDs were identified, signalling a paucity of information about the subject in nurses. The main strength of all these studies was the temporality between the predictors and MSDs where the predictors were assessed before the occurrence of MSDs. Temporality is one of the criteria relevant to the study of MSDs used to infer causality (Hales and Bernard, 1996). The small sample sizes in the majority of studies limited statistical power which may have resulted in the reduction of the ability of studies to detect associations in some instances.

Table 1.3: Summary of studies on risk factors for incident and persistent pain in hospital nurses and other occupational groups

Study	Study design	Study group Sample size	Data collection tool	Outcome measure	Association	
					Outcome/explanatory variable	Point estimate (95% CI)
Josephson et al., 1997, Sweden	Baseline and 3 year follow-up	Nurses Baseline 565 Follow-up 1) 553 Follow-up 2) 562 Follow-up 3) 419 Response rate not stated	<u>Baseline</u> Self-administered questionnaire about individual factors, physical exposure at work, psychosocial factors and musculoskeletal symptoms from the Nordic musculoskeletal questionnaire which was incorporated into the main questionnaire. <u>Follow-up</u> Nordic musculoskeletal questionnaire	Ongoing musculoskeletal symptoms of the neck, shoulder and back in the past 12 months categorised by a ten point scale (0-9). Cases reported ongoing symptoms, score >6, from at least one of the body location of interest.	<u>Incident pain</u> Job strain Baseline Follow-up 1 Follow-up 2 Follow-up 3 Physical exertion Baseline Follow-up 1 Follow-up 2 Follow-up 3 Job strain and physical exertion Baseline Follow-up 1 Follow-up 2 Follow-up 3	1.5 (1.1-2.1) 1.1 (0.8-1.6) 1.5 (1.2-2.0) 1.1 (0.8-1.6) 1.5 (1.1-2.1) 1.5 (1.2-2.1) 1.4 (1.1-1.8) 1.8 (1.4-2.4) 2.1 (1.4-3.3) 2.0 (1.3-3.0) 1.5 (1.0-2.3) 1.6 (1.0-2.5)
Smedley et al., 1997, England	Baseline and 3-monthly follow-up over two years	Nurses Baseline (961) Follow-up (838)	<u>Baseline</u> Postal questionnaire asking about individual factors, nursing activities and low back symptoms <u>Follow-up</u> Asked about any change in manual handling activities, occurrence of any low back pain and resultant sickness absence since the last contact	Incident low back pain at follow-up and low back pain leading to sickness absence	<u>Incident low back pain (LBP)</u> <i>History of low back pain</i> Last symptom >1 year None 1-6 days 1-4 weeks ≥1 month Last symptom ≤1 year 1-6 days 1-4 weeks ≥1 month <u>Low back pain</u> <i>Frequency of transferring patient from bed and chair</i> 0 1-4 5-9 >10	All LBP LBP leading to sickness absence 1 1 1.9 (1.1-3.1) 2.7 (1.1-6.6) 2.2 (1.3-3.6) 3.5 (1.5-8.1) 2.9 (1.7-5.0) 1.6 (0.5-5.1) 3.4 (2.0-5.8) 1.2 (0.3-4.5) 3.1 (2.0-4.9) 2.3 (0.9-5.6) 6.1 (4.1-9.1) 7.3 (3.5-15.2) All LBP LBP leading to sickness absence 1 1.3 (0.9-1.7) 1.6 (1.1-2.3) 1.6 (1.1-2.3)

Table 1.3: Summary of studies on risk factors for incident and persistent pain in hospital nurses and other occupational groups cont'd

Study	Study design	Study group Sample size	Data collection tool	Outcome measure	Association	
					Outcome/explanatory variable	Point estimate (95% CI)
					<i>Frequency of moving patient around on the bed</i> 0 1-4 5-9 >10 <i>Frequency of lifting patient in and out of bath with hoist</i> 0 1-4 ≥5 <i>Low mood</i> No Yes	1 1.3 (0.8-1.9) 1.5 (1.0-2.3) 1.7 (1.1-2.5) 1 1 1.4 (1.0-1.9) 2.0 (1.2-3.3) 2.1 (1.2-3.6) 0.3 (0.5-3.8) 1 1 1.4 (0.8-2.3) 3.4 (1.4-8.2)
Smedley et al., 2003, England	Baseline and 3 monthly follow-up over two years	Nurses Baseline (1157) Follow-up (587)	<u>Baseline</u> Postal questionnaire asking about demographic details, workplace activities, psychosocial aspects of work and musculoskeletal and non-musculoskeletal symptoms <u>Follow-up</u> Asked about new neck/shoulder pain and any change of job	Incident neck or shoulder pain lasting for longer than a day	<u>Incident neck or shoulder pain</u> <i>Past neck or shoulder pain</i> Never >1 year ago at baseline Within past year at baseline <i>Duration</i> Never <1 week 1-4 weeks >4 weeks <i>Past low back pain</i> Never >1 year ago at baseline Within past year at baseline <i>Duration</i> Never <1 week 1-4 weeks >4 weeks	1 1.6 (1.1-2.3) 2.8 (2.0-3.9) 1 1.7 (1.1-2.5) 2.3 (1.5-3.3) 2.6 (1.2-4.0) 1 1.8 (1.2-2.7) 1.9 (1.4-2.7) 1 1.4 (0.9-2.3) 1.8 (1.2-2.7) 2.3 (1.6-3.3)

Table 1.3: Summary of studies on risk factors for incident and persistent pain in hospital nurses and other occupational groups cont'd

Study	Study design	Study group Sample size	Data collection tool	Outcome measure	Association	
					Outcome/explanatory variable	Point estimate (95% CI)
					<u>Incident neck or shoulder pain</u> <i>Frequency of assisting patient to mobilise using walking aid</i> 0 1-4 ≥5 <i>Frequency of moving patient around in a wheelchair et cetera</i> 0 1-4 ≥5 Frequency of washing or drying a patient while on a chair 0 1-4 ≥5	1 1.4 (1.0-1.9) 1.6 (1.1-2.3) 1 1.2 (0.8-1.7) 1.6 (1.1-2.4) 1 1.1 (0.8-1.5) 1.7 (1.1-2.8)
Trinkoff et al., 2006, USA	Baseline, six months and nine months follow-up	Nurses Baseline (2624) Follow-up 1 (2230) Follow-up 2 (1918)	<u>Baseline</u> Postal questionnaires about demographic details, work factors, work schedule characteristics, physical and psychosocial work demands and MSD symptoms (pain, numbness, tingling, aching, stiffness or burning) in the neck shoulder and or back	MSD case: nurse reporting relevant symptoms lasting one week or more or occurring at least monthly, with moderate or more pain on average	<u>Incident neck pain</u> <i>Work 13+ hours</i> No Yes <i>< 10 hours off in between shifts</i> No Yes <i>Work while sick</i> No Yes <i>Work on day off/vacation day</i> No Yes <u>Incident shoulder pain</u> <i>Work 13+ hours</i> No Yes	1 1.9 (1.4-2.7) 1 1.6 (1.1-2.2) 1 2.4 (1.5-3.9) 1 1.9 (1.3-2.8) 1 1.9 (1.4-2.6)

Table 1.3: Summary of studies on risk factors for incident and persistent pain in hospital nurses and other occupational groups cont'd

Study	Study design	Study group Sample size	Data collection tool	Outcome measure	Association	
					Outcome/explanatory variable	Point estimate (95% CI)
					<i>< 10 hours off in between shifts</i> No Yes <i>Work while sick</i> No Yes <i>Work on day off/vacation day</i> No Yes <u>Incident back pain</u> <i>Work 13+ hours</i> No Yes <i>< 10 hours off in between shifts</i> No Yes <i>Work while sick</i> No Yes <i>Work on day off/vacation day</i> No Yes	1 1.9 (1.4-2.6) 1 1.8 (1.2-2.8) 1 1.9 (1.3-2.7) 1 1.9 (1.4-2.6) 1 1.6 (1.1-2.1) 1 1.5 (1.0-2.2) 1 1.4 (1.0-1.9)
Sadeghian et al., 2013, Iran	Baseline and one year follow-up	Nurses (218) Office workers (165)	<u>Baseline</u> Self administered questionnaire asking about demographic details, physical work factors, psychosocial aspects of work, mental health, somatising tendency and musculoskeletal pain of the neck and shoulders	Pain in the neck, right and left shoulders lasting a day or longer in the past month	<u>Incidence of neck/shoulder pain</u> <i>Occupational group</i> Nurses Office workers <i>Incentives</i> No Yes <i>Job dissatisfaction</i> No Yes	1 1.9 (1.3-2.8) 1 1.4 (1.0-2.0) 1 1.5 (1.0-2.1)

Table 1.3: Summary of studies on risk factors for incident and persistent pain in hospital nurses and other occupational groups cont'd

Study	Study design	Study group Sample size	Data collection tool	Outcome measure	Association	
					Outcome/explanatory variable	Point estimate (95% CI)
			<u>Follow-up</u> Musculoskeletal pain in the past month lasting a day or longer in the neck and shoulders		<u>Mental health</u> Good Intermediate Poor	1 1.3 (0.8-2.3) 1.8 (1.0-3.0)
Solidaki et al., 2012, Greece	Baseline and one year follow-up	Nurses Office workers Postal workers Total (518)	<u>Baseline</u> Self administered questionnaire about demographic details, physical work activities, psychosocial aspects of work, mental health somatising tendency, health beliefs and musculoskeletal pain of the low back, neck shoulders, elbows, wrists/hands and knees lasting for a least a day in the past year <u>Follow-up</u> Musculoskeletal pain in the low back, neck, shoulders, elbows, wrists/hands and knees lasting for at least one day in the past month	Multi-site pain (pain occurring at more than one site in the pain sites of interest in the study)	<u>Persistent multi-site pain</u> <u>Number of strenuous physical activities</u> 0-1 2 3 4-7 <u>Somatising tendency</u> 0 1 2+ <u>Beliefs about work causation</u> None Weak Strong	1 1.1 (0.4-2.6) 1.5 (0.6-3.4) 2.3 (1.0-5.6) 1 1.5 (0.8-3.1) 2.6 (1.5-4.6) 1 1.1 (0.6-2.3) 1.9 (1.1-3.3)
Vargas- Prada et al., 2013, Spain	Baseline and one year follow-up	Nurses (667) Office workers (438) Baseline (1105) Follow-up (971)	<u>Baseline</u> Computer assisted personal interviews asking about demographic details, occupational activities, health beliefs, mental health, somatising tendency and musculoskeletal pain lasting for at least a day in 10	Non disabling pain in the past month at follow-up Disabling pain in the past month at follow-up Incident non disabling pain Incident disabling pain Persistent non disabling pain	<u>Incident non-disabling pain</u> <u>Somatising tendency</u> 0 1 2+ <u>Incident disabling pain</u> <u>Somatising tendency</u> 0 1 2+	1 1.8 (1.2-2.6) 1.8 (1.1-3.0) 1 2.5 (1.7-3.7) 4.0 (2.5-6.4)

Table 1.3: Summary of studies on risk factors for incident and persistent pain in hospital nurses and other occupational groups cont'd

Study	Study design	Study group Sample size	Data collection tool	Outcome measure	Association		
					Outcome/explanatory variable	Point estimate (95% CI)	
			anatomical sites in the past month before baseline and whether the pain was disabling <u>Follow-up</u> Musculoskeletal pain lasting for at least a day in 10 anatomical sites in the past month before follow-up and whether the pain was disabling	Persistent disabling pain	<u>Persistent non-disabling pain</u> <i>Adverse beliefs about musculoskeletal pain</i> Prognosis <u>Incident disabling pain</u> <i>Adverse beliefs about musculoskeletal pain</i> Prognosis <u>Incident non-disabling pain</u> <i>Adverse beliefs about musculoskeletal pain</i> Prognosis <u>Persistent disabling pain</u> <i>Adverse beliefs about musculoskeletal pain</i> Prognosis	2.8 (0.9-8.7) 3.7 (1.1-12.5) 2.2 (0.9-5.2) 2.5 (1.2-5.5)	
Bonzini et al., 2015, Italy	Baseline and one year follow-up	Nurses (305)	<u>Baseline</u> Self-administered questionnaire about demographic details, work activities, stress at work (ERI) and musculoskeletal pain in the low back neck and shoulders <u>Follow-up</u> musculoskeletal pain in the low back neck and shoulders and ERI	Musculoskeletal pain lasting more than a day in the low back neck and shoulders in the past month and effort reward imbalance.	<u>Baseline</u> All LBP LBP with ERI>1 LBP with ER≤1 All NSP NSP with ERI>1 NSP with ERI≤1 Any pain with ERI>1 LBP with ERI>1 No pain with ERI>1 Any pain with ERI>1 NSP with ERI>1 No pain with ERI>1	<u>Follow-up</u> ERI>1 ERI>1 ERI>1 ERI>1 ERI>1 LBP LBP LBP NSP NSP NSP	2.1 (1.4-3.3) 0.9 (0.6-1.4) 2.7 (1.4-5.0) 2.3 (1.4-3.8) 1.1 (0.6-1.8) 2.6 (1.3-5.1) 1.2 (1.0-1.5) 1.0 (0.8-1.2) 1.2 (0.6-2.3) 1.2 (1.0-1.5) 1.1 (0.9-1.2) 0.9 (0.4-2.2)

1.3.2 MSDs in workers performing computer-telephone interactive tasks

Workers who perform computer-telephone interactive (CTI) tasks are at an increased risk of developing MSDs (Taylor et al., 2003, Toomingas and Gavhed, 2008). Their work involves using a computer while simultaneously talking over the telephone (Halford and Cohen, 2003). The CTI tasks form the main activity in call centres and office environments where communication for various industry groups including telecommunications and banking has been centralised and streamlined for efficient customer, sales and support services (Taylor et al., 2003, Croidieu et al., 2008). The ergonomic exposures of workers performing CTI tasks are similar to those of workers who use computers (Bergqvist et al., 1995, Sillanpää et al., 2003) but have additional exposures from the organisation of work which are unique to these tasks (Halford and Cohen, 2003, Toomingas et al., 2003).

The use of computers has long been associated with MSDs in workers from different occupational groups and workplaces (Bergqvist et al., 1995). As such, it is expected that workers who perform CTI tasks would have higher prevalences of MSDs (Sillanpää et al., 2003) than workers who use only computers (Jensen et al., 1998). The main risk factors that are associated with the development of MSDs in computer work are physical and psychosocial work factors (Bernard, 1997). The main physical factors are design and layout of the computer workstation which dictate the working posture. For instance, poor design and layout promote awkward posture (Marcus et al., 2002) which may lead to the development of MSDs. The psychosocial factors include poor job control, lack of social support, job insecurity and poor lighting.

1.3.2.1 Prevalence and body site localisation of MSDs in workers performing computer-telephone interactive tasks

Recent studies examining the prevalence of MSDs in workers performing computer-telephone interactive tasks are sparse. So are systematic literature reviews.

Workers who perform CTI tasks are found in many industries. However, only one systematic literature review of MSDs in workers in the telecommunications industry which included workers performing CTI tasks could be found (Crawford et al., 2008). A literature review was therefore, conducted on studies investigating the prevalence and body site localisation of MSDs in workers performing CTI tasks. These studies have been summarised and are presented in Table 1.5.

Five studies were reviewed and all were cross-sectional (Norman et al., 2004, Rocha et al., 2005, Sprigg et al., 2007, Norman et al., 2008, Fouad El-Bestar et al., 2011). Two used 12-month prevalence (Rocha et al., 2005, Fouad El-Bestar et al., 2011), another two used 1-month (Norman et al., 2004) and in one the period of prevalence was not stated. In all the studies, MSDs were measured by questionnaires. One study (Fouad El-Bestar et al., 2011), used clinical examination in addition to the questionnaire. The outcome measures were musculoskeletal symptoms and conditions occurring in the upper extremities and back. None of the studies included the lower limbs.

A study conducted in Sweden (Norman et al., 2004), investigated two groups of workers, one being call centre workers as the subjects and the other computer users as the reference group. The overall prevalence of symptoms among the call centre workers was higher than that of the reference group with women having a higher

prevalence than men. The prevalence in the body sites selected for the study followed a similar pattern with women having higher prevalences than men.

Table 1.4: Summary of studies on the prevalence and body site localisation of musculoskeletal pain in workers performing computer-telephone interactive tasks

Study	Study design	Study group (Sample size)	Outcome measure	Prevalence (%)				
				Any	Back and neck		Upper limb	
Norman et al., 2004, Sweden	Cross-sectional	Study group: Call centre operators Women (29) Men (28)	Symptom cases reporting pain or aches lasting for three days or more in the neck, scapular area, shoulders/upper arms, elbows/forearms, wrists, hands/fingers, upper back and lower back in the past month	86.0	Upper back	45.0	Scapular area	62.0
		68.0		Lower back	48.0	Shoulders/upper arms	41.0	
		Reference group: Other computer users Women (756) Men (470)		72.0	Neck	62.0	Elbows/forearms	31.0
				50.0	Upper back	7.0	Wrists	34.0
					Lower back	24.0	Hands/fingers	28.0
					Neck	23.0	Scapular area	21.0
							Shoulders/upper arms	17.0
							Elbows/forearms	13.0
							Wrists	8.0
							Hands/fingers	7.0
Rocha et al., 2005, Brazil	Cross-sectional	Call centre operators Females (95) and Males (13)	Reporting of symptoms (pain, numbness, tingling and burning sensation and stiffness, in the neck/shoulder and wrists/hands in the past year				Neck/shoulders	43.0
							Wrists/hands	39.0
							Neck/shoulders	8.0
							Wrists/hands	0.0
Sprigg et al., 2007, United Kingdom	Cross-sectional	Call centre operators (936) from:	Reporting of musculoskeletal disorders in the upper body (neck shoulders and upper back), lower back and arms (elbows, wrists and hands)	45.0	Upper body		Arms	
		34.0		Low back				
		Telecommunications and IT (200)		18.0				
					Upper body	46.0	Arms	17.0
					Low back	33.0		

Table 1.4: Summary of studies on the prevalence and body site localisation of musculoskeletal pain in workers performing computer-telephone interactive tasks cont'd

Study	Study design	Study group (Sample size)	Outcome measure	Prevalence (%)				
				Any	Back and neck		Upper limb	
		Financial services (193)			Upper body	8.0	Arms	15.0
				Low back	27.0			
		Retail (150)			Upper body	43.0	Arms	19.0
				Low back	37.0			
		Utilities (138)			Upper body	45.0	Arms	16.0
				Low back	33.0			
		Hotels and leisure (82)			Upper body	59.0	Arms	15.0
				Low back	41.0			
		Public and voluntary sector (81)		Upper body	53.0	Arms	25.0	
				Low back	28.0			
		Transport and travel (58)		Upper body	48.0	Arms	24.0	
				Low back	48.0			
		Emergency services (19)		Upper body	53.0	Arms	21.0	
				Low back	37.0			
		Outsourcing (15)		Upper body	27.0	Arms	27.0	
				Low back	47.0			
Norman et al., 2008, Sweden	Cross-sectional	Call centre (CC) operators (1183)	Reported musculoskeletal pain or aches in the neck/shoulder (neck and or shoulder/scapular area), arms/hands (shoulder joints/upper arms, elbows/lower arms, wrists and or hands and numbness in hands) in the past month		Neck/shoulders	65.0	Arms/hands	49.0
							Neck/shoulder only	25.0
							Shoulder joint/upper arm only	2.0
							Elbows/lower arms, wrists/hands and numbness in hands only	6.0

Table 1.4: Summary of studies on the prevalence and body site localisation of musculoskeletal pain in workers performing computer-telephone interactive tasks cont'd

Study	Study design	Study group (Sample size)	Outcome measure	Prevalence (%)				
				Any	Back and neck		Upper limb	
		Internal CCs (510)			Neck/shoulders	64.0	Arms/hands	51.0
							Neck/shoulder only	22.0
							Shoulder joint/upper arm only	2.0
							Elbows/lower arms, wrists/hands and numbness in hands only	6.0
		External CCs (673)			Neck/shoulders	67.0	Arms/hands	48.0
							Neck/shoulder only	27.0
							Shoulder joint/upper arm only	1.0
							Elbows/lower arms, wrists/hands and numbness in hands only	6.0
El-Bestar et al., 2011, Egypt	Cross-sectional	Telecommunication workers	Musculoskeletal symptoms (pain, stiffness, numbness and tingling or muscle weakness that had lasted over a year. Those with symptoms and satisfied certain conditions were sent for clinical examination and investigation for musculoskeletal conditions of the neck/upper extremity)	28.3				
		Subjects: Telephone and computer users (60)			Cervical spondylosis	18.3	Carpal tunnel syndrome	6.6
					Cervical disc space narrowing	18.3		

Table 1.4: Summary of studies on the prevalence and body site localisation of musculoskeletal pain in workers performing computer-telephone interactive tasks cont'd

Study	Study design	Study group (Sample size)	Outcome measure	Prevalence (%)				
				Any	Back and neck		Upper limb	
		Controls: Non-computer users (35)			Cervical radiculopathy	10.0	Carpal tunnel syndrome	0.0
				Thoracic outlet syndrome	3.3			
				Cervical spondylosis	11.4			
				Cervical disc space narrowing	11.4			
				Cervical radiculopathy	2.8			
				Thoracic outlet syndrome	2.8			

A similar pattern was observed in another study conducted in Brazil (Rocha et al., 2005), where female call centre operators had higher prevalences of symptoms in the body sites selected for the study than males.

A study examining working practices and MSDs in call centre workers from nine industries was conducted in the United Kingdom (Sprigg et al., 2007). The prevalence of symptoms in the body sites of interest in the study showed that the upper body had the highest prevalence of symptoms with a range of 27.0%-59.0% from "Outsourcing" on the lowest end and "Hotel and leisure" on the upper end. Low back was next with "Financial services" having the lowest prevalence (27.0%) and "Transport and travel" having the highest (48.0%). Finally, the prevalence for the arms ranged from 15.0%-27.0% with "Financial services" having the lowest prevalence and "Outsourcing" the highest.

Two comparative studies, one conducted in Sweden (Norman et al., 2008) and the other in Egypt (Fouad El-Bestar et al., 2011) are of interest. The Swedish study compared reported MSD pain in call centre (CC) workers in internal (departments or separate companies within larger corporations) and external (independent companies working on contracts from other companies) CCs while the Egyptian study compared diagnosed MSD conditions in telecommunications workers who were doing CTI tasks (subjects) and other workers who were not using computers (controls). In the Swedish study, the prevalences of pain in the body sites of interest in the study were similar. On the other hand, there were differences in the prevalences of MSD conditions of interest between the subjects and controls in the Egyptian study. The subjects had higher prevalences than the controls.

The reviewed studies were heterogeneous which presented a challenge when trying to summarise and integrate their findings (Armstrong et al., 1996). The differences were in the measurement tools, disease frequency estimates and outcome measures used. The cross-sectional study design, which was common in all the studies, brought a limitation of temporality between exposure and effect which complicates assessing causality.

1.3.2.2 Features and functional consequences of MSDs in workers performing computer-telephone interactive tasks

In the studies of MSDs in workers performing computer-telephone interactive tasks the features and functional consequences of MSDs have been used to indicate the presence of MSDs and their severity. In most of these studies, pain which is the main symptom of MSDs, was used as a feature which differentiates between workers with MSDs and those without or those who are cases and not cases (Rocha et al., 2005, Norman et al., 2008). In other studies, pain is used in combination with its duration in days for the same purpose mentioned above (Ferreira and Saldiva, 2002, Toomingas et al., 2003, Norman et al., 2004). A few studies have gone a step further to examine the functional consequences of MSDs which are a function of pain (Ferreira and Saldiva, 2002, d'Errico et al., 2010).

A study investigating working conditions and MSDs among workers in a call centre of a bank in Brazil (Rocha et al., 2005), used pain as one of the symptoms of neck or shoulder and wrist or hand MSDs to distinguish between workers with MSDs of these body sites and those without. Another study assessing the associations between work exposures and MSDs in internal and external call centres in Sweden

(Norman et al., 2008), used pain to make a distinction between workers with MSDs of the neck or shoulder and arm or hand and workers who did not have these MSDs. Studies from the same countries (Brazil and Sweden) mentioned above used pain, duration of pain and the number of days with pain to differentiate between workers with MSDs and those without. Ferreira (2002) studied the predictors of MSDs in workers involved in computer-telephone interactive tasks in a call centre of a bank in Brazil. The workers with MSDs had to have more than seven days of pain in the neck, shoulders, elbows, hands and wrists. In the Norman (2004) study, which evaluated working conditions and MSDs in female and male employees in a call centre in Sweden, the workers with MSDs of the neck, scapular area, shoulder or upper arm, upper back, elbow or forearm, wrist, hand or finger and lower back had to have pain for three days or more.

The severity of MSDs in workers doing CTI tasks has been reported in studies that include functional consequences of MSDs. These include days taken away from work, physician consultations and treatments due to MSDs. A study conducted in France, to examine the impact of working conditions on the health of call centre employees found that nearly half of the employees with various MSDs had consulted a doctor and up to 80.0% of these had received medical treatment for the MSDs (Charbotel et al., 2009). The inclusion criteria for MSDs in the d'Errico (2010) study was that the workers had to have consulted a physician and or taken medication for MSDs. The study evaluated whether the risk factors for neck or shoulder and elbow or wrist or hand MSDs were different in call centre workers in Italy. The study found that more than half of the workers with MSDs met these criteria (d'Errico et al.,

2010). These studies demonstrate the impact of some features that MSDs impose on workers doing CTI tasks.

1.3.2.3 Risk factors for MSDs in workers performing computer-telephone interactive tasks

The studies investigating the risk factors associated with MSDs in workers performing computer-telephone interactive tasks have suggested that the risk factors in these workers are multifactorial. This was supported by a systematic literature review on MSDs in the United Kingdom's telecommunications industry by Crawford (2008), which surmised that the risk factors for MSDs in telecommunications workers involved in CTI tasks in call centres comprise physical, psychosocial and individual factors. These categories of risk factors are similar to those used in the National Academy of Sciences conceptual model of possible involvement and influence of risk factors in the development of MSDs presented in 1.3.1.3 (Barondess et al., 2001). Using this model, the workplace can be replaced by the call centre where the CTI tasks are carried out. The worker can be replaced by call centre workers involved in CTI tasks. In this context, the call centre and the CTI tasks are possible sources of physical and psychosocial risk factors while the workers doing the CTI tasks represent the individual risk factors.

The configuration of the computer-telephone workstation may present physical risk factors to the workers while psychosocial risk factors may emanate from the management including electronic monitoring of CTI tasks. Individual risk factors consist of physical activities and social aspects of life such as participation in sports and smoking respectively; and biological characteristics comprising age and sex; and lastly, psychological characteristics with mental health and somatising tendency as some of the factors. The information presented in 1.3.1.3 applies here as well.

1.3.2.3.1 Risk factors for prevalent MSDs in workers performing computer-telephone interactive tasks

The studies investigating MSDs and associated risk factors in workers performing computer-telephone interactive tasks have been mainly prevalence studies of prevalent MSDs. Prevalent MSDs provide an estimate of the size of the MSD problem in the at risk population which in this case is the workers performing CTI tasks (Toomingas and Gavhed, 2008, Charbotel et al., 2009). Potential risk factors have been sought in different workplaces across many industries (Ferreira et al., 1997, Halford and Cohen, 2003). Although studies have been done in many industries, only one systematic literature review of MSD studies in the telecommunications industry which included workers doing CTI tasks could be found (Crawford, 2008). This review presented a synopsis of the potential risk factors in workers doing CTI tasks. A literature review of studies examining the risk factors associated with prevalent MSDs in workers performing CTI tasks was therefore conducted. The summary of the studies reviewed is presented in table 1.6.

The reviewed studies were mainly cross-sectional and used 12-month and 1-month period prevalences of MSD symptoms. It has been said that the exposures from CTI tasks affect the upper extremities which are constituted by the neck, shoulders, elbows, wrists and hands. It is, therefore, not surprising that all of the reviewed studies used the upper extremities as the outcome variable which was divided into neck or shoulders and wrists or hands. It has been suggested that some of the risk factors for these two locations are different (Halford and Cohen, 2003). As such, the outcome variables are organised according to neck or shoulder, wrist or hand following the nomenclature of the National Academy of Sciences (2001) conceptual

model categories of risk factors (physical, psychosocial and individual) presented in 1.3.1.3.

1.3.2.3.1.1 Physical, psychosocial and individual risk factors for prevalent MSDs of the neck or shoulders

Comfort of the work environment was identified as a physical risk factor associated with neck or shoulder MSDs which incorporated workstation design and layout and physical environmental factors by some studies (Ferreira and Saldiva, 2002, Norman et al., 2008) while others used actual terms such as thermal comfort (Rocha et al., 2005) and insufficient desk lighting (d'Errico et al., 2010). In the Ferreira (2002) study, psychosocial risk factors were also incorporated into the said physical risk factor. Rest breaks (Rocha et al., 2005, Norman et al., 2008), psychological demand and social support (Norman et al., 2008), stress levels (Lin et al., 2009) and job control (d'Errico et al., 2010) were all associated with neck or shoulder MSDs.

The association of age with neck or shoulder MSDs was inconsistent showing a positive relationship in one study (d'Errico et al., 2010) and no relationship in other studies (Norman et al., 2008, Lin et al., 2009) while length of service showed consistency in the two studies which included it (Lin et al., 2009, d'Errico et al., 2010). Gender (female) was consistently associated with neck or shoulder MSDs in the studies that included it (Norman et al., 2008, Lin et al., 2009, d'Errico et al., 2010).

1.3.2.3.1.2 Physical, psychosocial and individual risk factors for prevalent MSDs of the wrists or hands

Comfort of the work environment was also associated with wrist or hand MSDs (Ferreira and Saldiva, 2002, Norman et al., 2008) and in the study of d'Errico (2010), insufficient work space and lack of forearm support were determinants. In the same

way as in the neck or shoulder MSDs, psychosocial risk factors were incorporated into the physical risk factor (Ferreira and Saldiva, 2002). Iso-strain, which is the combination of job demand, control and social support (Norman et al., 2008) and job security (d'Errico et al., 2010), were associated with wrist or hand MSDs. The individual risk factor associated with wrist or hand MSDs was age (Norman et al., 2008, Lin et al., 2009). It is important to note that in the Lin (2009) study, MSDs were not differentiated into neck or shoulder and wrists or hands but were referred to as musculoskeletal discomfort.

The heterogeneity of studies was noted in so far as measurement methods, outcome measures and risk factors are concerned. This makes it difficult to summarise the findings and to compare and contrast the studies as has been pointed out by others (Hagberg et al., 2012, Armstrong et al., 1996). The preponderance of cross-sectional studies with sparse systematic literature reviews limits their ability to establish a causal relationship between the risk factors and MSDs (da Costa and Vieira, 2010).

Table 1.5: Risk factors for musculoskeletal disorders in workers performing computer-telephone interactive tasks

Study	Study design	Study group; sample size (response rate)	Data collection tool	Outcome measure	Association	
					Outcome/ explanatory variable	Point estimate (95% CI)
Ferreira and Saldiva, 2002, Brazil	Retrospective twice weekly follow-ups from October 1995-January 1996	Call centre operators in a bank (62) Active telemarketing centre (24) Telephone call centre (38)	Interviews of managers, supervisors and operators to identify features of the operations; observations and measurements of workstations and physical environment; self administered questionnaire about demographic details, musculoskeletal symptoms, exercises during rest, ergonomics of workstation, work equipment, information network, work organisation and social environment.	Reports of musculoskeletal symptoms (pain, prickling, stiffness et cetera) in the neck and or shoulder, hand and or wrist lasting over seven consecutive days an time in the current job	<u>Incident neck or shoulder</u> Active telemarketing	-
					<u>Incident hand or wrist</u> Active telemarketing	-
Rocha et al., 2005, Brazil	Cross-sectional	Operators at a telephone call centre Females (95) Males (13)	An ergonomic work analysis tool of the activities performed in the call centre and questionnaire (not specified) to collect demographic details, psychosocial and physical risk factors and presence of musculoskeletal symptoms in the past year	Reporting of symptoms (pain, numbness, tingling and burning sensation and stiffness, in the neck/shoulder and wrists/ hands in the past year	<u>Neck/shoulder</u> <i>Daily rest breaks for recovery</i> Three/more One /Two <i>Thermal comfort</i> Good/regular Bad <u>Wrist/hands</u> <i>Calls answered daily</i> ≤140 >140	1 3.17 (1.11-8.97) 1 3.06 (1.09-8.62) 1 3.36 (1.16-9.71)
Norman et al., 2008, Sweden	Cross-sectional	Call centre (CC) operators (1183) Response rate (77.0%) Internal CC (510) External CC (673)	A self administered questionnaire about demographic details, characteristics of work, physical and psychosocial exposures and musculoskeletal symptoms in the past month	Reported musculoskeletal pain or aches in the neck/shoulder (neck and or shoulder/scapular area), arms/hands (shoulder joints/upper arms, elbows/lower	<u>Neck/shoulder</u> <i>Gender</i> Men Women <i>Age (continuous)</i> <i>Complexity of work</i> High Medium Low	<u>Internal CC</u> 1 2.26 (1.35-3.76) 1.01 (0.99-1.03) 1 1.02 (0.57-1.82) 2.41 (1.08-5.40) <u>External CC</u> 2.23 (1.42-3.48) 0.99 (0.98-1.01)

Table 1.5: Risk factors for musculoskeletal disorders in workers performing computer-telephone interactive tasks cont'd

Study	Study design	Study group; sample size (response rate)	Data collection tool	Outcome measure	Association		
					Outcome/ explanatory variable	Point estimate (95% CI)	
				arms, wrists and or hands and numbness in hands) in the past month	<i>Total time of customer calls/day</i>	<u>Internal CC</u>	<u>External CC</u>
					≤240 minutes	1	1
					>240-≤330 minutes	3.47 (1.50-8.03)	0.65 (0.35-1.23)
					>330-≤420 minutes	1.76 (0.92-3.34)	1.16 (0.66-2.03)
					>420 minutes	0.98 (0.45-2.13)	1.21 (0.68-2.16)
					<i>Average duration of calls</i>		
					≤120 seconds	1	1
					>120-≤180 seconds	1.84 (0.91-3.72)	0.33 (0.19-0.58)
					>190-≤300 seconds	2.00 (1.00-3.98)	0.82 (0.45-1.47)
					>300 seconds	1.84 (0.85-3.99)	0.79 (0.41-1.51)
					<i>Continuous computer work without a break > 10 minutes</i>		
					≤90 minutes		1
					>90-≤120 minutes		1.00 (1.14-4.74)
					>120-≤150 minutes		2.33 (1.14-4.74)
					>150 minutes		0.31 (0.71-2.40)
					<i>Comfort of work environment</i>		
					High (≤300)	1	1
					(>30-≤36)	0.72 (0.39-1.32)	0.25 (0.72-2.16)
					(>36-≤43)	1.33 (0.69-2.56)	1.88 (1.05-3.38)
					Low (>43)	6.63 (2.46-17.90)	3.07 (1.67-5.64)
				<i>Psychological demands</i>			
				Low(≤98)	1	1	
				(>98-≤113)	1.52 (0.78-2.97)	0.88 (0.52-1.56)	
				(>113-≤127)	2.10 (1.06-4.17)	1.56 (0.86-2.82)	
				High(>127)	1.38 (0.70-2.69)	0.88 (0.50-1.57)	

Table 1.5: Risk factors for musculoskeletal disorders in workers performing computer-telephone interactive tasks cont'd

Study	Study design	Study group; sample size (response rate)	Data collection tool	Outcome measure	Association	
					Outcome/ explanatory variable	Point estimate (95% CI)
					<i>Social support</i>	<u>Internal CC</u> <u>External CC</u>
					High(≤14)	1
					(>14-≤17)	1.66 (0.95-2.92)
					(>17-≤21)	1.46 (0.88-2.43)
					Low(>21)	1.99 (1.06-3.71)
					<i>Support from supervisor</i>	
					High(≤18)	1
					(>18-≤24)	2.00 (1.03-3.87)
					(>24-≤29)	1.88 (0.92-3.87)
					Low(>29)	1.75 (0.84-3.66)
					<u>Arms/hands</u>	<u>Internal CC</u> <u>External CC</u>
					<i>Gender</i>	
					Men	1 1
					Women	2.92 (1.62-5.25) 1.88 (1.17-3.03)
					<i>Age (continuous)</i>	1.03 (1.00-1.06) 1.01 (0.99-1.03)
					<i>Complexity of work</i>	
					High	1
					Medium	1.07 (0.57-2.01)
					Low	2.58 (1.07-6.26)
					<i>Total time of customer calls/day</i>	
					≤240 minutes	1 1
					>240-≤330 minutes	5.89 (2.30-15.09) 0.57 (0.29-1.12)
					>330-≤420 minutes	2.05 (1.00-4.21) 1.01 (0.55-1.84)
					>420 minutes	1.61 (0.66-3.94) 0.91 (0.49-1.68)
					<i>Average duration of calls</i>	
					≤120 seconds	1 1
					>120-≤180 seconds	2.48 (1.10-5.59) 0.34 (0.19-0.60)
					>190-≤300 seconds	2.01 (0.91-4.46) 0.63 (0.33-1.20)
					>300 seconds	2.18 (0.91-5.26) 0.84 (0.42-1.69)

Table 1.5: Risk factors for musculoskeletal disorders in workers performing computer-telephone interactive tasks cont'd

Study	Study design	Study group; sample size (response rate)	Data collection tool	Outcome measure	Association		
					Outcome/ explanatory variable	Point estimate (95% CI)	
					<i>Continuous computer work without a break > 10 minutes</i> ≤90 minutes >90-≤120 minutes >120-≤150 minutes >150 minutes <i>Comfort of work environment</i> High (≤300 (>30-≤36) (>36-≤43) Low (>43) <i>Psychological demands</i> Low(≤98) (>98-≤113) (>113-≤127) High(>127) <i>Decision latitude</i> Low(≤98) (>98-≤113) (>113-≤127) High(>127) <i>Support from supervisor</i> High(≤18) (>18-≤24) (>24-≤29) Low(>29)	<u>Internal CC</u> 1 0.93 (0.56-1.55) 2.48 (1.19-5.19) 1.46 (0.78-2.75) 1 0.68 (0.33-1.39) 1.63 (0.78-3.38) 9.61 (3.11-29.72) 1 1.55 (0.71-3.38) 2.49 (1.13-5.48) 1.49 (0.70-3.18) 1 1.28 (0.63-2.60) 2.45 (1.06-5.69) 0.65 (0.29-1.46) 1 3.59 (1.66-7.79) 3.07 (1.34-7.05) 2.58 (1.13-5.86)	<u>External CC</u> 1 1.66 (0.91-3.01) 2.59 (1.40-4.79) 4.07 (2.14-7.72) 1 1.68 (0.94-3.02) 1.73 (0.96-3.12) 2.43 (1.25-4.75)
Lin et al., 2009 Taiwan	Cross-sectional	Call centre operators (1023)	Self-administered questionnaire asking about demographic details, perceived job stress, major job stress factors, psychosocial job characteristics and musculoskeletal discomfort in the past 12 months	Musculoskeletal discomfort of moderate and severe rating occurring in the past 12 months	<u>Musculoskeletal discomfort</u> <i>Gender</i> Men Women <i>Age group (years)</i> <25 25-34 >34	1 2.24 (1.54-3.26) 1 0.97 (0.63-1.51) 1.42 (0.72-2.78)	

Table 1.5: Risk factors for musculoskeletal disorders in workers performing computer-telephone interactive tasks cont'd

Study	Study design	Study group; sample size (response rate)	Data collection tool	Outcome measure	Association	
					Outcome/ explanatory variable	Point estimate (95% CI)
					<i>Length of employment (years)</i>	
					≤1	1
					1-2	1.64 (1.11-2.41)
					2-4	1.67 (1.09-2.55)
					>4	1.72 (1.06-2.79)
					<i>Employment status</i>	
					Part time	1
					Full time	1.59 (1.00-2.51)
					<i>Marital status</i>	
					Single	1
					Married	1.22 (0.78 -1.90)
					Children	
					No	1
					Yes	1.30 (0.73-2.31)
					<i>Stress levels</i>	
					Low	1
					Intermediate	2.00 (1.29-3.10)
					High	2.60 (1.61-4.19)
d'Errico et al., 2010 Italy	Cross-sectional	Call centre operators (775)	Self administered questionnaire about socio-demographic details working conditions and musculoskeletal disorders that resulted in consulting a doctor or taking medication because of the symptoms in the past four weeks	Musculoskeletal symptoms (pain, burning sensation, stiffness, numbness or tingling in the neck/shoulder and elbow/wrists/hands that resulted in consulting a doctor or taking medication at any time during the past 28 days	<u>Neck/shoulder</u>	
					Elevated noise	1.28 (1.07-1.52)
					Not possible to lean back while sitting	1.27 (1.05-1.52)
					Insufficient desk lighting	1.27 (1.05-1.53)
					<i>Job control</i>	
					Middle tertile	1.30 (1.02-1.64)
					Low tertile	1.25 (0.98-1.60)
					Previous injuries	1.83 (1.55-2.16)
					Chronic diseases	1.39 (1.16-1.62)
					Female gender	1.30 (1.06-1.59)

Table 1.5: Risk factors for musculoskeletal disorders in workers performing computer-telephone interactive tasks cont'd

Study	Study design	Study group; sample size (response rate)	Data collection tool	Outcome measure	Association	
					Outcome/ explanatory variable	Point estimate (95% CI)
					Age	
					30-39	1.38 (1.11-1.71)
					40-49	1.27 (0.98-1.65)
					>49	1.43 (1.09-1.89)
					<u>Elbow, wrists/hand</u>	
					Insufficient working space	1.78 (1.15-2.76)
					Lack of forearm support	1.63 (1.10-2.43)
					Job insecurity	2.24 (1.33-3.75)
					2-3 seconds interval between calls	2.15 (1.25-3.71)
					<2 seconds time interval between calls	1.79 (1.00-3.19)
					<i>CC seniority (years)</i>	
					4-6	1.34 (0.73-2.47)
					>6	1.82 (1.09-3.04)
					Education status	
					High school degree	2.07 (0.84-5.06)
					Less than high school degree	2.99 (1.15-7.79)
					Previous injuries	1.94 (1.29-2.92)

1.3.3 MSDs and ethnicity

The multifactorial nature of MSDs brings in a host of risk factors that belong to the individual dimension under psychosocial risk factors. The term “psychosocial” in occupational health is used to describe a number of factors considered to be non-physical, including culture and societal factors (Bernard, 1997, Feuerstein et al., 2004). Psychosocial factors used to be considered as confounders in the past, but now are treated as independent risk factors for MSDs (Feuerstein et al., 2004). In recent years, the number of epidemiological studies that includes psychosocial factors has increased (Faucett, 2005). This interest in psychosocial factors in MSD studies has been generated by the observed variation in subjective responses to physical exertion and muscle loading, and variation in severity of MSD symptoms (Feuerstein et al., 2004). These factors present opportunities for intervention.

one psychosocial factor, ethnicity, refers to the social or cultural heritage that a particular group shares in terms of customs, language, values, religion, social ties and habits passed down from one generation to the next (Dalton et al., 2001). The relationship between ethnicity and pain intensity has long been recognised. It has been suggested that psychological and cognitive variables are heavily influenced by socio-cultural learning and experiences which have an impact on the physiological processes involved in human pain perception and response (Melzack & Wall, 1967,1970). A literature review on South Asian migrants in the United Kingdom reported that the migrants experienced more musculoskeletal pain than indigenous UK Whites (Njobvu et al., 1999). It was not clear whether this was due to real differences between the groups or just perceptions about pain.

A school of thought proposing that the genesis of MSDs is as a result of a psychologically mediated response to an external trigger such as workplace exposure that is conditioned by individual characteristics and cultural circumstances is emerging (Coggon, 2005). This theory was born from observations made in different countries, where in one a major epidemic of repetitive strain injuries that was not paralleled in other countries occurred in the 1980s (Gun, 1990). In another country, from 1953 to 1992, there was a seven fold increase in rates of incapacity for work due to MSDs of the back at the time when physical work demands were decreasing. These observations show geographical variations and time trends which cannot be accounted for by workplace activities (Coggon, 2005). It is believed that if the theory is tested and proven correct, it will have practical implications for the prevention and management of MSDs.

A prospective follow-up study was conducted for up to three years in the United States on 632 newly employed computer users to examine the relationship between musculoskeletal symptoms and MSDs and associated risk factors (Gerr et al., 2002). Questionnaires were completed about demographic details, personal history and upper limb musculoskeletal symptoms (defined by criteria on symptoms, severity and consequences) at study entry. Upper limb musculoskeletal symptoms were divided into neck or shoulder and hand or arm musculoskeletal symptoms. Computer users who did not report musculoskeletal symptoms at study entry filled in daily diaries about work practices and new musculoskeletal symptoms. Those who developed new musculoskeletal symptoms were examined for specific diagnosis of MSD.

The study group was young, predominantly female and had tertiary education. Most of them were working as secretaries and had more than two years experience using

computers. Less than half were designated as non-Whites. Female gender and previous history of upper limb pain predicted upper limb musculoskeletal symptoms and MSDs. Age and ethnicity (non-White) predicted neck or shoulder musculoskeletal symptoms and MSDs while period of past computer use predicted hand or arm musculoskeletal symptoms and MSDs. The study used a prospective design which satisfied the temporality criterion of exposure before the effect. The exclusion of other domains of MSD risk factors during multivariate analysis may have biased the results.

A study to investigate cross-cultural differences between 393 Dutch nursing personnel and 351 Greek nurses compared risk factors for MSDs, MSD occurrence and related consequences in the two groups (Alexopoulos et al., 2006). The same self-administered questionnaire was used in both groups of nurses to collect information on individual, physical and psychosocial risk factors; occurrence of MSDs in the past 12 months; related sickness absence and medical care seeking.

As expected, female nurses were predominant in both groups. The majority of Greek nurses had higher education levels and longer service than Dutch nurses. A higher proportion of Greek nurses compared to Dutch nurses were exposed to physical risk factors known to affect the low back and neck. It was thus not surprising that Greek nurses had a higher prevalence of low back and neck MSDs than Dutch nurses. Sickness absence due to MSDs was similar in both groups. Although similar proportions of nurses in both groups sought medical care, the Greek nurses consulted medical specialists while Dutch nurses consulted general practitioners. Awkward back postures and moderate perceived general health were found to be associated with low back MSDs in both groups.

The Dutch and Greek nurses reported high prevalences of MSDs with low back having the highest prevalence. Physical load was more important than psychosocial load as it was found to be associated with low back MSD in both groups. The results of this study suggest that cross-cultural differences between Dutch and Greek nurses may have not played a role in the reporting of MSDs and their risk factors. Medical care seeking reflects the differences between the Dutch and Greek health care systems.

A study examining MSDs, the influence of acculturation and psychosocial aspects of work on MSDs was conducted among 156 migrant women workers comprising 62 Thai, 28 Vietnamese and 66 Filipino living in Korea (Lee et al., 2011). Information on socio-demographic details, acculturation strategy, psychosocial aspects of work and MSDs was collected using a structured questionnaire. There were no significant differences in the socio-demographic details of the women except for age and daily working hours. The Vietnamese women were younger than the Filipino women who had fewer daily working hours than Thai women.

The overall prevalence of any MSD was higher in Vietnamese and lower in Filipino women. As a group, the women preferred the separation strategy of acculturation with no significant differences in the total mean scores of acculturative stress in the subgroups. The subscales that showed differences were perceived discrimination, homesickness and perceived hate. Vietnamese were less likely to feel discrimination than Thai, but felt more homesick than Thai and Filipino women, and were less likely to perceive hate. Regarding psychosocial aspects of work, there were significant differences among the subgroups. Of note were the higher demand, lower control, higher interpersonal conflict and higher job insecurity among

Vietnamese women than the other groups. As expected, the Vietnamese women were at a high risk of developing MSDs. The separation strategy of acculturation was found to be associated with MSDs in all the women. No association was found with psychosocial aspects of work.

The findings of this study should be interpreted with the limitations in mind, which included sample size, sampling strategy, low reliability of internal consistency for psychosocial aspects of work domain, the fact that physical factors were not considered, and the cross-sectional study design.

A cross-sectional study on psychosocial and cultural influences on MSDs was conducted in 193 Brazilian and 558 Italian hospital nurses to compare the prevalence of MSDs and their association with physical and psychosocial risk factors (Carugno et al., 2012). Information on demographic details, individual, physical and psychosocial risk factors and occurrence of MSDs with related disability and sickness absence was obtained through self-administered questionnaires which were specifically designed for the CUPID project.

As expected, the majority of nurses were female with similar distribution of sex in the two groups. The Brazilian nurses were older, with a longer duration of service and a higher percentage of full time hours worked per week compared to the Italian nurses who had a higher proportion of lifting heavy loads and working with hands above shoulder height. A higher proportion of Brazilian nurses was satisfied with their jobs and had poor mental health compared to Italian nurses. Lastly, both groups reported similar percentages of two or more distressing somatic symptoms (somatising tendency).

MSD prevalences in the past month were similar for low back and neck while, for the shoulders, it was higher in Brazilian than Italian nurses. In both groups, lifting of heavy loads was not associated with MSD of the low back. Neck and shoulder MSDs were associated with working with hands above shoulder height in both groups. Somatising tendency in both Italian and Brazilian nurses was associated with all the MSDs of interest in the study including disabling and multi-site pain and sickness absence. There were no marked differences in the MSD prevalences and psychosocial risk factors identified in the two groups of nurses despite possible differences in cultural and social backgrounds.

1.3.4 Summary of reviewed MSD studies on hospital nurses, workers performing computer-telephone interactive tasks and ethnicity

MSDs were prevalent in both hospital nurses and workers performing CTI tasks.

The spine, upper limbs (and lower limbs, to a lesser extent) were the areas mostly investigated in nurses while the spine and upper limbs were the focus in workers performing CTI tasks. The main features which were used to characterise MSDs in both groups were pain and related consequences which included missing work, consulting health care providers and taking medicine.

Figure 1.2 shows the different dimensions of MSD risk factors reported in the studies and also demonstrates the multifactorial nature of MSDs (Punnett and Wegman, 2004, Punnett, 2014). The risk factors fall into two main categories: work and non-work risk factors, according to their origin (Barondess et al., 2001). The work risk factors from the workplace environment, activities, processes and organization fall into two subcategories consisting of physical and psychosocial work risk factors (Buckle and Devereux, 2002). Examples of physical risk factors for the nurses are manual patient handling (Smith et al., 2005) and working while bent and twisted (Choobineh et al., 2010), while for workers, doing CTI tasks are insufficient work space and lack of forearm support (d'Errico et al., 2010). Psychosocial risk factors for nurses are physical and psychological demands (Trinkoff et al., 2003) and conflicting demands (Choobineh et al., 2010) and, for workers doing CTI tasks are work demand, control and support (Norman et al., 2008) and number of calls answered in a day (Rocha et al., 2005).

Non-work risk factors encompass individual risk factors (Cole and Rivilis, 2004).

These risk factors represent the intrinsic and extrinsic aspects of the individual. The intrinsic aspects fall into two categories which are physiological and psychological

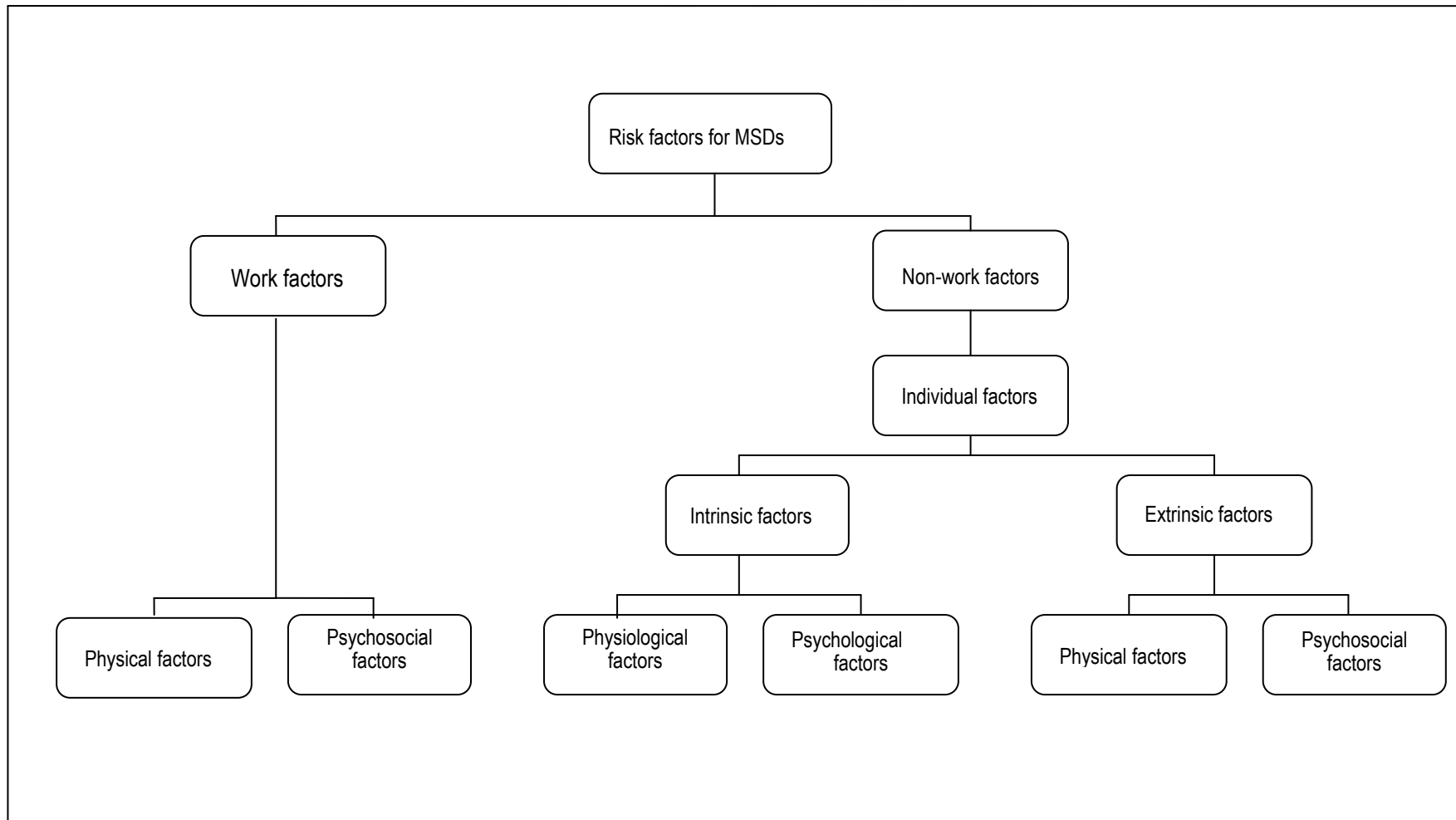


Figure 1.2: Categories of MSD risk factors extracted from the literature on MSDs in hospital nurses and workers performing computer-telephone interactive tasks

risk factors, while the extrinsic aspects comprise physical and psychosocial risk factors. The intrinsic risk factors for nurses are age, sex, BMI (Trinkoff et al., 2003) and perceived general health (Alexopoulos et al., 2003) and for workers doing CTI tasks, they are age, sex (Norman et al., 2008), and stress levels (Lin et al., 2009). Extrinsic risk factors for nurses are having other dependents (Trinkoff et al., 2003) and alcohol consumption (Smith et al., 2004a). For workers doing CTI tasks, these are having children (Lin et al., 2009) and education status (d'Errico et al., 2010).

The reviewed studies suggest that MSDs are predicted by ethnicity and also indicate that ethnicity may play a role in the development of MSDs through acculturation.

Another view is that ethnicity has no influence in the relationship between MSDs and their risk factors. Therefore, it can be concluded that the current information is inconsistent and that better designed studies are required to clarify the issue.

1.3.5 Study justification, aim and objectives

MSDs are one of the main causes of morbidity in the working population. Their impact is pervasive and permeates through society. Work has long been suspected of being involved in the development of MSDs. Bernardino Ramazzini gave descriptions of working postures which he thought led to the development of MSDs in the workers of his time. Later, epidemiological investigations provided credible evidence about physical work exposures as risk factors for MSDs. More recently, psychosocial aspects of work have been recognised as independent risk factors for MSDs. Interest in other factors of individual characteristics in the socio-cultural realm is growing. This includes factors such as ethnicity which has been associated with health outcomes in the past. Identification of risk factors that can be modified should be the goal in the prevention of MSDs.

1.3.5.1 Justification for the study

Hospital and call centre environments have been identified internationally as generators of risks for MSDs. This puts nurses and call centre workers at high risk of developing MSDs. Specifically, the source of risks has been traced to the work environment design and organisational factors which are thought to interact to produce MSDs.

Nurses are an indispensable resource in all countries of the world. They form pillars of healthcare systems. Their own health needs to be nurtured in order for the countries' healthcare systems to be able to deliver quality healthcare to their people. However, nursing has become a scarce skill for a number of reasons including MSDs. Nurses leave nursing or change their jobs due to MSDs as well as other

reasons. The prevention of MSDs can be used as one of several retention strategies for nurses.

Call centre companies experience high turnover of workers involved in CTI tasks partly because of working conditions that are high risk for MSDs. Conditions such as high job demand, low control and social support, electronic monitoring of calls and poor design of the workstations occur frequently in call centre companies. These companies end up experiencing high costs to recruit and train new staff. Identification of modifiable MSD risk factors should be a priority.

A number of potential MSD risk factors have been identified in studies on nurses and bank workers. However, very few studies have included socio-cultural factors which are now suspected of playing a role in the development of MSDs. In SA, MSD risk factors in nurses have remained largely unidentified and MSDs in bank workers have not been studied. There is need to test the hypotheses in the two groups of workers: the burden of MSDs is high; MSDs have a negative impact on workers and their places of work; prevalent MSD risk factors cover all domains of MSD risk factors; ethnicity influences the development of MSDs; and prevalent and persistent MSD risk factors in nurses are similar. South Africa, with its multicultural population provides a suitable target population to test these hypotheses.

1.3.5.2 Aim of the study

The main aim of the study was to assess the exposure- effect relationship between MSDs in the low back, neck, shoulders, elbows, hands or wrists, upper limbs and knees, and associated multi-dimensional risk factors comprising physical and psychosocial work factors and individual factors in the public hospital nurses and

bank workers. The nurses were working in high risk wards and the bank workers in call centres.

1.3.5.3 Objectives of the study

- i) To determine the 12-month prevalences and body site localisation of MSDs in South African public hospital nurses and bank workers.

- ii) To characterise the features and consequences of prevalent MSDs in South African public hospital nurses and bank workers.

- iii) To identify the risk factors associated with prevalent MSDs in South African public hospital nurses and bank workers.

- v) To determine incident and persistent MSDs in South African public hospital nurses.

- vi) To identify risk factors associated with persistent MSDs in South African public hospital nurses.

Chapter 2: Methodology

2.1 Introduction

In this chapter, details of the methods used in the study are presented. They cover three periods, namely pre data collection, data collection and post data collection.

Pre data collection incorporates study design, setting, population and sampling. Data collection includes data collection tools, interviewer training and quality assurance.

Finally, post data collection deals with data management and analysis.

2.2 Study design

The study used cross-sectional and follow-up designs. The cross-sectional study was conducted in two South African occupational groups: 1) public hospital nurses; and 2) bank workers. The follow-up was successful in public hospital nurses, who were re-evaluated on average \pm SD 12.2 \pm 0.2 months after baseline; range 11.2-13.0 months. The follow-up was unsuccessful in bank workers.

2.3 Study setting

The study was conducted in two public hospitals and a commercial bank as the plan was to recruit nurses and bank workers, respectively. Public hospital nurses experience high levels of MSDs yet the associated risk factors are largely unknown. MSDs in bank workers specifically, those who perform call centre work have not been studied in South Africa.

2.3.1 Selection of study sites

The selection of the two public hospitals and the commercial bank was strategic as they were located in Gauteng Province which has the largest population (12.3 million) in South Africa (Census, 2011). The population consists of all the different ethnic groups of South Africa which are pertinent to our study. The Black African group, which is mainly constituted by Sotho and Nguni ethnic groups, forms more

than three quarters of the Gauteng Province’s population. The remainder of the population comprises White, Coloured, Asian and “other” ethnic groups (Figure 2.1). These are population descriptors used by Statistics South Africa in census documents to describe the different ethnic groups of South Africa.

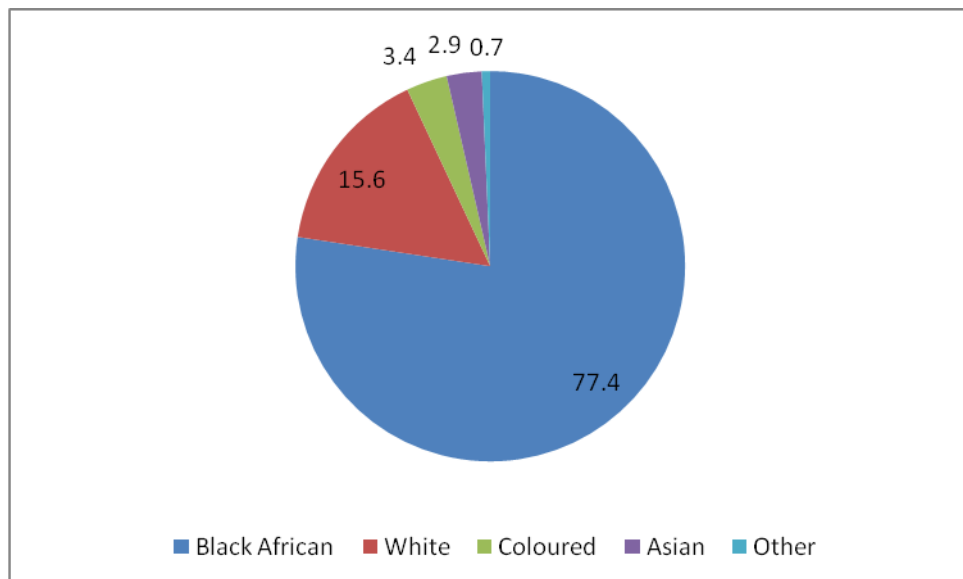


Figure 2.1: Gauteng ethnic groups (Census, 2011)

The hospital wards (Bernal et al., 2015) and bank call centre environment (Ferreira et al., 1997) were selected for the study because they have been reported in the literature to be high risk environments for MSDs .

2.3.1.1 Public sector hospitals

In South Africa, public sector hospitals substantially outnumber private sector hospitals. The public sector hospitals serve the majority (84.0%) of South Africans (Jobson, 2015), especially the poor who cannot afford to pay for medical services. Besides being public hospitals, the study hospitals were academic hospitals. Academic hospitals have added responsibilities of teaching and training the country’s health professionals. As a result, they are larger and have bigger populations than

the non-academic public hospitals. At the time of the study, there were 10 academic hospitals in South Africa, with four situated in the Gauteng Province (City Press, 2013). Two were located in Johannesburg and the other two in Pretoria. Due to resource constraints, it was decided that two hospitals would be studied. Hospital A and Hospital B, located in Johannesburg and Pretoria respectively, were selected to ensure that at least the main ethnic groups of South Africa are included in the study.

2.3.1.2 The banking industry

The banking industry in South Africa is well developed and effectively regulated (Matoti, 2014). However, it is dominated by four large banks which employ 133 210 workers which is 85.0% of the industry's staff composition of 156 718 employees. Sixty one percent (81 258) are based in the Gauteng Province (Matoti, 2014). Due to resource constraints, it was decided that one bank would be studied. Three of the four large banks were invited to participate in the study. The bank that satisfied all the requirements of the study was selected.

2.4. Hospital A

The hospital was accredited with over 1000 beds and provided general hospital services categorised as secondary, tertiary and highly specialised services. The staff complement was approximately 4000 healthcare workers of whom about 2000 were nurses.

2.4.1 Environment setting

The hospital building had nine storeys. The wards selected for the study fell under Casualty, Gynaecology and Obstetrics, Intensive Care Unit, Medical, Orthopaedic, Surgical and Theatre. There were 341 nurses working in these wards. The beds in the wards were not height adjustable which meant that they could not be adjusted to

the working height of the nurses. Lifting aids were not available. Patient handling tasks involved turning the patient on the bed; moving the patient from the bed to the chair and back to the bed; moving the patient from the bed to the stretcher or wheelchair and back to the bed. Other nursing tasks included making up beds, bathing patients, putting up drips, giving injections, drawing blood and giving medication.

2.4.2 Work organization

The nurses worked 12-hour day and night shifts. Day shift started at 06h00 and ended at 18h00, and night shift started at 18h00 and ended at 06h00. The shift schedules were organised in such a way that nurses worked 40 hours per week. Tea breaks in the morning and afternoon were 15 minutes each and lunch breaks were 30 minutes. The hospital did not have an occupational health service for healthcare workers and the nurses were not trained on ergonomics or good patient handling techniques.

2.5 Hospital B

Hospital B was a tertiary hospital that operated on a referral basis. The hospital provided specialised and highly specialised services including emergency specialised medical care. The hospital had over 800 beds and employed approximately 1600 nurses (Sr Montana, personal communication, 2016).

2.5.1 Environment setting

The hospital was a 10 storey building. The wards, lifting aids, patient handling tasks, nursing tasks and work organization were similar to those presented in 2.4.1. At the time of the study, there were 392 nurses working in the study wards. However, some wards in Hospital B were supplied with electric beds which were height adjustable.

Surprisingly, some of the nurses were not making use of this feature of the beds. It was observed that in some instances, the side of the bed with the height adjustment foot pedal was placed against the wall which made it inaccessible. Thus, the use of beds was not different from that in Hospital A which had non-adjustable beds.

2.5.2 Work organization

The working time arrangement and breaks were similar to those in Hospital A.

Hospital B had an occupational health service for its healthcare workers. Similar to Hospital A, the nurses were not educated and trained on ergonomics. However, a physiotherapist regularly trained the nurses once a month on good patient handling techniques which were reinforced by posters.

2.6 The bank

The study bank was situated in the Johannesburg central business district. It is purported to be the oldest bank in South Africa and had branches in a number of African countries (Net Industries, 2016). It provided banking services to over seven million customers across South Africa.

2.6.1 Environment setting

The bank had workers who were working in Home Loan Collection (HLC) and Credit Card Collection (CCC). These areas were referred to as Call Centres and the workers were using computers and telephones. In HLC, there were 150 workers while in CCC there were 140 workers. During one of the study preparatory meetings with the managers of these areas, a walkthrough of HLC and CCC was carried out by the principal investigator using the Health and Safety Executive Display Screen Equipment Guidance on Regulations. The office environment was open plan type with four-way computer workstations.

The workstations comprised chairs, computer and telephonic equipment and L-shaped wooden desks which were circumscribed by dividing boards. The chair back rests and arm rests were not height adjustable. The seat pans had rounded front edges and contoured surfaces which were big enough to accommodate the buttocks of the workers. Both the back rests and seat pans could not be adjusted independently. The controls for adjusting the height of the chair and the angle of the back rest simultaneously with the seat pan were positioned on the right hand side of the chair under the seat pan. The material covering the chairs was permeable and the base had five stars with casters. The computer equipment was of the Philips desk top type, model 1705 and the landline telephones were connected to hand sets and Plantronics headphones. It was observed that the staff did not have space for their personal belongings and most of them used cushions to support their backs. The windows were fitted with white vertical blinds, the floors were carpeted, and air conditioning was installed.

2.6.2 Work organization

HLC dealt with customers who were in arrears with their mortgage bonds while CCC dealt with customers who had exceeded their credit limits and those in arrears with their credit card payments. Both HLC and CCC were using a target system where workers had a target of 120 calls per day. The working hours for the HLC were from 08:00-16:30 from Monday to Friday and the workers were expected to work two Saturdays in a month from 08:00-12:00. In the CCC, the workers worked from 07:30-15:55 from Monday to Friday and did not work on Saturdays. For both HLC and CCC there were two 15-minute tea breaks in the morning and afternoon. The lunch break times differed - in the HLC it was one hour and 15 minutes and only one hour in the CCC. The minimum entry educational level required to work in these

areas was matriculation (12th grade) and workers received intensive training for one month after being employed. The workers in the HLC mentioned that they were shown how to adjust their chairs.

2.7 Study population

2.7.1 Hospitals A and B

The study population comprised men and women nurses of all ethnic groups who met the inclusion criteria for the study (Table 2.1). The nurses were excluded if they were contract nurses (may not fulfil the length of service required in the study and may not be available at follow-up) or student nurses, were working in wards not identified as suitable for the study, had a service of less than a year and were older than the usual working age (> 65 years). The wards in the following seven departments were identified as wards suitable for the study: Casualty; Gynaecology and Obstetrics; Intensive Care Unit; Medical; Orthopaedic; Surgical; and Theatre.

Table 2.1: Inclusion criteria for nurses in the study

Nurses who were employed on a permanent basis by the study hospitals
Nurses who were working in wards which were identified as suitable for the study
Nurses who had a service of at least one year
Nurses who were of usual working age (\leq 65 years)

2.7.2 The bank

The population selected for the study were men and women bank workers comprising all ethnic groups employed by the bank who worked in HLC or CCC (sections with workers involved in computer-telephone interactive tasks) and who met the inclusion criteria for the study (Table 2.2). Bank workers were included in the study, if they were permanently employed; were involved in CTI tasks; were

Table 2.2: Inclusion criteria for bank workers in the study

Bank workers who were employed on a permanent basis

Bank workers who were involved in computer-telephone interactive tasks

Bank workers who were working in HLC or CCC

Bank workers who had a service of ≥ 1 year

Bank workers who were of usual working age (≤ 65 years)

working in HLC or CCC; had a service of at least one year; and were of usual working age (≤ 65 years).

2.8 Sample size estimation

The sample size for this study was calculated using Stata 12 (Release 12.1 Statacorp, College Station, Texas, USA). Since low back pain is the most common MSD (Alexopoulos et.al, 2006), we decided to use an estimate of low back pain between nurses and computer operators from a previous study to derive our sample size and power (Warnakulasuriya et al., 2012). The computer operators were represented by bank workers in our study. The difference in prevalence between the nurses and bank workers was 2% at 95% confidence interval, which gave a sample size of 117 study participants for each group.

2.9 Selection of study participants

2.9.1 Hospitals A and B

The nurses who were present at work in the wards listed in 2.4.1 during the study period were eligible to participate in the study. A room was allocated for the study where nurses came to attend a presentation about the objectives of the study presented by the principal investigator. Questions raised by the nurses were addressed and information sheets about the study (Appendix C) were given to the

nurses. Nurses were then invited to participate in the study by signing consent forms (Appendix D) which included the baseline and follow-up components of the study.

2.9.2 The bank

The bank workers who were present at work in HLC and CCC during the study period were eligible to participate in the study. The managers of these areas provided a list of workers working under them. During the study period, the managers released a group of about 10 workers at a time to attend the presentation sessions about the study. A room was allocated for the study where recruitment of participants took place. The principal investigator explained the objectives of the study to the workers and addressed questions that workers raised. Information sheets (Appendix C) with a brief description of the study were given to the workers. After the presentation, the workers were invited to participate in the study by signing consent forms (Appendix D).

2.10 Preparation for study implementation

2.10.1 Hospital A

After receiving permission for the study from the hospital executive director, meetings were held with key personnel at the hospital to publicize and garner support for the study in preparation for its implementation. One such meeting was held with the deputy director for nursing who endorsed the study and provided a list of wards which had been identified as suitable for the study with names and contact numbers of nursing managers in charge of those wards. Another meeting was held with the nursing managers to explain the study objectives and provide information about the study so that they could inform the nurses in their wards.

2.10.2 Hospital B

The hospital executive director gave permission for the study which paved the way for its implementation. After the principal investigator had presented the study protocol to the deputy director for nursing, arrangements were made with the training department to support and co-ordinate the data collection phase of the study. A presentation about the study was made to the staff in the training department and information was provided which they sent to the nursing managers of the wards which were identified as suitable for the study.

2.10.3 The bank

After the bank Executive Director had accepted the invitation to the study, the Core Banking Solutions manager became the liaison for the study. The heads of Credit Risk and Human Resources were invited to a meeting where the principal investigator presented the study objectives and answered questions they raised. The contact details of the operational managers of the suitable areas for the study were provided so that arrangements for the study can be made directly with them. Before the fieldwork commenced, the operational managers were briefed about the study and they suggested the flow of workers to the interviews which would have minimal disruption to the work in the call centres. Information sheets about the study were provided so that they could give them to the workers.

2.11 Data collection tools

2.11.1 Questionnaires

The main data collection tools for the study were two questionnaires: a baseline questionnaire (Appendix E); and a follow-up questionnaire for nurses (Appendix F) which was administered approximately 12 months later. The baseline questionnaire had five sections while the follow-up questionnaire had four sections. The

questionnaires were based on the CUPID questionnaires but four questions pertinent to the South African population were added to the baseline questionnaire. Other tools included an analogue portable foot scale and a stature meter for weight and height measurements, respectively.

2.11.1.1 Baseline questionnaire

Four of the five sections of the baseline questionnaire covered work and non-work MSD risk factors, and one section dealt with MSDs themselves, that is the health effects of exposure to these factors. The questions asked about the occurrence of pain in the past 12 months and past month in six body sites. These were low back, neck, shoulders, elbows, wrists or hands, and knees. The overview of the baseline questionnaire is shown in Table 2.3. The work risk factors are contained in section 2 which deals with “Your current work”. This section, included questions about current job, length of service, number of working hours per week and whether any of the specified physically demanding activities and psychosocial aspects of work occurred in the job on an average day. The questions on physically demanding work activities

Table 2.3: Overview of the baseline questionnaire

Section	Risk factors for MSDs		
	Work factors	Non-work factors	MSDs
1. About yourself	-	√	-
2. Your current work	√	-	-
3. Aches and pain	-	-	√
4. Your views on the causes and prevention of pain	-	√	-
5. Your health more generally	-	√	-

√=Applicable; (-)=Not applicable.

asked about the use of a keyboard for more than four hours, repeated wrist or finger movement for more than four hours, repeated elbow bending for more than one

hour, working with hands above shoulder height for more than one hour, lifting loads of more than or equal to 25 kg by hand, and kneeling or squatting for more than one hour. These questions were asked to solicit exposure to ergonomic risk factors in the current job. These risk factors are widely accepted and have been used in other studies (Maclaire, 2001). The questions relating to psychosocial aspects of work were about incentives, job demands, job control, social support at work, job satisfaction and security of employment.

The other sections of the baseline questionnaire contained non-work factors which were in sections 1, 4 and 5. These sections dealt with non-work factors representing individual factors which can be further differentiated into intrinsic and extrinsic factors. The intrinsic factors included age, body mass index, sex, handedness, mental health status, and somatising tendency. The mental health questions were taken from the relevant subsection of the Short Form (SF)-36 Questionnaire (Ware, 2000) while the questions on somatising tendency were taken from the Brief Symptom Inventory (Derogatis and Melisaratos, 1983). Extrinsic factors included ethnicity, educational level, smoking status and adverse belief about low back and arm pain. The questions about adverse belief were modified from the Fear Avoidance Beliefs Questionnaire (Waddell et al., 1993).

The questions on the outcome of interest (musculoskeletal pain and associated features) were contained in section 3 "Aches and pain" of the baseline questionnaire and included pain in six anatomical sites, namely low back, neck, shoulders, elbows, wrists or hands, and knees. The questions about musculoskeletal pain and associated features were adapted from the Standardised Nordic Questionnaire

(Kuorinka,1987). The pain sites were shown on diagrams delineating the location of pain.

2.11.1.2 Follow-up questionnaire for the South African public hospital nurses

The follow-up questionnaire for nurses had three sections as shown in Table 2.4. Section 1 “About yourself” provided information that made it possible to link the follow-up questionnaire with the baseline questionnaire. Section 2 “Your current work” collected information about any change of job between baseline and follow-up period with reasons. The questions in sections 3 were similar to those in the baseline questionnaire which asked about pain in the low back, neck, shoulders, elbows, wrists or hands and knees in the past month.

Table 2.4 Overview of the follow-up questionnaire

Section	Follow-up questionnaire		
	Risk factors for MSDs		MSDs
	Work factors	Non-work factors	
1. About yourself	-	√	-
2. Your current work	√	-	-
3. Aches and pain	-	-	√

√=Applicable; (-)=Not applicable.

2.11.1.3 Supplementary questions

Four questions were added to the baseline questionnaire after careful consideration of questions and concerns raised during presentations of the study protocol by the principal investigator at different forums to raise awareness about the study. These questions were: 1) Have the study participants been in a frightening situation? 2) Have the study participants been in financial difficulties? 3) Have the study participants had an injury in the past; and 4) do workers suffering from musculoskeletal pain deserve compensation?

The first two questions were modified from Life Events and Difficulties Schedule (Brown and Harris, 1989) and had been included in the recent thesis on South African mineworkers by Dias (2014). Past injuries have been linked with the development of MSDs (Forde, 2005) and compensation has been associated with adverse health outcomes in workers with MSDs (Rasmussen et. al, 2001).

2.12 Pilot study

The baseline and follow-up questionnaires were written and piloted in the English language which is the second language of the majority of workers in South Africa, including the study participants. The baseline questionnaire was piloted at the National Institute for Occupational Health (NIOH) and at another department (Indexing) in the study bank which was not involved in this study where workers were using computers. The NIOH, being a healthcare institution, was selected for the pilot using its workers as surrogates for the hospital nurses. The pilot was conducted through interviewer administered questionnaires. The purpose of the pilot was to assess if the questions were comprehensible to the pilot subjects and to determine the length of time it would take to administer one questionnaire. The pilot subjects found it difficult to understand the question about climbing 30 flights of stairs or more. As a result, the question was omitted from the baseline questionnaire. The interviews took an average of 30 minutes with a range of 20-45 minutes.

2.13 Interviewer training

One person was trained by the principal investigator in the administration of questionnaires. She was a medical scientist who was working with the principal investigator in the Ergonomics Unit in the Occupational Medicine Section at NIOH. The principal investigator was experienced in the administration of questionnaires

through participation in many projects carried out by the Occupational Medicine Section of the NIOH.

The training took one day and entailed giving background information about the study, going through the questionnaire and getting the trainee to practice by administering the questionnaires to selected staff members in the Occupational Medicine Section. The background information about the study was going to be used by the trainee to explain the study to potential study participants. The trainee was encouraged to ask questions if she did not understand nor needed clarity on something. She was given time to go through the questionnaire on her own to ensure good understanding of the questions before the practical exercise of administering it. At the end of the practical exercise, the principal investigator held a session with the subject who was interviewed, and the medical scientist, to get comments about the interview, and areas that needed strengthening were addressed.

2.14 Overview of data collection

Data were collected by interviewer administered questionnaires in nurses and interviewer assisted in bank workers.

2.14.1 Data collection at baseline

2.14.1.1 Hospitals A and B

Data collection occurred in January and November 2008 in Hospital A, and Hospital B, respectively. A total of 282 nurses, 141 nurses in each hospital, was invited to participate. Of these, 252 nurses (130 in Hospital A and 122 in Hospital B) took part in the study: a response rate of 89.4%. The interviews were conducted in rooms allocated for the study in the different wards. In each ward, one nurse was

interviewed at a time. At the end of the interview, weight and height measurements were taken. The principal investigator alternated with the medical scientist in conducting interviews and taking weight and height measurements.

2.14.1.2 The Bank

At the Bank, interviewer assisted data collection was done in February 2009 in a room allocated for the study. The bank workers were free to ask questions if they wanted clarity on any question in the questionnaire. After the interviews, measurements of weights and heights were taken. A total of 236 workers working in the HLC or CCC participated. Fifty four workers did not take part (49 did not come to the study debriefing sessions and five were not at work during the study period).

The response rate for the study was 82.8%.

2.14.2 Data collection at follow-up

Nurses were telephoned and reminded about the follow-up a month before the due date. In Hospital A, the follow-up interviews happened in January 2009, while in Hospital B they happened in November 2009. In a similar manner as at baseline, the interviews were conducted in designated rooms in the wards. One hundred and eighty nine nurses were successfully re-interviewed after the follow-up period, a 75.3% response rate.

2.14.3 Weight and height measurements

The weight was measured using Soehnle certified classic X1 scale. It was placed on a flat surface on the ground with the kilogram window easy to read. The scale was zeroed before the participants put both their barefeet on the designated area on the scale. The weight was then read from the window of the scale.

For height measurement, the Panamedic stature meter which was two meters long was used. The meter was placed on the floor and the tape was pulled out until zero was on the red line on the window of the meter. The top part of the tape was secured on the wall. When taking measurements, the participants were asked to stand with the back facing the wall and the head positioned straight. The tape was pulled down vertically to the top of the participant's head and the measurement was taken from the red line.

2.15 Quality assurance

In order to ensure that reliable data were collected, standardised and validated questionnaires were used. The questionnaires were piloted to ensure that the questions were well understood by the study participants. The interviewers were trained (medical scientist) and experienced (principal investigator) in the administration of the study questionnaires. At the end of the day during the data collection period at the hospitals, the principal investigator checked the completed questionnaires for consistency and completeness. Anomalies that were detected were discussed with the medical scientist and addressed as soon as possible by contacting the study participants. At the Bank, the completed questionnaires were checked for missing data during weight and height measurements. These measurements were taken using the manufacturers' instructions.

2.16 Data management

One nurse who did not meet the inclusion criteria was excluded resulting in a final study sample of 251 nurses. The final study sample of bank workers was 236 as all of them met the study inclusion criteria. The questionnaires were coded and entered twice into the Epidata 3.1 software (Lauritsen et al., 2000) by two independent data capturers producing two datasets. The two datasets were cleaned by correcting

errors. The data were imported into Stata 12 (Release 12.1 Stata Corporation, College Station, Texas, USA) in preparation for analysis. Numerical and categorical data were plotted on histograms and bar graphs, respectively. The graphs were checked for unusual and suspicious values against the original observations in the questionnaires which were corrected accordingly.

Variables body mass index (BMI), age and sick leave days due to “any” pain in the past 12 months, were categorised. BMI was calculated by dividing weight (W) in kilograms by height squared (H^2) in metres ($W \text{ (kg)} / H^2 \text{ (m)}$) and then categorised into three ordinal groups: normal (15-25); overweight (26-30); and obese (31-69) whereas, age was categorised into four groups namely <30; 30-39; 40-49; and ≥ 50 years. Similarly with sick leave days, the number of workers in each category (1-5; 6-30 and > 30 days) was multiplied by 2.5; 8 and 32 days, respectively. Eight and 32 days were chosen arbitrarily to give a conservative estimate.

The prevalence of pain in each body site was obtained by dividing the sum of the positive responses for each body site (numerator) with the total number of workers who answered the questions (denominator) and then multiplying the resultant fraction by 100 to get a percentage. “Any” body site prevalence was obtained by dividing the sum of workers who reported “any” pain (numerator) by the total number of workers who answered the questions (denominator) and then multiplying the resultant fraction by 100 to get a percentage.

2.17 Data analysis

The cross-sectional data of public hospital nurses and bank workers were combined and named South African workers in order to increase the power of the study. Data analysis of SA workers, public hospital nurses and bank workers were performed.

2.17.1 Descriptive statistics

Data were summarized using descriptive statistics. Quantitative data were summarized using means, standard deviations, medians and ranges. For qualitative variables, data were summarized using frequencies, percentages and 95% confidence intervals. The summaries are presented for individual characteristics of the study participants, possible physically demanding work activities, psychosocial aspects of work and associated MSD pain.

2.17.2 Statistical testing

Association between two dependent categorical variables was tested using McNemar test and its associated p-value in the follow-up study of the public hospital nurses. A p-value ≤ 0.05 was considered statistically significant.

2.17.3 Multiple regression analysis

Binary logistic regression was used in the multiple regression analysis to identify possible risk factors associated with MSDs. The associations with MSDs were estimated with odds ratios (ORs) and their 95% confidence intervals (CIs). The number of explanatory variables to be entered in the full model was guided by the “rule” of having at least 10 events per explanatory variable (Peduzzi et al., 1996). All the variables selected for the study are shown in Table 2.5. The “no” categories of yes or no explanatory variables were made the reference. These included past injuries, all variables representing work factors and psychological factors, excluding somatising tendency and mental health status. “Men” was made the reference for sex. For ordinal variables, the lowest category was made the reference. For instance, less than 30 years was made the reference for age group; normal for BMI group; high school for educational level; never-smoked for smoking status; 0 symptom for the number of distressing somatic symptoms. “Good” was the

Table 2.5: Explanatory variables used in the study

WORK FACTORS	NON-WORK FACTORS
Physical	Physical
Repeated wrist or finger movement >4 hours*	Age group
Repeated elbow bending > 1 hour*	Sex
Working with hands above shoulder height > 1 hour*	Body mass index (BMI) group
Upper limb load ^a	Past injuries
Lifting ≥ 25 kg loads by hand**	Psychological
Kneeling or squatting > 1 hour**	Financial difficulties ⁱ
Physical load ^b	Deserve compensation ^j
Psychosocial	Number of distressing somatic symptoms ^k
Working under time pressure ^c	Frightening situation ^l
Lack of control ^d	Adverse beliefs about low back and/or arm pain ^m
Lack of social support ^e	Mental health status ⁿ
Job insecurity ^f	Psychosocial
Job dissatisfaction ^g	Occupational group
Incentives ^h	Ethnic group (ethnicity) ^o
	Educational level
	Smoking status

^aReports of any two or more of the variables marked with one asterisk.

^bReports of any three or more of the variables marked with one and two asterisks.

^cA target amount of work or a number of articles done or finished in a day or working under pressure to complete tasks by a fixed time.

^dChoice in all of: how work is done; what is done at work; and work time table and break times –seldom or never.

^eAssistance or support from colleagues or supervisors-seldom or never

^fFeel that job would be insecure or very insecure if off work for three months due to serious illness.

^gVery dissatisfied or dissatisfied about the job taking everything into consideration.

^hPiecework or payment of a bonus if an agreed number of tasks are finished in a day.

ⁱBeing in financial difficulties- slight or big problem.

^jPeople with musculoskeletal disorders deserve compensation.

^kNumber of at least moderately distressing somatic symptoms in the past seven days from a total of seven.

^lBeing in a frightening situation-slight or big problem.

^mBelief that low back and/or arm pain is caused by work.

ⁿClassified into three levels corresponding to approximate thirds of the observed distribution of scores in the study.

^oSocial or cultural heritage that a particular group shares in terms of customs, language, values, religion, social ties and habits passed down from one generation to the next (Dalton, 2001).

reference value for mental health status. Lastly, the group with the largest number of participants (Sotho) was made the reference for ethnic group.

The explanatory variables representing physically demanding work activities were defined for each body site (Table 2.6) in order to minimise chance findings. Different full models were built for each body site as the literature shows that explanatory variables for the different body sites are different (da Costa and Vieira, 2010).

Table 2.6: Physically demanding work activities on an average working day with corresponding body site

Physically demanding work activity	Body site
Use of keyboard >4 hours	Wrists or hands
Repeated wrist/finger movement >4 hours*	Wrists or hands
Repeated elbow bending >1 hour*	Elbows
Working with hands above shoulder height >1 hour*	Neck and shoulders
Upper limb load ^a	Upper limbs
Lifting \geq 25 kg loads by hand**	Low back
Kneeling or squatting >1 hour**	Knees
Physical load ^b :	“Any” site

^aReports of any two or more of the variables marked with 1 asterisk.

^bReports of any three or more of the variables marked with 1 and 2 asterisks.

The well established confounding variables of sex and age group were put together with the variable “occupational group” in the partial models to select the explanatory variables to go into the full regression model.

2.17.3.1 Partial modelling

The partial models were built with age group, sex and occupational group, which were selected a priori, and each explanatory variable of interest. The cut-off point for an explanatory variable to be entered in the full model was a p-value \leq 0.2 (Maldondo and Greenland, 1993).

2.17.3.2 Binary logistic regression

From the full model, (containing all the variables selected from the partial models with p-values \leq 0.2) the backward hierarchical stepwise method of eliminating variables with p-value \geq 0.05 was used to build final models. Starting with the full model, variables were eliminated one at a time until variables satisfying the retention criterion of p-value $<$ 0.05 remained. The likelihood ratio (LR) test was performed at each step to determine if there was a good fit between the data and the model. If,

during the variable elimination process, the p-value for the LR test was significant (p-value <0.05), the variable was retained even if its p-value was ≥ 0.05 .

Post regression testing was performed on the resultant final model containing only significant variables. The goodness of fit tests used in this regard were the Pearson χ^2 test if the covariate patterns were less than or equal to 20. For covariate patterns greater than 20, the Hosmer-Lemeshow (H-L) χ^2 was used. The receiver operating characteristic (ROC) curve was used to determine the area under the curve. The goodness of fit tests and ROC curves were expected to have p-values > 0.05. and areas $\geq 70\%$, respectively.

Further testing was performed on the final models using Stata 11 (Release 11.1 Stata Corporation College Station, Texas, USA). Predicted probabilities with their 95% CIs from all the variables in the final models were obtained and converted to predicted prevalences by multiplying them by 100. Another test performed was the test for linear trend of the ORs. It was done on final models which contained categorical explanatory variables with more than two levels, demonstrating increasing trend in the ORs.

2.18 Ethical considerations

The study was approved by the Faculty of Health Sciences Research Ethics Committee of the University of Pretoria (Appendix G) and the Human Research Ethics Committee (Medical) at the University of Witwatersrand (Appendix H). Potential study participants were briefed about the objectives of the study and how it was going to be conducted. They were given study information sheets to keep if they so wished. The information sheets had the name and contact details of the principal investigator to make it possible to contact the principal investigator. It was

made clear that participation in the study was voluntary and that it required a signed informed consent form. It was further clarified that their participation in the study was not going to jeopardize their employment. They could discontinue their participation in the study if they so wished, without giving any explanation.

The names of the participants were not written on the questionnaires but codes were used. These codes were used to link the questionnaires with the consent forms. For confidentiality purposes, the questionnaires and consent forms were kept separately in a locked room to which only the principal investigator had access. When reporting the findings of the study, group data have been and will be presented with no mention of study participants' names and study sites' names.

Chapter 3: Cross-sectional study of the South African public hospital nurses and bank workers

3.1 Introduction

Cross-sectional data from two occupational groups comprising 251 public hospital nurses and 236 bank workers (N=487) referred to herein as the South African (SA) workers, were pooled. In this chapter, the description of the SA workers regarding their exposure to risk factors associated with MSDs, the occurrence of MSDs and identification of possible risk factors linked to the development of MSDs are presented. Data for each occupational group (nurses and bank workers) are presented separately in subsequent chapters.

3.2 Description of the South African workers

Each worker provided information on exposure to MSD risk factors which included individual characteristics and workplace conditions. Individual characteristics included physical, psychosocial and psychological characteristics while workplace conditions delved into physical work activities and psychosocial aspects of work.

3.2.1 Individual physical and psychosocial characteristics

The distributions of the physical and psychosocial characteristics are presented in Table 3.1. The physical characteristics that were considered were age, sex, body mass index (BMI) and past injuries. The mean age \pm SD was 36.7 ± 10.0 years with the youngest worker being 19 years and the oldest 65 years. A large percentage of workers (87.7%) were less than 50 years of age. Women were over represented at 82.5%. The mean BMI \pm SD was 27.6 ± 6.7 and BMI ranged from 15-69. More than half (59.0%) of the workers had abnormal BMI and just over a quarter (26.2%) had had injuries in the past.

Table 3.1: Individual physical and psychosocial characteristics of the SA workers (N=487)

Individual characteristic	N	%	Missing values
Physical			
Age group (years)			
<30	141	29.3	
30-39	143	29.7	
40-49	138	28.7	
≥50	59	12.3	
Total	481	100.0	6
Sex			
Men	85	17.5	
Women	402	82.5	
Total	487	100.0	0
BMI group			
Normal	186	41.0	
Overweight	136	30.0	
Obese	132	29.0	
Total	454	100.0	33
Past injuries			
Yes	127	26.2	
No	358	73.8	
Total	485	100.0	2
Psychosocial			
Ethnic group			
Sotho ^a	206	42.4	
Nguni ^b	146	30.0	
Other ^c	134	27.6	
Total	486	100.0	1
Educational level			
High school	147	30.2	
Tertiary	339	69.8	
Total	486	100.0	1
Smoking status			
Non-smoker	377	77.4	
Current smoker	40	8.2	
Ex-smoker	70	14.4	
Total	487	100.0	0

^aConsists of Pedi, Tswana and Sotho.

^bConsists of Xhosa and Zulu.

^cConsists of Afrikaner, Coloured, Indian, Tsonga and Venda.

Sixteen point nine percent of the injuries had been sustained in the past 12 months and 8.7% more than 12 months ago. The data on psychosocial characteristics of the workers showed that most of the workers (72.4%) belonged to the two main Black

ethnic groups of South Africa with Sotho being a larger percentage (42.4%) than Nguni (30.0%). About 70.0% of the workers had acquired higher education and more than three quarters (77.4%) had never smoked.

3.2.2 Individual psychological characteristics

Table 3.2 summarises the psychological characteristics of the SA workers. More than two thirds (71.4%) had financial difficulties. The percentages of workers

Table 3.2: Individual psychological characteristics of the SA workers (N=487)

Individual psychological characteristic	N	%	Missing values
Financial difficulties ^a			
Yes	345	71.4	
No	138	28.6	
Total	483	100.0	4
Deserve compensation ^b			
Yes	305	64.3	
No	169	35.7	
Total	474	100.0	13
Number of distressing somatic symptoms ^c			
0	176	36.1	
1	116	23.8	
2+	195	40.1	
Total	487	100.0	0
Frightening situation ^d			
Yes	227	47.3	
No	253	52.7	
Total	480	100.0	7

^aBeing in financial difficulties-slight or big problem .

^bPeople with musculoskeletal pain deserve compensation.

^cNumber of at least moderately distressing somatic symptoms in the past seven days from a total of seven.

^dBeing in a frightening situation-slight or big problem.

Table 3.2: Individual psychological characteristics of the SA workers (N=487)
cont'd

Individual psychological characteristic	N	%	Missing values
Adverse beliefs about pain ^e			
Low back and arm			
Yes	182	37.4	
No	305	62.6	
Total	487	100.0	0
Arm			
Yes	151	31.1	
No	335	68.9	
Total	486	100.0	1
Low back			
Yes	142	29.2	
No	345	70.8	
Total	487	100.0	0
Mental health status ^f			
Good	177	36.3	
Intermediate	139	28.6	
Poor	171	35.1	0
Total	487	100.0	

^eBelief that low back and/ or arm pain is caused by work.

^fClassified into three levels corresponding to approximate thirds of the observed distribution of scores in the study sample.

who were of the opinion that workers suffering from musculoskeletal pain deserved to be compensated and those who had one or more moderately distressing somatic symptoms (somatising tendency) in the past week were similar at 64.4% and 63.9%, respectively. Forty three percent of the workers had been in a frightening situation and 37.4% believed that low back and arm pain is caused by work.

3.2.3 Physical workplace activities

The workers reported the physically demanding activities in their jobs on an average day. Their responses are captured in Table 3.3. The most common physically demanding activity reported was repeated elbow bending for more than an hour (82.5%), followed by repeated wrist or finger movement for more than four hours

Table 3.3: Physically demanding activities on an average day in the jobs of the SA workers (N=487)

Physical work activity		N	%	Missing values
Repeated elbow bending >1 hour [*]	Yes	400	82.5	
	No	85	17.5	
	Total	485	100.0	2
Repeated wrist/finger movement >4 hours	Yes	374	77.4	
	No	109	22.6	
	Total	483	100.0	4
Upper limb load ^a	Yes	360	75.2	
	No	119	24.8	
	Total	479	100.0	8
Use of keyboard >4 hours	Yes	265	54.5	
	No	221	45.5	
	Total	486	100.0	1
Physical load ^b	Yes	237	49.7	
	No	240	50.3	
	Total	477	100.0	10
Lifting ≥25 kg loads by hand ^{**}	Yes	213	43.8	
	No	273	56.2	
	Total	486	100.0	1
Working with hands above shoulder height >1 hour [*]	Yes	196	40.6	
	No	287	59.4	
	Total	483	100.0	4
Kneeling or squatting >1 hour ^{**}	Yes	69	14.2	
	No	416	85.8	
	Total	485	100.0	2

^aReports of any two or more of the variables marked with 1 asterisk.

^bReports of any three or more of the variables marked with 1 and 2 asterisks.

(77.4%). As expected, the 54.5% of workers who reported using a keyboard for more than four hours included all of the bank workers. Similarly, 94.8% of the 213 workers who reported lifting loads of 25 kg and above by hand were nurses. The

least common physically demanding work activity reported was kneeling or squatting for more than an hour (14.2%).

3.2.4 Psychosocial aspects of work

The psychosocial aspects of work as perceived by the workers are shown in Table

3.4. Most of the workers (87.5%) felt that they were working under time pressure, 47.1% thought that their jobs would not be safe if they were to have a significant

Table 3.4: Stressful psychosocial work conditions in the jobs of the SA workers (N=487)

Psychosocial work condition	N	%	Missing values
Working under time pressure ^a			
Yes	425	87.5	
No	61	12.5	
Total	486	100.0	1
Job insecurity ^b			
Yes	227	47.1	
No	255	52.9	
Total	482	100.0	5
Job dissatisfaction ^c			
Yes	185	38.1	
No	300	61.9	
Total	485	100.0	2
Incentives ^d			
Yes	174	36.5	
No	302	63.5	
Total	476	100.0	11
Lack of control ^e			
Yes	148	30.6	
No	336	69.4	
Total	484	100.0	3
Lack of social support ^f			
Yes	79	16.5	
No	400	83.5	
Total	479	100.0	8

^a A target amount of work or a number of articles done or finished in a day or working under pressure trying to complete tasks by a fixed time.

^b Feel that job would be insecure or very insecure if off work for three months due to serious illness.

^c Very dissatisfied or dissatisfied about the job taking everything into consideration.

^d Piecework or payment of a bonus if an agreed number of tasks are finished in a day.

^e Choice in all of: how work is done; what is done at work; and work time table and break times-seldom or never.

^f Assistance or support from colleagues or supervisors-seldom or never.

illness that kept them away from work for three months (job insecurity) and 38.1% were not satisfied with their jobs as a whole, when taking everything into consideration (job dissatisfaction).

3.3 Occurrence of MSDs in the South African workers in the past 12 months

Workers responded to questions asking about pain that lasted for more than a day in six body sites (low back, neck, shoulders, elbows, wrists or hands and knees) in the past 12 months.

MSD prevalence together with features associated with MSD pain follow. They include the number of body sites affected by pain, number of days with pain, number of days away from work with pain and consultation for pain

3.3.1 Prevalence of MSDs in the past 12 months

The prevalence of MSDs is presented as prevalence of “any” pain (includes all body sites) and prevalence of site specific pain (pain according to body site) in the past 12 months (Figure 3.1). The prevalence (95% CI) of “any” pain was very high at 80.5% (77.0%-84.0%). Low back pain was the most prevalent pain at 56.9% (277/487); followed by neck pain at 46.2% (225/487).

The pain in the upper limbs was largely right sided, contributing more than 80.0% to the prevalence of shoulder pain (38.8% (189/487)), elbow pain (14.4% (70/487)) and wrist or hand pain (24.6% (120/487)).

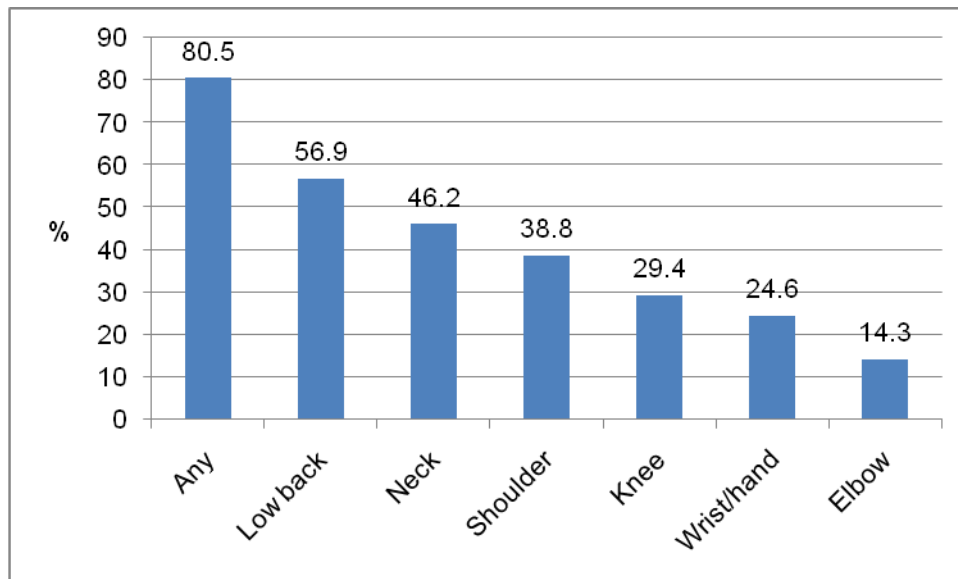


Figure 3.1: 12-month prevalence of reported MSD pain by body site in the SA workers

3.3.2 Features associated with MSDs

The features associated with MSDs included the number of painful body sites, the number of days the workers had had pain; the number of days they had been away from work due to pain; and whether they had sought help from a medical or alternative practitioner for pain.

3.3.2.1 Number of body sites affected by pain

The prevalence of pain according to the number of body sites is summarized in Figure 3.2. The largest percentage of the workers (22.6% (110/487)) reported pain in two body sites followed by 20.1% (98/487) who reported pain in one body site. The prevalence (95% CI) of workers reporting multi-site pain was 37.8% (33.5%-42.1%).

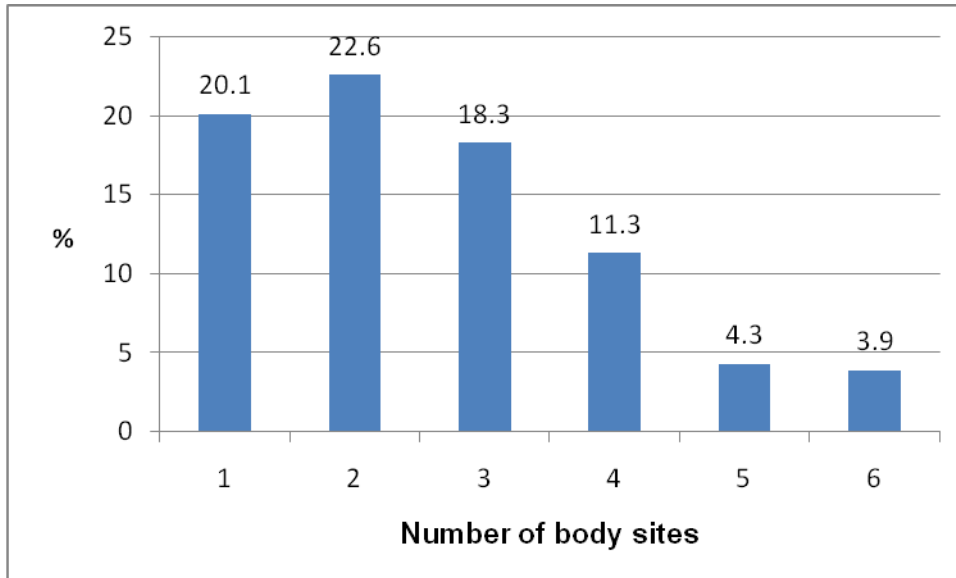


Figure 3.2: Number of painful body sites reported by the SA workers

3.3.3.2 Number of days with pain

The number of days for which workers reported to have had site specific pain is depicted in Figure 3.3. This followed a similar pattern as that of the prevalence of pain presented in 3.3.1. The largest percentage of workers (23.2% (113/487)) reported 1-6 days for low back pain and the smallest percentage (3.3% (16/487)) reported 1-12 months for elbow pain. The percentage of workers reporting more

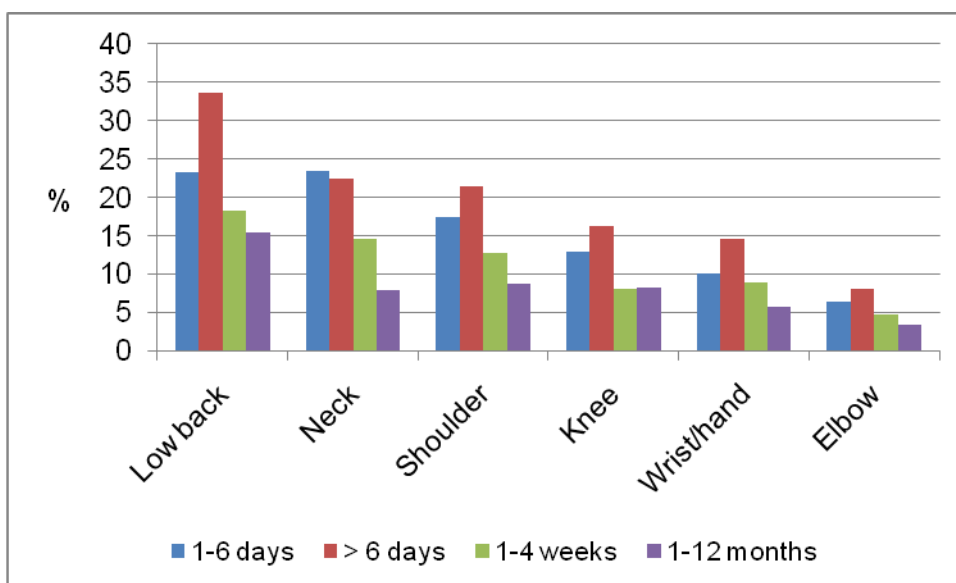


Figure 3.3: Number of days with pain reported by the SA workers

than six days of pain followed a similar pattern with the largest percentage of workers reporting low back pain (33.7% (164/487)) and the smallest percentage reporting elbow pain (8.0% (39/487)).

3.3.3.3 Number of days away from work with pain

The number of days away from work with site specific pain for those who took sick leave is depicted in Figure 3.4. The figure clearly shows that 1-5 days away from work due to site specific pain was reported more frequently by the workers as compared to the 6-30 and more than 30 days. Workers with low back pain had the

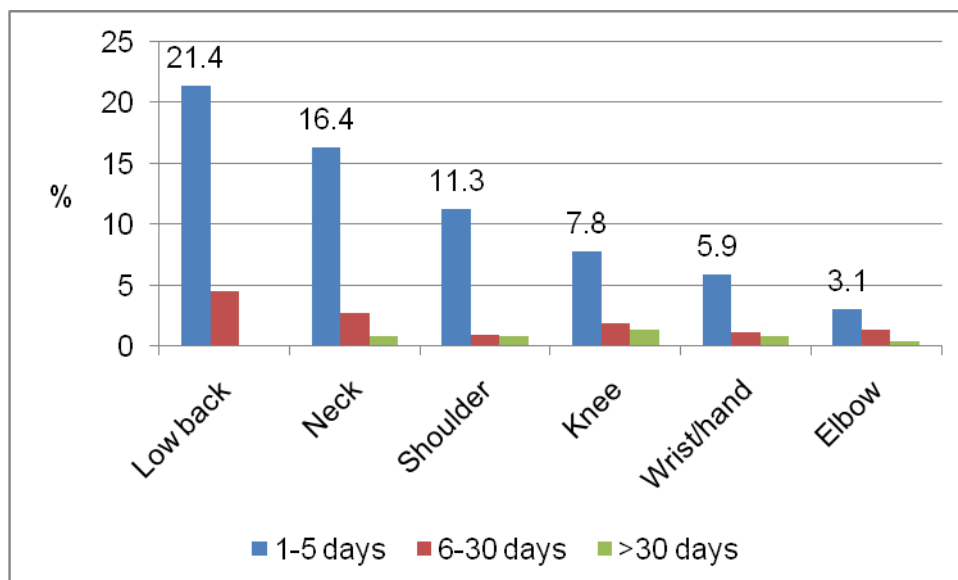


Figure 3.4: Number of days away from work with pain reported by the SA workers

largest percentage off work for 1-5 days (21.4% (104/487)) while those with elbow pain had the smallest (3.1% (15/487)).

A total of 38.8% (187/482) of workers had taken days away from work due to “any” pain in the past 12 months. Of these, 27.6% (133/482) had taken 1-5 days; 8.7% (42/482) had taken 6-30 days and 2.5% (12/482) had taken more than 30 days of

sick days. A conservative estimate of total days away from work due to pain in the past 12 months was 1052.5 days, that is, an average of 2.2 days per worker per year.

3.3.3.3 Consultation with a healthcare provider for pain

Among the questions answered by the workers who reported site specific pain, was one asking if workers had consulted a medical provider or alternative practitioner for pain. More than half (58.6% (230/392)) of the workers who had reported site specific pain had consulted for the pain (Figure 3.5). Most workers had consulted for knee (54.5% (78/143)) and low back pain (53.4% (148/277)), and the least for elbow pain (37.1% (26/70)).

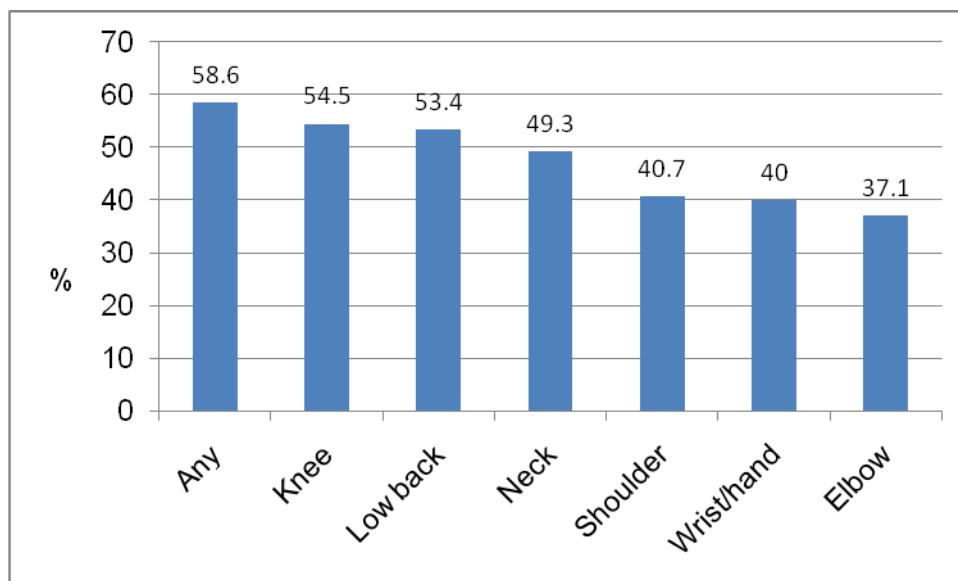


Figure 3.5: Consultation for pain in different body sites reported by the SA workers

3.4 Risk factors associated with MSDs

In order to identify factors associated with MSDs, those identified in the literature to be associated with the development of MSDs and other South African factors

identified as pertinent were selected. Ethnicity was included to explore its involvement in the development of MSDs.

3.4.1 Multiple regression analysis of MSD pain in the past 12 months with possible risk factors in the South African workers

Binary logistic regression was used for the partial, full and final models. The models are presented in tables summarizing the results of multiple regression analysis of “any”, low back, neck, shoulder, elbow, wrist or hand, upper limb and knee pain. The tables show variables that satisfied the selection criterion for the full model ($p \leq 0.2$). The categories ex-smoker and current smoker of the variable smoking status were combined because of small numbers. Appendix I (table for “any” pain) shows all the variables tested for in the full model. In the tables which follow N=the number of subjects with the site-specific pain and n=the number of subjects with pain in each level of the variable.

3.4.1.1 Partial and full models of “any” pain in the past 12 months in the South African workers

The explanatory variables with the ORs indicating associations with “any” pain are presented in the partial and full models of “any” pain in Table 3.5. Starting with the partial models, the variables that were positively associated with “any” pain were the following: past injuries; smoking status (ever-smoked); deserve compensation; somatising tendency (two or more symptoms); frightening situation; adverse beliefs about low back and arm pain; working under time pressure; job insecurity; and job dissatisfaction. The reports of “any” pain increased with increasing age, although the confidence intervals (95% CIs) included one.

The full model showed that there was no positive association between occupational group (bank workers) and “any” pain. However, past injuries, smoking status (ever-

smoked), somatising tendency (one and two or more symptoms), frightening situation and adverse belief about low back and arm pain were positively associated with “any” pain. There seemed to be an increasing trend between somatising tendency and the reporting of “any” pain by the workers. As in the partial model, the reports of “any” pain increased with increasing age group even though the 95% CIs included one.

Table 3.5: Multiple regression of “any” pain in the past 12 months with possible risk factors in the SA workers: Partial and full models

Explanatory variable	“Any” pain in past 12 months (N=392)		
	n (%)	Partial model ^a OR (95% CI)	Full model ^b OR (95% CI)
*Occupational group			
Nurses	211 (53.8)	1	1
Bank workers	181 (46.2)	0.70 (0.42-1.17)	0.28 (0.12-0.66)
Age group (years)			
<30	109 (28.2)	1	1
30-39	110 (28.4)	0.86 (0.48-1.53)	1.16 (0.57-2.36)
40-49	117 (30.2)	1.34 (0.70-2.58)	1.61 (0.71-3.61)
≥50	51 (13.2)	1.53 (0.64-3.68)	2.08 (0.74-5.85)
Sex			
Men	62 (15.8)	1	1
Women	330 (84.2)	1.22 (0.66-2.25)	1.24 (0.58-2.65)
BMI group			
Normal	143 (36.5)	1	1
Overweight	117 (29.8)	1.68 (0.89-3.18)	1.34 (0.66-2.73)
Obese	104 (26.5)	0.85 (0.47-1.55)	0.75 (0.37-1.49)
Missing	28 (7.1)	1.19 (0.41-3.46)	0.79 (0.24-2.59)
*Past injuries			
No	274 (70.3)	1	1
Yes	116 (29.7)	3.43 (1.74-6.76)	2.82 (1.30-6.10)
Educational level			
High school	121 (30.9)	1	1
Tertiary	270 (69.1)	0.65 (0.35-1.19)	0.57 (0.27-1.21)
*Smoking status			
Never-smoked	296 (75.5)	1	1
Ever-smoked	96 (24.5)	2.45 (1.28-4.70)	2.43 (1.09-5.25)
Financial difficulties			
No	105 (27.1)	1	1
Yes	283 (72.9)	1.49 (0.91-2.43)	1.17 (0.65-2.10)
*Deserve compensation			
No	128 (33.4)	1	1
Yes	255 (66.6)	1.67 (1.02-2.73)	1.44 (0.79-2.60)
*Number of distressing somatic symptoms			
0	122 (31.1)	1	1
1	95 (24.2)	1.48 (0.86-2.57)	2.30 (1.16-4.55)
≥2	175 (44.6)	2.83 (1.56-5.12)	3.23 (1.63-6.38)
*Frightening situation			
No	189 (48.8)	1	1
Yes	198 (51.2)	2.61 (1.58-4.31)	1.94 (1.09-3.47)

^aAdjusted for occupational group, age group and sex; occupational group, age group and sex were mutually adjusted.

^bAdjusted for all the risk factors in the table.

*Explanatory variables associated with “any” pain in partial and/ or full models.

Table 3.5: Multiple regression of “any” pain in the past 12 months with possible risk factors in the SA workers: Partial and full models cont’d

Explanatory variable	“Any” pain in past 12 months (N=392)		
	n (%)	Partial model ^a OR (95% CI)	Full model ^b OR (95% CI)
*Adverse belief about low back and arm pain			
No	231 (58.9)	1	1
Yes	161 (41.1)	2.26 (1.32-3.87)	1.97 (1.04-3.70)
Mental health status			
Good	132 (33.7)	1	1
Intermediate	111 (28.3)	1.53 (0.96-2.42)	1.02 (0.54-1.93)
Poor	149 (38.0)	1.54 (0.99-2.41)	1.40 (0.69-2.83)
*Working under time pressure			
No	43 (11.0)	1	1
Yes	348 (89.0)	2.42 (1.27-4.62)	1.76 (0.84-3.67)
*Job insecurity			
No	200 (51.5)	1	1
Yes	188 (48.5)	1.76 (1.06-2.94)	1.54 (0.82-2.88)
*Job dissatisfaction			
No	230 (58.8)	1	1
Yes	161 (41.2)	2.18 (1.30-3.66)	1.63 (0.90-2.95)

^aAdjusted for occupational group, age group and sex; occupational group, age group and sex were mutually adjusted.

^bAdjusted for all the risk factors in the table.

*Explanatory variables associated with “any” pain in partial and/ or full models.

3.4.1.2 Final model and predicted prevalences of “any” pain in the past 12 months in the South African workers

The final model of “any” pain, showing statistically significant explanatory variables and predicted prevalences are presented in Table 3.6. The variable occupational group (bank workers) still showed no positive association with “any” pain in the final model. Past injuries, smoking status (ever-smoked), somatising tendency (one and two or more symptoms), frightening situation, adverse beliefs about low back and arm pain, and job dissatisfaction remained positively associated with “any” pain. An increasing trend with somatising tendency and “any” pain persisted. Furthermore, the ORs for reports of “any” pain increased with increasing age with 95% CIs that included one as in the full model.

Table 3.6: Multiple regression of “any” pain in the past 12 months with possible risk factors and predicted prevalences in the SA workers: Final model

Explanatory variable	“Any” pain in past 12 months (N=392)			
	n (%)	^a Final model	Predicted prevalence	
		^b OR (95% CI)	% (95% CI)	^c Δ (%)
*Occupational group				
Nurses	211 (53.8)	1	85.3 (80.9-89.5)	
Bank workers	181 (46.2)	0.51 (0.27-0.96)	74.8 (68.7-80.9)	-10.5
Age group (years)				
<30	109 (28.2)	1	77.7 (70.9-84.5)	
30-39	110 (28.4)	1.12 (0.58-2.18)	77.9 (71.7-84.2)	
40-49	117 (30.2)	1.71 (0.82-3.56)	84.2 (78.1-90.3)	
≥50	51 (13.2)	2.23 (0.86-5.79)	86.6 (78.5-94.8)	8.9
Sex				
Men	62 (15.8)	1	78.4 (69.8-87.0)	
Women	330 (84.2)	1.37 (0.67-2.83)	81.2 (77.5-84.9)	2.8
*Past injuries				
No	274 (70.3)	1	77.9 (73.9-81.9)	
Yes	116 (29.7)	2.88 (1.36-6.10)	89.6 (84.1-95.2)	11.7
*Smoking status				
Never-smoked	296 (75.5)	1	78.2 (74.2-82.2)	
Ever-smoked	96 (24.5)	2.80 (1.31-5.96)	88.8 (83.0-94.5)	10.6
*Number of distressing somatic symptoms				
0	122 (31.1)	1	71.6 (65.2-78.0)	
1	95 (24.2)	2.23 (1.15-4.31)	82.4 (75.7-89.1)	10.8
≥2	175 (44.6)	3.52 (1.84-6.72)	88.7 (84.1-93.2)	17.1
*Frightening situation				
No	189 (48.8)	1	76.8 (71.9-81.6)	
Yes	198 (51.2)	2.11 (1.21-3.68)	85.6 (81.0-90.3)	8.8
*Adverse beliefs about low back and arm pain				
No	231 (58.9)	1	77.7 (73.4-82.1)	
Yes	161 (41.1)	1.95 (1.08-3.52)	86.2 (81.1-91.4)	8.5
*Job dissatisfaction				
No	230 (58.8)	1	78.1 (73.7-82.4)	
Yes	161 (41.2)	1.79 (1.01-3.18)	85.3 (80.2-90.4)	7.2

^aPost regression tests: Hosmer-Lemeshow χ^2 p-value group (8)=0.13; group (10)=0.27; group (12); 0.55; ROC curve =78.3%.

^bAdjusted ORs of significant risk factors.

^cDifference in predicted prevalences of associated level/s of explanatory variables and relevant reference groups.

*Explanatory variables associated with “any” pain in final model with their respective predicted prevalences.

The predicted prevalences of “any” pain showed that the “number of distressing somatic symptoms” had the biggest effect with an increase of 17.1% in the prevalence of “any” pain in the workers who reported two or more distressing

somatic symptoms as compared to those who reported no symptoms. The reporting of past injuries was estimated to increase the prevalence by 11.7% and smoking status by 10.6%. The South African bank workers would have a decrease of 10.5% in the prevalence over the nurses.

3.4.1.3 Linear trend in the ORs of the number of distressing somatic symptoms in the final model of “any” pain in the past 12 months in the South African workers

The test of linear trend in the ORs of the “number of distressing somatic symptoms” is shown in Table 3.7. The inclusion of the number of distressing somatic symptoms

Table 3.7: Linear trend in the ORs of the number of distressing somatic symptoms in the final model of “any” pain in the SA workers

Explanatory variable	“Any” pain in past 12 months (N=392)		
	n (%)	^a Final model OR (95% CI)	^b Final model OR (95% CI)
Occupational group			
Nurses	211 (53.8)	1	1
Bank workers	181 (46.2)	0.51 (0.27-0.96)	0.51 (0.27-0.96)
Age group (years)			
<30	109 (28.2)	1	1
30-39	110 (28.4)	1.12 (0.58-2.18)	1.12 (0.58-2.18)
40-49	117 (30.2)	1.73 (0.83-3.59)	1.71 (0.82-3.56)
≥50	51 (13.2)	2.22 (0.85-5.74)	2.23 (0.86-5.79)
Sex			
Men	62 (15.8)	1	1
Women	330 (84.2)	1.37 (0.67-2.83)	1.37 (0.67-2.83)
Past injuries			
No	274 (70.3)	1	1
Yes	116 (29.7)	2.88 (1.36-6.10)	2.88 (1.36-6.10)
Smoking status			
Never-smoked	296 (75.5)	1	1
Ever-smoked	96 (24.5)	2.72 (1.29-5.75)	2.80 (1.31-5.96)

^aEffect of the number of distressing somatic symptoms taken as linear in the model.

^bNumber of distressing somatic symptoms entered in the model as a categorical factor.

Table 3.7: Linear trend in the ORs of the number of distressing somatic symptoms in the final model of “any” pain in the SA workers cont’d

Explanatory variable	“Any” pain in past 12 months (N=392)		
	n (%)	^a Final model OR (95% CI)	^b Final model OR (95% CI)
*Number of distressing somatic symptoms			
No	122 (31.1)	1	1
Yes	270 (68.9)	1.90 (1.37-2.62)	1.87 (1.35-2.59)
Frightening situation			
No	189 (48.8)	1	1
Yes	198 (51.2)	2.12 (1.22-3.69)	2.11 (1.21-3.68)
Adverse beliefs about low back and arm pain			
No	231 (58.9)	1	1
Yes	161 (41.1)	1.94 (1.08-3.50)	1.95 (1.08-3.52)
Job dissatisfaction			
No	230 (58.8)	1	1
Yes	161 (41.2)	1.79 (1.01-3.18)	1.79 (1.01-3.18)

^aEffect of the number of distressing somatic symptoms taken as linear in the model.

^bNumber of distressing somatic symptoms entered in the model as a categorical factor.

*Explanatory variable showing results of linear trend when entered as linear and categorical in “any” pain final model.

as a categorical factor did not improve the fit of the final model when the effect of the number of distressing somatic symptoms was regarded as linear. This was demonstrated by the likelihood ratio test p-value of 0.57. Therefore, the parsimonious model where the effect of the “number of distressing symptoms” was taken as linear can be adopted as the model that provides a better fit. It can be interpreted as: the odds of reporting “any” pain by the workers increased by 1.90 times from one level of “the number of distressing somatic symptoms” to the next.

3.4.1.4 Partial and full models of low back pain in the past 12 months in the South African workers

The partial and full models of low back pain containing explanatory variables showing associations with low back pain are presented in Table 3.8. In the partial models, these variables included BMI group (overweight), past injuries, smoking

Table 3.8: Multiple regression of low back pain in the past 12 months with possible risk factors in the SA workers: Partial and full models

Explanatory variable	Low back pain in past 12 months (N=277)		
	n (%)	Partial model ^a OR (95% CI)	Full model ^b OR (95% CI)
Occupational group			
Nurses	146 (52.7)	1	1
Bank workers	131 (47.3)	1.29 (0.76-2.18)	0.62 (0.35-1.08)
Age group (years)			
<30	72 (26.4)	1	1
30-39	73 (26.7)	0.98 (0.60-1.58)	0.84 (0.49-1.45)
40-49	89 (32.6)	1.67 (1.00- 2.79)	1.37 (0.75-2.51)
≥50	39 (14.3)	1.80 (0.93-3.49)	1.73 (0.80-3.72)
Sex			
Men	41 (14.8)	1	1
Women	236 (85.2)	1.09 (0.72-1.64)	1.35 (0.75-2.42)
*BMI group			
Normal	88 (31.8)	1	1
Overweight	89 (32.1)	1.92 (1.18-3.13)	1.81 (1.05-3.09)
Obese	78 (28.2)	1.31 (0.80-2.16)	1.11 (0.64-1.93)
Missing	22 (7.9)	2.03 (0.89-4.61)	1.64 (0.66-4.03)
*Past injuries			
No	187 (68.0)	1	1
Yes	88 (32.0)	2.15 (1.38-3.37)	1.92 (1.18-3.14)
Ethnic group			
Sotho	107 (38.6)	1	1
Nguni	85 (30.7)	1.27 (0.82-1.96)	1.29 (0.80-2.09)
Other	85 (30.7)	1.60 (0.96-2.65)	1.71 (0.95-3.08)
*Smoking status			
Never-smoked	206 (74.4)	1	1
Ever-smoked	71 (25.6)	1.72 (1.05-2.80)	1.41 (0.80-2.48)
Financial difficulties			
No	71 (25.8)	1	1
Yes	204 (74.2)	1.35 (0.90-2.02)	1.18 (0.75-1.87)
*Number of distressing somatic symptoms			
0	75 (27.1)	1	1
1	69 (24.9)	1.99 (1.22-3.24)	1.77 (1.04-3.00)
≥2	133 (48.0)	3.13 (2.00- 4.90)	2.42 (1.46-4.00)
Frightening situation			
No	137 (50.2)	1	1
Yes	136 (49.8)	1.39 (0.95-2.02)	1.03 (0.67-1.59)

^aAdjusted for occupational group, age group and sex; occupational group, age group and sex were mutually adjusted.

^bAdjusted for all the risk factors in the table.

*Explanatory variables associated with low back pain in the partial and/ or full models.

Table 3.8: Multiple regression of low back pain in the past 12 months with possible risk factors in the SA workers: Partial and full models cont'd

Explanatory variable	Low back pain in past 12 months (N=277)		
	n (%)	Partial model ^a OR (95% CI)	Full model ^b OR (95% CI)
Adverse beliefs about low back pain			
No	187 (67.5)	1	1
Yes	90 (32.5)	1.47 (0.97-2.22)	1.20 (0.75-1.93)
Mental health status			
Good	90 (32.5)	1	1
Intermediate	84 (30.3)	1.53 (0.96-2.42)	1.16 (0.69-1.95)
Poor	103 (37.2)	1.54 (0.99-2.41)	1.06 (0.63-1.78)
*Working under time pressure			
No	28 (10.1)	1	1
Yes	249 (89.9)	1.80 (1.02-3.17)	1.61 (0.85-3.05)
*Lack of social support			
No	216 (80.0)	1	1
Yes	54 (20.0)	1.80 (1.02-3.17)	1.67 (0.94-2.98)
Job insecurity			
No	140 (50.9)	1	1
Yes	135 (49.1)	1.35 (0.90-2.02)	1.00 (0.63-1.59)
*Job dissatisfaction			
No	157 (56.7)	1	1
Yes	120 (43.3)	1.74 (1.18-2.56)	1.48 (0.95-2.30)

^aAdjusted for occupational group, age group and sex; occupational group, age group and sex were mutually adjusted.

^bAdjusted for all the risk factors in the table.

*Explanatory variables associated with low back pain in the partial and/ or full models.

status (ever- smoked), somatising tendency (one and two or more symptoms), working under time pressure, lack of social support and job dissatisfaction. The ORs indicated an increasing pattern among increasing levels of somatising tendency and reporting of low back pain. The reporting of low back pain increased with age but the 95% CIs included one. In the full model, BMI group (overweight), past injuries and somatising tendency (one and two or more symptoms) remained associated with low back pain. An increasing pattern among increasing levels of somatising tendency and age group with low back pain remained.

3.4.1.5 Final model and predicted prevalences of low back pain in the past 12 months in the South African workers

Explanatory variables with statistically significant ORs illustrating association with low back pain and predicted prevalences are portrayed in the final model (Table 3.9)

Table 3.9: Multiple regression of low back pain in the past 12 months with possible risk factors and predicted prevalences in the SA workers: Final model

Explanatory variable	Low back pain in past 12 months (N=277)			
	n (%)	^a Final model	Predicted prevalence	
		^b OR (95% CI)	% (95% CI)	^c Δ (%)
Occupational group				
Nurses	146 (52.7)	1	60.3 (53.8-66.8)	
Bank workers	131 (47.3)	0.70 (0.42-1.18)	52.9 (45.8-60.0)	-7.4
Age group (years)				
<30	72 (26.4)	1	54.5 (46.0-62.9)	
30-39	73 (26.7)	0.84 (0.49-1.43)	50.9 (42.9-58.9)	
40-49	89 (32.6)	1.42 (0.79-2.56)	62.1 (53.8-70.4)	
≥50	39 (14.3)	1.68 (0.79-3.54)	64.5 (52.5-76.5)	10
Sex				
Men	41 (14.8)	1	54.1 (43.2-64.9)	
Women	236 (85.2)	1.29 (0.72-2.28)	57.4 (52.7-62.1)	3.3
*BMI group				
Normal	88 (31.8)	1	50.8 (43.2-58.2)	
Overweight	89 (32.1)	1.84 (1.08-3.11)	64.4 (56.5-72.4)	
Obese	78 (28.2)	1.10 (0.64-1.89)	55.5 (47.0-63.9)	
Missing	22 (7.9)	1.62 (0.66-3.92)	65.6 (49.6-81.5)	8.9
*Past injuries				
No	187 (68.0)	1	53.0 (48.0-57.9)	
Yes	88 (32.0)	2.04 (1.26-3.28)	67.9 (59.9-75.9)	8.9
*Ethnic group				
Sotho	107 (38.6)	1	51.9 (45.2-58.6)	
Nguni	85 (30.7)	1.22 (0.76-1.96)	55.5 (47.8-63.2)	
Other	85 (30.7)	1.86 (1.07-3.23)	65.9 (57.7-74.3)	14
*Number of distressing somatic symptoms				
0	75 (27.1)	1	43.9 (36.7-51.3)	
1	69 (24.9)	1.81 (1.07-3.03)	57.8 (49.1-66.5)	13.9
≥2	133 (48.0)	2.72 (1.69-4.40)	67.8 (61.3-74.4)	23.9
*Job dissatisfaction				
No	157 (56.7)	1	52.8 (47.3-58.2)	
Yes	120 (43.3)	1.61 (1.06-2.45)	63.2 (56.6-69.9)	10.4

^aPost regression tests :Hosmer-Lemeshow χ^2 p-value group (8)=0.43; group (10)=0.94; group (12)=0.84; ROC curve=70.2%.

^bAdjusted ORs of significant risk factors.

^cDifference in the predicted prevalences of associated level/s of explanatory variables and the relevant reference groups.

*Explanatory variables associated with low back pain with their respective predicted prevalences in the final model.

The BMI group (overweight), past injuries, ethnic group (other), somatising tendency (one and two or more symptoms) and job dissatisfaction increased the odds of reporting low back pain by the workers. The ORs of somatising tendency increased with the reports of low back pain as in the partial and full models. Again, as in previous models of low back pain, the reports of low back pain increased with age group although the 95% CIs included one.

The predicted prevalences of low back pain show the number of distressing somatic symptoms as the variable that will have the largest increase (23.9% higher compared to no symptoms) in the prevalence of low back pain in SA workers who report two or more distressing somatic symptoms. Ethnic group (other) would have a 14.0% increase over the Sotho group and job dissatisfaction is estimated to increase low back pain by 10.4%.

3.4.1.5.1 Linear trend in the ORs of the number of distressing somatic symptoms in the final model of low back pain in the past 12 months in the South African workers

The test for linear trend in the ORs of the “number of distressing somatic symptoms” is shown in Table 3.10. The inclusion of the number of distressing somatic symptoms as a binary categorical factor did not improve the fit of the final model when the effect of the number of distressing somatic symptoms was taken as linear. This is demonstrated by the likelihood ratio test p-value of 0.69. Therefore, the parsimonious model where the “number of distressing symptoms” was taken as linear, can be adopted as the model that provides a better fit. It can be summarised as: the odds of reporting low back pain by the workers increased by 1.65 times from one level of the “number of distressing somatic symptoms” to the next.

Table 3.10: Linear trend in the ORs of the number of distressing somatic symptoms in the final model of low back pain in the SA workers

Explanatory variable	Low back pain in past 12 months (N=277)		
	n (%)	^a Final model OR (95% CI)	^b Final model OR (95% CI)
Occupational group			
Nurses	146 (52.7)	1	1
Bank workers	131 (47.3)	0.70 (0.42-1.18)	0.70 (0.42-1.18)
Age group (years)			
<30	72 (26.4)	1	1
30-39	73 (26.7)	0.84 (0.49-1.43)	0.84 (0.49-1.43)
40-49	89 (32.6)	1.42 (0.79-2.57)	1.42 (0.79-2.56)
≥50	39 (14.3)	1.67 (0.79-3.52)	1.68 (0.79-3.54)
Sex			
Men	41 (14.8)	1	1
Women	236 (85.2)	1.29 (0.72-2.29)	1.29 (0.72-2.28)
BMI group			
Normal	88 (31.8)	1	1
Overweight	89 (32.1)	1.85 (1.09-3.13)	1.84 (1.08-3.11)
Obese	78 (28.2)	1.11 (0.65-1.90)	1.10 (0.64-1.89)
Missing	22 (7.9)	1.63 (0.67-3.94)	1.62 (0.66-3.92)
Past injuries			
No	187 (68.0)	1	1
Yes	88 (32.0)	2.04 (1.27-3.29)	2.04 (1.26-3.28)
Ethnic group			
Sotho	107 (38.6)	1	1
Nguni	85 (30.7)	1.22 (0.76-1.96)	1.22 (0.76-1.96)
Other	85 (30.7)	1.86 (1.07-3.23)	1.86 (1.07-3.23)
*Number of distressing somatic symptoms			
No	75 (27.1)	1	1
Yes	202 (72.9)	1.65 (1.29-2.09)	1.65 (1.30-2.09)
Job dissatisfaction			
No	157 (56.7)	1	1
Yes	120 (43.3)	1.62 (1.06-2.46)	1.61 (1.06-2.45)

^a Effect of distressing somatic symptoms taken as linear in the model.

^b Number of distressing somatic symptoms entered in the model as a categorical factor.

*Explanatory variable showing results of linear trend when entered as linear and categorical in the low back pain final model.

3.4.1.7 Partial and full models of neck pain in the past 12 months in the South African workers

The partial and full models of neck pain showing explanatory variables with ORs signifying positive associations with neck pain are displayed in Table 3.11.

Occupational group (bank worker), past injuries, financial difficulties, somatising tendency (two or more symptoms), frightening situation, mental health status (poor), working under time pressure, lack of social support and job dissatisfaction were positively associated with neck pain in the partial models.

Table 3.11: Multiple regression of neck pain in the past 12 months with possible risk factors in the SA workers: Partial and full models

Explanatory variable	Neck pain in past 12 months (N=225)		
	n (%)	Partial model ^a OR (95% CI)	Full model ^b OR (95% CI)
*Occupational group			
Nurses	100 (44.4)	1	1
Bank workers	125 (55.6)	1.94 (1.29-2.92)	1.20 (0.60-2.27)
Age group (years)			
<30	62 (28.0)	1	1
30-39	66 (29.9)	1.26 (0.77-2.05)	1.49 (0.82-2.71)
40-49	69 (31.2)	1.56 (0.93-2.61)	1.50 (0.77-2.90)
≥50	24 (10.9)	1.09 (0.56-2.08)	1.26 (0.56-2.84)
Sex			
Male	39 (17.3)	1	1
Female	186 (82.7)	1.21 (0.71-2.05)	1.35 (0.72-2.52)
BMI group			
Normal	82 (36.4)	1	1
Overweight	75 (33.3)	1.58 (0.97-2.56)	1.46 (0.83-2.55)
Obese	54 (24.0)	0.85 (0.51-1.40)	0.84 (0.46-1.52)
missing	14 (6.2)	1.21 (0.55-2.69)	1.08 (0.43-2.71)
*Past injuries			
No	146 (65.5)	1	1
Yes	77 (34.5)	2.12 (1.38-3.25)	1.91 (1.16-3.13)
Educational level			
High school	83 (37.1)	1	1
Tertiary	141 (62.9)	0.72 (0.44-1.17)	0.65 (0.36-1.18)
Smoking status			
Never-smoked	161 (71.6)	1	1
Ever –smoked	64 (28.4)	1.56 (0.97-2.51)	1.43 (0.81-2.51)

^aAdjusted for occupational group, age group and sex; occupational group, age group and sex were mutually adjusted.

^bAdjusted for all the risk factors in the table.

*Explanatory variables associated with neck pain in the partial and/ or full models.

Table 3.11: Multiple regression of neck pain in the past 12 months with possible risk factors in the SA workers: Partial and full models cont'd

Explanatory variable	Neck pain in past 12 months (N=225)		
	n (%)	Partial model ^a OR (95% CI)	Full model ^b OR (95% CI)
*Financial difficulties			
No	48 (21.7)	1	1
Yes	173 (78.3)	1.77 (1.17-2.68)	1.88 (1.16-3.07)
Deserve compensation			
No	73 (33.3)	1	1
Yes	146 (66.7)	1.47 (0.98-2.21)	1.46 (0.91-2.33)
*Number of distressing somatic symptoms			
0	58 (25.8)	1	1
1	50 (22.2)	1.48 (0.91-2.43)	1.56 (0.89-2.72)
≥2	117 (52.0)	2.81 (1.81-4.37)	2.40 (1.43-4.02)
*Frightening situation			
No	92 (41.8)	1	1
Yes	128 (58.2)	2.41 (1.65-3.53)	1.97 (1.27-3.04)
*Mental health status			
Good	63 (28.0)	1	1
Intermediate	66 (29.3)	1.58 (1.00-2.51)	1.29 (0.76-2.20)
Poor	96 (42.7)	2.12 (1.35-3.32)	1.26 (0.73-2.16)
*Working under time pressure			
No	16 (7.1)	1	1
Yes	208 (92.9)	2.29 (1.23-4.25)	1.86 (0.91-3.80)
*Lack of social support			
No	176 (78.9)	1	1
Yes	47 (21.1)	1.72 (1.04-2.85)	1.79 (0.99-3.23)
Job insecurity			
No	105 (47.1)	1	1
Yes	118 (52.9)	1.31 (0.88-1.96)	1.09 (0.68-1.74)
*Job dissatisfaction			
No	126 (56.2)	1	1
Yes	98 (43.8)	1.50 (1.03-2.19)	1.17 (0.74-1.83)

^aAdjusted for occupational group, age group and sex; occupational group, age group and sex were mutually adjusted.

^bAdjusted for all the risk factors in the table.

*Explanatory variables associated with neck pain in the partial and/ or full models.

In the full model, the variables that were associated with neck pain were past injuries, financial difficulties, somatising tendency (two or more symptoms) and frightening situation.

3.4.1.8 Final model and predicted prevalences of neck pain in the past 12 months in the South African workers

The final model of neck pain and predicted prevalences are presented in Table 3.12.

Table 3.12: Multiple regression of neck pain in the past 12 months with possible risk factors and predicted prevalences in the SA workers: Final model

Explanatory variable	Neck pain in the past 12 months (N=225)			
	n (%)	^a Final model	Predicted Prevalence	
		^b OR (95% CI)	% (95% CI)	Δ (%)
*Occupational group				
Nurses	100 (44.4)	1	40.5 (34.2-46.8)	
Bank workers	125 (55.6)	1.66 (1.04-2.67)	50.5 (43.8-57.1)	10.0
Age group (years)				
<30	62 (28.0)	1	39.8 (31.8-47.8)	
30-39	66 (29.9)	1.47 (0.84-2.58)	46.2 (38.5-54.0)	
40-49	69 (31.2)	1.56 (0.86-2.83)	49.9 (41.8-57.9)	
≥50	24 (10.9)	1.40 (0.67-2.93)	45.7 (33.6-57.8)	5.9
Sex				
Men	39 (17.3)	1	40.2 (29.8-50.6)	
Women	186 (82.7)	1.42 (0.78-2.60)	46.5 (41.8-51.2)	6.3
*Past injuries				
No	146 (65.5)	1	41.5 (36.5-46.4)	
Yes	77 (34.5)	2.03 (1.25-3.28)	56.6 (48.0-65.2)	15.1
*Financial difficulties				
No	48 (21.7)	1	38.3 (30.4-46.2)	
Yes	173 (78.3)	1.81 (1.13-2.90)	48.1 (43.1-53.1)	9.8
*Number of distressing somatic symptoms				
0	58 (25.8)	1	35.2 (27.9-42.4)	
1	50 (22.2)	1.49 (0.87-2.56)	43.6 (35.1-52.2)	
≥2	117 (52.0)	2.51 (1.53-4.10)	55.1 (48.1-62.0)	19.9
*Frightening situation				
No	92 (41.8)	1	37.8 (31.8-43.8)	
Yes	128 (58.2)	2.09 (1.37-3.18)	53.3 (46.9-59.6)	15.5
*Working under time pressure				
No	16 (7.1)	1	31.5 (19.1-43.9)	
Yes	208 (92.9)	2.09 (1.04-4.22)	47.1 (42.6-51.6)	15.6
*Lack of social support				
No	176 (78.9)	1	43.7 (39.0-48.3)	
Yes	47 (21.1)	1.86 (1.06-3.27)	55.6 (43.2-64.1)	11.9

^aPost regression tests :Hosmer-Lemeshow χ^2 p-value group (8)=0.92; group (10)=0.61; group (12)=0.80; ROC curve =73.5%.

^bAdjusted ORs of significant risk factors.

^cDifference in predicted prevalences of associated level/s of explanatory variables and relevant reference groups.

*Explanatory variables associated with neck pain with their respective predicted prevalences in the final model.

The occupational group (bank workers), past injuries, financial difficulties, somatising tendency (two or more symptoms), frightening situation, working under time pressure and lack of social support increased the odds of reporting neck pain by the workers.

The predicted prevalences of neck pain show that the number of distressing somatic symptoms would increase the prevalence of neck pain in the SA workers who report two or more distressing somatic symptoms by 19.9% versus those who do not report symptoms. Working under time pressure (15.6%), frightening situation (15.5%) and past injuries (15.1) are estimated to increase the prevalence of neck pain to a similar extent.

3.4.1.9 Partial and full models of shoulder pain in the past 12 months in the South African workers

The partial and full models of shoulder pain showing explanatory variables with ORs indicating positive associations with shoulder pain are presented in Table 3.13. The

Table 3.13: Multiple regression of shoulder pain in the past 12 months with possible risk factors in the SA workers: Partial and full models

Explanatory variable	Shoulder pain in past 12 months (N=189)		
	n (%)	Partial model ^a OR (95% CI)	Full model ^b OR (95% CI)
Occupational group			
Nurses	103 (54.5)	1	1
Bank workers	86 (45.5)	1.14 (0.75-1.73)	0.83(0.50-1.39)
*Age group (years)			
<30	44 (23.5)	1	1
30-39	46 (24.6)	0.98 (0.58-1.64)	1.03 (0.59-1.80)
40-49	69 (36.9)	1.97 (1.17-3.32)	2.40 (1.36-4.25)
≥50	28 (15.0)	1.80 (0.94-3.46)	2.74 (1.35-5.55)
*Sex			
Male	21 (11.1)	1	1
Female	168 (88.9)	1.85 (1.03-3.33)	1.81 (0.98-3.36)
*Past injuries			
No	124 (66.3)	1	1
Yes	63 (33.7)	2.08 (1.35-3.22)	1.87 (1.18-2.96)

^aAdjusted for occupational group, age group and sex; occupational group, age group and sex were mutually adjusted.

^bAdjusted for all the risk factors in the table.

*Explanatory variables associated with shoulder pain in partial and/or full models.

Table 3.13: Multiple regression of shoulder pain in past the 12 months with possible risk factors in the SA workers: Partial and full models cont'd

Explanatory variable	Shoulder pain in past 12 months (N=189)		
	n (%)	Partial model ^a OR (95% CI)	Full model ^b OR (95% CI)
Smoking status			
Never- smoked	142 (75.1)	1	1
Ever- smoked	47 (24.9)	1.54 (0.94-2.53)	1.43 (0.84-2.42)
Financial difficulties			
No	47 (25.0)	1	1
Yes	141 (75.0)	1.32 (0.87-2.02)	1.10 (0.70-1.74)
*Number of distressing somatic symptoms			
0	54 (28.6)	1	1
1	43 (22.8)	1.29 (0.77-2.15)	1.07 (0.62-1.84)
≥2	92 (48.7)	2.22 (1.41-3.50)	1.69 (1.03-2.79)
*Frightening situation			
No	87 (46.5)	1	1
Yes	100 (53.5)	1.72 (1.17-2.54)	1.42 (0.93-2.18)
Adverse beliefs about arm pain			
No	121 (64.0)	1	1
Yes	68 (36.0)	1.40 (0.93-2.10)	1.27 (0.81-1.98)
*Mental health status			
Good	60 (31.7)	1	1
Intermediate	46 (24.3)	0.97 (0.60-1.58)	0.68 (0.40-1.15)
Poor	83 (43.9)	1.98 (1.24-3.13)	1.26 (0.75-2.11)
*Job insecurity			
No	90 (48.1)	1	1
Yes	97 (51.9)	1.59 (1.05-2.42)	1.33 (0.85-2.08)
*Job dissatisfaction			
No	103 (54.5)	1	1
Yes	86 (45.5)	1.70 (1.15-2.51)	1.49 (0.98-2.28)

^aAdjusted for occupational group, age group and sex; occupational group, age group and sex were mutually adjusted.

^bAdjusted for all the risk factors in the table.

*Explanatory variables associated with shoulder pain in partial and/or full models.

variables which were positively associated with shoulder pain in the partial models were age group (40-49 years), sex (women), past injuries, somatising tendency (two or more symptoms), frightening situation, mental health status (poor), job insecurity and job dissatisfaction.

In the full model, age group (40-49 and 50 years and above), past injuries, and somatising tendency (two or more symptoms) were associated with shoulder pain. The reporting of shoulder pain increased with age although the CIs spanned one.

3.4.1.10 Final model and predicted prevalences of shoulder pain in the past 12 months in the South African workers

The final model of shoulder pain listing significant explanatory variables associated

Table 3.14: Multiple regression of shoulder pain in the past 12 months with possible risk factors and predicted prevalences in the SA workers: Final model

Explanatory variable	n (%)	Shoulder pain in the past 12 months (N=189)		
		^a Final model ^b OR (95% CI)	Predicted prevalence % (95% CI)	^d Δ (%)
Occupational group				
Nurses	103 (54.5)	1	39.7 (33.6-45.7)	
Bank workers	86 (45.5)	0.96 (0.61-1.51)	37.8 (31.3-44.3)	1.9
*Age group (years)				
<30	44 (23.5)	1	31.8 (23.9-39.7)	
30-39	46 (24.6)	1.00 (0.57-1.73)	31.7 (24.3-39.2)	
40-49	69 (36.9)	2.23 (1.27-3.90)	48.5 (40.2-56.8)	16.7
≥50	28 (15.0)	2.40 (1.21-4.79)	48.9 (36.8-61.2)	17.1
*Sex				
Men	21 (11.1)	1	28.2 (17.9-38.4)	
Women	168 (88.9)	1.83 (1.04-3.37)	40.9 (36.2-45.6)	12.7
*Past injuries				
No	124 (66.3)	1	34.8 (30.0-39.5)	
Yes	63 (33.7)	2.04 (1.30-3.20)	50.5 (41.9-59.1)	15.7
*Number of distressing somatic symptoms				
0	54 (28.6)	1	32.7 (25.7-39.7)	
1	43 (22.8)	1.10 (0.64-1.88)	35.6 (27.3-43.8)	
≥2	92 (48.6)	1.81 (1.11-2.96)	46.1 (39.1-53.1)	13.4
Mental health status^c				
Good	60 (31.7)	1	37.0 (29.8-44.2)	
Intermediate	46 (24.3)	0.75 (0.45-1.26)	32.2 (24.8-39.6)	
Poor	83 (43.9)	1.50 (0.91-2.47)	46.1 (38.7-53.5)	9.1
*Job dissatisfaction				
No	103 (54.5)	1	34.9 (29.7-40.2)	
Yes	86 (45.5)	1.58 (1.05-2.39)	44.9 (38.0-51.8)	10.0

^aPost regression tests :Hosmer-Lemeshow χ^2 p-value group (8)=0.01; group (10)=0.26; group (12)=0.16; ROC curve =70.2%.

^bAdjusted ORs of significant risk factors.

^cReturned to the model; p-value 0.027.

^dDifference in predicted prevalences of associated level/s of explanatory variables and relevant reference groups.

*Explanatory variables associated with shoulder pain with their respective predicted prevalences in the final model.

with shoulder pain and predicted prevalences are shown in Table 3.14. Age group (40-49 and 50 years and above), sex (women), past injuries, somatising tendency (two or more symptoms) and job dissatisfaction were positively associated with shoulder pain. However, the variable mental health status was included in the final model even though it was not statistically significant because the likelihood ratio test became significant when it was removed from the model.

In the predicted prevalences of shoulder pain, age group (50 years and above) was the variable estimated to account for the largest increase (17.1%) in the prevalence of shoulder pain in the SA workers, in contrast with those younger than 30 years. The 40-49 years age group is estimated to have a similar increase (16.7%). Past injuries would contribute an increase of 15.7% and the “number of distressing somatic symptoms” 13.4%.

3.4.1.11 Linear trend in the ORs of age group in the final model of shoulder pain in the past 12 months in South African workers

The test for linear trend in the ORs of age group is presented in Table 3.15. The inclusion of age group as a categorical factor did not improve the fit of the final model when the effect of age group was taken as linear. This was demonstrated by the likelihood ratio test p-value of 0.19. Therefore, the parsimonious model where age group was taken as linear can be adopted as the model that provides a better fit. It can be interpreted as: the odds of reporting shoulder pain by the workers increased by 1.43 times from one age group to the next.

Table 3.15: Linear trend in the ORs of age group in the final model of shoulder pain in the South African workers

Explanatory variable	Shoulder pain in the past 12 months (N=189)		
	n (%)	^a Final model	^b Final model
		OR (95% CI)	OR (95% CI)
Occupational group			
Nurses	103 (54.5)	1	1
Bank workers	86 (45.5)	0.96 (0.61-1.51)	0.96 (0.61-1.51)
*Age group (years)			
No	44 (23.5)	1	1
Yes	143 (76.5)	1.43 (1.16-1.77)	1.34 (1.06-1.68)
Sex			
Men	21 (11.1)	1	1
Women	168 (88.9)	1.86 (1.01-3.41)	1.83 (0.99-3.37)
Past injuries			
No	124 (66.3)	1	1
Yes	63 (33.7)	1.98 (1.26-3.09)	2.04 (1.30-3.20)
Number of distressing somatic symptoms			
0	54 (28.6)	1	1
1	43 (22.8)	1.14 (0.67-1.94)	1.10 (0.64-1.88)
≥2	92 (48.6)	1.87 (1.15-3.05)	1.81 (1.11-2.96)
Mental health status			
Good	60 (31.7)	1	1
Intermediate	46 (24.3)	0.74 (0.44-1.24)	0.75 (0.45-1.26)
Poor	83 (43.9)	1.51 (0.92-2.47)	1.50 (0.91-2.47)
Job dissatisfaction			
No	103 (54.5)	1	1
Yes	86 (45.5)	1.61 (1.07-2.43)	1.58 (1.05-2.39)

^aEffect of age group taken as linear in the model.

^bAge group entered in the model as a categorical factor.

*Explanatory variable showing results of linear trend when entered as linear and categorical in the shoulder pain final model.

3.4.1.11 Partial and full models of elbow pain in the past 12 months in the South African workers

The partial and full models of elbow pain with explanatory variables indicating associations with elbow pain appear in Table 3.16. In the partial model, the variables that were associated with elbow pain were sex (women), financial difficulties, somatising tendency (two or more symptoms), frightening situation, mental health status (poor) and repeated bending of the elbow for more than one hour. In the full model, sex (women), somatising tendency (two or more symptoms),

mental health status (poor) and repeated elbow bending for more than an hour were still associated with elbow pain.

Table 3.16: Multiple regression of elbow pain in the past 12 months with possible risk factors in the SA workers: Partial and full models

Explanatory variable	Elbow pain in past 12 months (N=70)		
	n (%)	Partial model ^a OR (95% CI)	Full model ^b OR (95% CI)
Occupational group			
Nurses	33 (47.1)	1	1
Bank workers	37 (52.9)	1.55 (0.89-2.70)	1.04 (0.49-2.19)
Age group (years)			
<30	22 (31.9)	1	1
30-39	15 (21.7)	0.60 (0.29-1.24)	0.50 (0.21-1.18)
40-49	22 (31.9)	0.92 (0.46-1.83)	0.66 (0.28-1.53)
≥50	10 (14.5)	1.03 (0.43-2.42)	1.13 (0.41-3.09)
*Sex			
Men	6 (8.6)	1	1
Women	64 (91.4)	3.10 (1.23-7.84)	2.81 (1.01-7.80)
BMI group			
Normal	20 (28.6)	1	1
Overweight	27 (38.6)	1.99 (1.00-3.95)	1.90 (0.89-4.08)
Obese	16 (22.9)	1.13 (0.53-2.43)	1.20 (0.51-2.83)
Missing	7 (10.0)	2.56 (0.90-7.22)	2.13 (0.66-6.88)
Ethnic group			
Sotho	23 (32.9)	1	1
Nguni	25 (35.7)	1.68 (0.90-3.12)	1.94 (0.97-3.86)
Other	22 (31.4)	1.31 (0.64-2.68)	1.62 (0.73-3.58)
Past injuries			
No	45 (66.2)	1	1
Yes	23 (33.8)	1.62 (0.91-2.86)	1.57 (0.83-2.97)
*Financial difficulties			
No	12 (17.1)	1	1
Yes	58 (82.9)	2.10 (1.08-4.08)	1.80 (0.88-3.68)
*Number of distressing somatic symptoms			
0	12 (17.1)	1	1
1	14 (20.0)	1.29 (0.77-2.15)	1.46 (0.62-3.45)
≥2	44 (62.9)	2.22 (1.41-3.50)	2.63 (1.23-5.58)

^aAdjusted for occupational group, age group and sex; occupational group, age group and sex were mutually adjusted.

^bAdjusted for all the risk factors in the table.

*Explanatory variables associated with elbow pain in partial and/ or full models.

Table 3.16: Multiple regression of elbow pain in the past 12 months with possible risk factors in the SA workers: Partial and full models cont'd

Explanatory variable	Elbow pain in past 12 months (N=70)		
	n (%)	Partial model ^a OR (95% CI)	Full model ^b OR (95% CI)
*Frightening situation			
No	29 (41.4)	1	1
Yes	41 (58.6)	1.78 (1.04-3.02)	1.12 (0.61-2.06)
Adverse beliefs about arm pain			
No	42 (60.0)	1	1
Yes	28 (40.0)	1.53 (0.89-2.64)	0.94 (0.50-1.77)
*Mental health status			
Good	14 (20.0)	1	1
Intermediate	20 (28.6)	1.92 (0.92-4.00)	1.83 (0.81-4.13)
Poor	36 (51.4)	2.93 (1.47-5.81)	2.23 (1.02-4.87)
*Repeated elbow bending > 1 hour			
No	3 (4.3)	1	1
Yes	67 (95.7)	5.27 (1.60-17.28)	4.91 (1.42-16.96)
Lack of social support			
No	54 (77.1)	1	1
Yes	16 (22.9)	1.67 (0.88-3.15)	1.65 (0.81-3.36)
Job dissatisfaction			
No	35 (50.0)	1	1
Yes	35 (50.0)	1.67 (0.99-2.82)	1.16 (0.64-2.12)

^aAdjusted for occupational group, age group and sex; occupational group, age group and sex were mutually adjusted.

^bAdjusted for all the risk factors in the table.

*Explanatory variables associated with elbow pain in partial and/ or full models.

3.4.1.12 Final model and predicted prevalences of elbow pain in the past 12 months in the South African workers

The final model of elbow pain containing explanatory variables that are positively associated with elbow pain and predicted prevalences are presented in Table 3.17. Somatising tendency (two or more symptoms), mental health status (poor) and repeated elbow bending for more than an hour remained positively associated with elbow pain.

Table 3.17: Multiple regression of elbow pain in the past 12 months with possible risk factors and predicted prevalences in the SA workers: Final model

Explanatory variable	Elbow pain in the past 12 months (N=70)			
	n (%)	^a Final model ^b OR (95% CI)	Predicted prevalence % (95% CI)	^c Δ (%)
Occupational group				
Nurses	33 (47.1)	1	13.9 (9.5-18.3)	
Bank workers	37 (52.9)	1.21 (0.66-2.24)	14.9 (10.3-19.6)	1.0
Age group (years)				
<30	22 (31.9)	1	15.6 (9.6-21.6)	
30-39	15 (21.7)	0.63 (0.29-1.39)	11.6 (6.3-16.9)	
40-49	22 (31.9)	0.94 (0.46-1.94)	14.6 (9.1-20.1)	
≥50	10 (14.5)	1.23 (0.50-3.03)	17.4 (8.1-26.8)	1.8
Sex				
Men	6 (8.6)	1	7.1 (1.5-12.7)	
Women	64 (91.4)	2.56 (0.99-6.65)	15.9 (12.4-19.4)	8.8
*Number of distressing somatic symptoms				
0	12 (17.1)	1	7.9 (3.7-12.3)	
1	14 (20.0)	1.51 (0.65-3.48)	12.1 (6.3-17.9)	
≥2	44 (62.9)	2.79 (1.34-5.78)	20.5 (14.9-26.1)	12.6
*Mental health status				
Good	14 (20.0)	1	9.4 (4.7-14.1)	
Intermediate	20 (28.6)	1.81 (0.83-3.92)	14.2 (5.6-19.8)	
Poor	36 (51.4)	2.43 (1.16-5.07)	18.8 (13.1-24.4)	9.4
*Repeated elbow bending > 1 hour				
No	3 (4.3)	1	3.9 (-0.3-8.2)	
Yes	67 (95.7)	4.87 (1.46-16.25)	16.4 (12.9-19.9)	12.5

^aPost regression tests :Hosmer-Lemeshow χ^2 p-value group (8)=0.58; group (10)=0.53; group (12)=0.70; ROC curve =73.2%.

^bAdjusted ORs of significant risk factors.

^cDifference in predicted prevalence of associated level/s of explanatory variables and relevant reference groups.

*Explanatory variables associated with elbow pain with their respective predicted prevalences in the final model.

The predicted prevalences of elbow pain indicate that the estimated effect of two or more distressing somatic symptoms and repeated elbow bending on the prevalence is expected to increase by 12.6% and 12.5%, respectively.

3.4.1.12 Partial and full models of wrist or hand pain in the past 12 months in the South African workers

In Table 3.18, the partial and full models of wrist or hand pain are presented with explanatory variables and accompanying ORs indicating associations with wrist or

Table 3.18: Multiple regression of wrist or hand pain in the past 12 months with possible risk factors in the SA workers: Partial and full models

Explanatory variable	n (%)	Wrist or hand pain in past 12 months (N=120)	
		Partial model ^a OR (95% CI)	Full model ^b OR (95% CI)
*Occupational group			
Nurses	56 (46.7)	1	1
Bank workers	64 (53.3)	1.61 (1.01-2.56)	0.96 (0.53-1.73)
Age group (years)			
<30	32 (27.6)	1	1
30-39	27 (23.3)	0.79 (0.43-1.43)	0.91 (0.47-1.74)
40-49	42 (36.2)	1.46 (0.82-2.60)	1.48 (0.75-2.90)
≥50	15 (12.9)	1.16 (0.55-2.45)	1.59 (0.68-3.71)
*Sex			
Men	13 (10.8)	1	1
Women	107 (89.2)	2.17 (1.09-4.30)	2.27 (1.07-4.81)
*Ethnic group			
Sotho	35 (29.2)	1	1
Nguni	41 (34.2)	1.87 (1.11-3.15)	1.92 (1.11-3.33)
Other	44 (36.7)	1.97 (1.09-3.54)	2.21 (1.18-4.13)
*Number of distressing somatic symptoms			
0	27 (22.5)	1	1
1	25 (20.8)	1.46 (0.79-2.71)	1.50 (0.93-2.41)
≥2	68 (56.7)	2.84 (1.67-4.82)	2.95 (1.66-5.26)
*Frightening situation			
No	54 (45.4)	1	1
Yes	65 (54.6)	1.56 (1.01-2.41)	1.50 (0.93-2.41)
Mental health status			
Good	37 (30.8)	1	1
Intermediate	30 (25.0)	1.04 (0.60-1.81)	0.78 (0.42-1.45)
Poor	53 (44.2)	1.54 (0.92-2.59)	1.16 (0.66-2.07)
Lack of social support			
No	95 (79.8)	1	1
Yes	24 (20.2)	1.43 (0.82-2.48)	1.33 (0.73-2.36)
Job dissatisfaction			
No	66 (55.5)	1	1
Yes	53 (44.5)	1.43 (0.92-2.21)	1.30 (0.81-2.08)

^aAdjusted for occupational group, age group and sex; occupational group, age group and sex were mutually adjusted.

^bAdjusted for all the risk factors in the table.

*Explanatory variables associated with wrist or hand pain in partial and/ or full models.

hand pain. In the partial models, variables that were associated with wrist or hand pain were occupational group (bank workers), sex (women), ethnic group (Nguni and other), somatising tendency (two or more symptoms) and frightening situation.

In the full model, sex (women), ethnic group (Nguni and other) and somatising tendency (two or more symptoms) were variables associated with wrist or hand pain. An increasing pattern was observed between age group and reports of wrist or hand pain although the 95% CIs included one.

3.4.1.13 Final model and predicted prevalences of wrist or hand pain in the past 12 months in the South African workers

The final model of wrist or hand pain and predicted prevalences are shown in Table 3.19. It portrays the explanatory variables with ORs demonstrating positive

Table 3.19: Multiple regression of wrist or hand pain in the past 12 months with possible risk factors and predicted prevalences in the SA workers: Final model

Explanatory variable	Wrist/hand pain in the past 12 months (N=120)			
	n (%)	^a Final model ^b OR (95% CI)	Predicted prevalence % (95% CI)	^c Δ (%)
Occupational group				
Nurses	56 (46.7)	1	23.8 (17.9-29.6)	
Bank workers	64 (53.3)	1.06 (0.61-1.86)	24.6 (18.6-30.6)	0.8
Age group (years)				
<30	32 (27.6)	1	23.5 (16.2-30.7)	
30-39	27 (23.3)	0.74 (0.39-1.39)	19.6 (13.1-25.9)	
40-49	42 (36.2)	1.20 (0.65-2.22)	28.5 (21.7-35.8)	
≥50	15 (12.9)	1.18 (0.54-2.57)	26.1 (15.1-37.0)	2.6
*Sex				
Men	13 (10.8)	1	15.3 (7.3-23.4)	
Women	107 (89.2)	2.28 (1.09-4.74)	26.1 (21.8-30.3)	10.8
*Ethnic group				
Sotho	35 (29.2)	1	17.5 (12.2-22.7)	
Nguni	41 (34.2)	1.85 (1.08-3.18)	27.8 (20.7-34.8)	10.3
Other	44 (36.7)	2.02 (1.09-3.72)	30.5 (22.0-39.1)	13.0
*Number of distressing somatic symptoms				
0	27 (22.5)	1	15.3 (9.9-20.7)	
1	25 (20.8)	1.59 (0.84-3.00)	21.2 (13.9-28.5)	
≥2	68 (56.7)	3.07 (1.76-5.35)	33.8 (27.1-40.5)	18.5

^a Post regression tests :Hosmer-Lemeshow χ^2 p-value group (8)=0.23; group (10)=0.59; group (12)=0.50; ROC curve =68.6%.

^bAdjusted ORs of significant risk factors.

^cDifference in predicted prevalences of associated level/s of explanatory variables and relevant reference groups.

*Explanatory variables associated with wrist or hand pain with respective predicted prevalences in the final model.

associations with wrist or hand pain. These variables included sex (women), ethnic

group (Nguni and other) and somatising tendency (two or more symptoms).

The predicted prevalences of wrist or hand pain show that somatising tendency (two or more symptoms) is estimated to contribute the largest increase (18.5%) in the prevalence of wrist or hand pain.

3.4.1.14 Partial and full models of upper limb pain in the past 12 months in the South African workers

The partial and full models of upper limb pain appear in Table 3.20. The models present explanatory variables that are associated with upper limb pain.

Table 3.20: Multiple regression of upper limb pain in the past 12 months with possible risk factors in the SA workers: Partial and full models

Explanatory variable	n (%)	Upper limb pain in past 12 months (N=260)	
		Partial model	Full model
		^a OR (95% CI)	^b OR (95% CI)
Occupational group			
Nurses	136 (52.3)	1	1
Bank workers	124 (47.7)	1.26 (0.83-1.90)	0.73 (0.42-1.26)
Age group (years)			
<30	72 (28.1)	1	1
30-39	64 (25.0)	0.70 (0.43-1.14)	0.66 (0.38-1.14)
40-49	86 (33.6)	1.33 (0.79-2.23)	1.36 (0.76-2.42)
≥50	34 (13.3)	1.12 (0.58-2.13)	1.41 (0.68-2.92)
*Sex			
Men	30 (11.5)	1	1
Women	230 (88.5)	2.49 (1.44-4.29)	2.39 (1.30-4.37)
*Past Injuries			
No	177 (68.6)	1	1
Yes	81 (31.4)	1.97 (1.27-3.07)	1.73 (1.07-2.80)
*Ethnic group			
Sotho	100 (38.5)	1	1
Nguni	79 (30.4)	1.24 (0.80-1.92)	1.19 (0.73-1.93)
Other	81 (31.2)	1.58 (0.95-2.63)	1.87 (1.05-3.34)

^aAdjusted for occupational group, age group and sex; occupational group, age group and sex were mutually adjusted.

^bAdjusted for all the risk factors in the table.

*Explanatory variables associated with upper limb pain in partial and/ or full models.

Table 3.20: Multiple regression of upper limb pain in the past 12 months with possible risk factors in the SA workers: Partial and full models cont'd

Explanatory variable	n (%)	Upper limb pain in past 12 months (N=260)	
		Partial model ^a OR (95% CI)	Full model ^b OR (95% CI)
Financial difficulties			
No	65 (25.2)	1	1
Yes	193 (74.8)	1.40 (0.93-2.11)	1.19 (0.75-1.87)
*Number of distressing somatic symptoms			
0	69 (26.5)	1	1
1	60 (23.1)	1.61 (0.99-2.63)	1.50 (0.88-2.54)
≥2	131 (50.4)	3.39 (2.15-5.33)	2.82 (1.70-4.67)
*Frightening situation			
No	121 (47.1)	1	1
Yes	136 (52.9)	1.76 (1.20-2.56)	1.43 (0.93-2.20)
Adverse beliefs about arm pain			
No	168 (64.6)	1	1
Yes	92 (35.4)	1.51 (1.00-2.26)	1.33 (0.82-2.10)
*Upper limb load			
No	53 (20.7)	1	1
Yes	203 (79.3)	1.56 (1.02-2.41)	1.33 (0.83-2.15)
*Mental health status			
Good	82 (31.5)	1	1
Intermediate	67 (25.8)	1.10 (0.70-1.74)	0.72 (0.43-1.22)
Poor	111 (42.7)	2.23 (1.41-3.52)	1.38 (0.82-2.34)
*Job insecurity			
No	124 (48.2)	1	1
Yes	133 (51.8)	1.66 (1.10-2.49)	1.22 (0.77-1.93)
*Job dissatisfaction			
No	145 (56.0)	1	1
Yes	114 (44.0)	1.76 (1.19-2.59)	1.44 (0.93-2.23)

^aAdjusted for occupational group, age group and sex; occupational group, age group and sex were mutually adjusted.

^bAdjusted for all the risk factors in the table.

*Explanatory variables associated with upper limb pain in partial and/ or full models.

Sex (women), past injuries, somatising tendency (two or more symptoms), frightening situation, mental health status (poor), upper limb load, job insecurity and job dissatisfaction were positively associated with upper limb pain in the partial models.

In the full model, sex (women), past injuries, ethnic group (other) and somatising tendency (two or more symptoms) were the variables which showed associations with upper limb pain. The reports of upper limb pain tended to increase with increasing age but the CIs included one.

3.4.1.15 Final model and predicted prevalences of upper limb pain in the past 12 months in the South African workers

The final model of upper limb pain with significant explanatory variables demonstrating positive associations with upper limb pain and predicted prevalences appear in Table 3.21. Sex (women), past injuries, ethnic group (other), somatising

Table 3.21: Multiple regression of upper limb pain in the past 12 months with possible risk factors and predicted prevalences in the SA workers: Final model

Explanatory variable	Upper limb pain in past 12 months (N=260)			
	n (%)	^a Final model	Predicted prevalence	
		^b OR (95% CI)	% (95% CI)	^c Δ (%)
Occupational group				
Nurses	136 (52.3)	1	56.7 (50.3-63.1)	
Bank workers	124 (47.7)	0.72 (0.43-1.23)	48.8 (41.8-53.8)	-7.9
Age group (years)				
<30	72 (28.1)	1	53.8 (45.6-61.9)	
30-39	64 (25.0)	0.64 (0.37-1.10)	45.2 (37.5-52.9)	
40-49	86 (33.6)	1.30 (0.73-2.29)	58.5 (50.4-66.6)	
≥50	34 (13.3)	1.25 (0.62-2.55)	57.2 (45.2-69.0)	3.4
*Sex				
Men	30 (11.5)	1	37.4 (26.7-48.1)	
Women	230 (88.5)	2.45 (1.35-4.46)	56.4 (51.7-61.0)	19.0
*Past injuries				
No	177 (68.6)	1	49.7 (44.9-54.5)	
Yes	81 (31.4)	1.81 (1.13-2.91)	62.9 (54.8-71.2)	13.2
*Ethnic group				
Sotho	100 (38.5)	1	48.3 (41.8-54.9)	
Nguni	79 (30.4)	1.17 (0.72-1.88)	52.0 (44.4-59.6)	
Other	81 (31.2)	1.81 (1.03-3.18)	61.8 (53.2-70.4)	13.5

^aPost regression tests :Hosmer-Lemeshow χ^2 p-value group (8)=0.50; group (10)=0.15; group (12)=0.24; ROC curve =72.4%.

^bAdjusted ORs of significant risk factors.

^cDifference in predicted prevalences of associated level/s of explanatory variables and relevant reference groups.

Table 3.21: Multiple regression of upper limb pain in the past 12 months with possible risk factors and predicted prevalences in the SA workers: Final model cont'd

Explanatory variable	Upper limb pain in past 12 months (N=260)			
	n (%)	Final model		Predicted prevalence % (95% CI) ^c Δ (%)
		OR (95% CI)		
Mental health status ^d				
Good	82 (31.5)	1	50.6 (43.4-57.9)	
Intermediate	67 (25.8)	0.76 (0.46-1.27)	46.5 (38.8-54.3)	
Poor	111 (42.7)	1.59 (0.96-2.63)	61.2 (53.9-68.4)	10.6
Number of distressing somatic symptoms				
0	69 (26.5)	1	40.9 (33.7-48.2)	
1	60 (23.1)	1.58 (0.94-2.67)	50.6 (41.9-59.3)	
≥2	131 (50.4)	3.12 (1.90-5.11)	65.8 (59.1-72.5)	24.9
Job dissatisfaction				
No	145 (56.0)	1	48.9 (43.6-54.3)	
Yes	114 (44.0)	1.58 (1.03-2.41)	59.7 (52.9-66.4)	10.8

^aPost regression tests :Hosmer-Lemeshow χ^2 p-value group (8)=0.50; group (10)=0.15; group (12)=0.24; ROC curve =72.4%.

^bAdjusted ORs of significant risk factors.

^cDifference in predicted prevalences of associated level/s of explanatory variables and relevant reference groups.

^dReturned to the model; p-value 0.031.

*Explanatory variables associated with upper limb pain with their respective predicted prevalences in the final model.

tendency (two or more symptoms) and job dissatisfaction increased the odds of reporting upper limb pain by the workers. The variable mental health status was kept in the final model even though it was not statistically significant because the likelihood ratio test became significant when it was removed from the model.

Regarding the predicted prevalences of upper limb pain, somatising tendency was the variable that would have the largest increase (24.9%) in the prevalence of upper limb pain in SA workers reporting two or more symptoms versus those not reporting symptoms. Sex (women) is estimated to increase the prevalence by 19.0%. Ethnic group (other) and past injuries had similar effects at 13.5% and 13.2%, respectively.

3.4.1.16 Partial and full models of knee pain in the past 12 months in the South African workers

The partial and full models of knee pain are presented in Table 3.22. They contain explanatory variables with corresponding ORs representing associations with knee

pain, which were age group (40-49 years), financial difficulties, somatising tendency (two or more symptoms), mental health status (intermediate), working under time pressure and job dissatisfaction while “past injuries” was negatively associated with knee pain.

Table 3.22: Multiple regression of knee pain in the past 12 months with possible risk factors in the SA workers: Partial and full models

Explanatory variable	Knee pain in past 12 months (N=143)		
	n (%)	Partial model ^a OR (95% CI)	Full model ^b OR (95% CI)
Occupational group			
Nurses	81 (56.6)	1	1
Bank workers	62 (43.4)	0.96 (0.62-1.50)	0.65 (0.35-1.19)
*Age group (years)			
<30	29 (20.7)	1	1
30-39	36 (25.7)	1.21 (0.68-2.14)	1.08 (0.57-2.05)
40-49	54 (38.6)	2.21 (1.25-3.89)	2.27 (1.19-4.33)
≥50	21 (15.0)	1.91 (0.94-3.84)	2.36 (1.07-5.20)
Sex			
Men	16 (11.2)	1	1
Women	127 (88.8)	1.46 (0.77-2.78)	1.53 (0.77-3.06)
*Past injuries			
No	89 (63.1)	1	1
Yes	52 (36.9)	0.89 (0.84-0.95)	2.39 (1.44-3.95)
Ethnic group			
Sotho	65 (45.4)	1	1
Nguni	37 (25.9)	0.70 (0.43-1.13)	0.73 (0.42-1.25)
Other	41 (28.7)	0.90 (0.52-1.56)	1.00 (0.54-1.83)
*Financial difficulties			
No	24 (16.9)	1	1
Yes	118 (83.1)	2.47 (1.49-4.08)	2.45 (1.42-4.24)
*Number of distressing somatic symptoms			
0	34 (23.8)	1	1
1	34 (23.8)	1.76 (1.00-3.10)	1.56 (0.85-2.87)
≥2	75 (52.4)	3.01 (1.82-4.97)	2.51 (1.43-4.39)

^aAdjusted for occupational group, age group and sex; occupational group, age group and sex were mutually adjusted.

^bAdjusted for all the risk factors in the table.

*Explanatory variables associated with knee pain in partial and / or full models.

Table 3.22: Multiple regression of knee pain in the past 12 months with possible risk factors in the SA workers: Partial and full models cont'd

Explanatory variable	Knee pain in past 12 months (N=143)		
	n (%)	Partial model ^a OR (95% CI)	Full model ^b OR (95% CI)
Frightening situation			
No	69 (48.6)	1	1
Yes	73 (51.4)	1.45 (0.96-2.19)	1.07 (0.67-1.71)
*Mental health status			
Good	44 (30.8)	1	1
Intermediate	50 (34.9)	1.82 (1.10-3.01)	1.31 (0.74-2.32)
Poor	49 (34.3)	1.31(0.79-2.17)	0.77 (0.42-1.39)
Kneeling or squatting			
No	116 (81.1)	1	1
Yes	27 (18.9)	1.51 (0.83-2.73)	1.15 (0.58-2.25)
*Working under time pressure			
No	8 (5.6)	1	1
Yes	135 (94.4)	3.64 (1.64-8.06)	3.88 (1.59-9.47)
*Job dissatisfaction			
No	70 (49.0)	1	1
Yes	73 (51.0)	2.31 (1.52-3.50)	2.23 (1.41-3.53)

^aAdjusted for occupational group, age group and sex; occupational group, age group and sex were mutually adjusted.

^bAdjusted for all the risk factors in the table.

*Explanatory variables associated with knee pain in partial and / or full models.

In the full model, age group (40-49 and 50 years and above), past injuries, financial difficulties, somatising tendency (two or more symptoms), working under time pressure and job dissatisfaction were variables positively associated with knee pain. It was observed that the reports of knee pain increased with increasing age group although the CIs included one.

3.4.1.17 Final model and predicted prevalences of knee pain in the past 12 months in the South African workers

The final model of knee pain and predicted prevalences are portrayed in Table 3.23. It shows significant explanatory variables with positive associations with knee pain. The variables that showed positive associations with knee pain were age group (40-49 and 50 years and above), past injuries, financial difficulties, somatising tendency

(two or more symptoms), working under time pressure and job dissatisfaction. The reports of knee pain increased with increasing age group.

Table 3.23: Multiple regression of knee pain in the past 12 months with possible risk factor and predicted prevalences in the SA workers: Final model

Explanatory variable	Knee pain in the past 12 months (N=143)			
	n (%)	^a Final model ^b OR (95% CI)	Predicted prevalence % (95% CI)	^c Δ (%)
Occupational group				
Nurses	81 (56.6)	1	32.8 (26.9-38.7)	
Bank workers	62 (43.4)	0.61 (0.37-1.01)	25.0 (19.6-30.5)	-7.8
*Age group (years)				
<30	29 (20.7)	1	22.0 (15.1-28.9)	
30-39	36 (25.7)	1.11 (0.59-2.08)	24.2 (17.5-30.9)	
40-49	54 (38.6)	2.18 (1.16-4.09)	36.0 (28.4-43.7)	14.0
≥50	21 (15.0)	2.50 (1.16-5.38)	38.9 (27.3-50.6)	16.9
Sex				
Men	16 (11.2)	1	23.2 (13.7-32.7)	
Women	127 (88.8)	1.54 (0.78-3.04)	30.1 (25.9-34.4)	6.9
*Past injuries				
No	89 (63.1)	1	24.8 (20.6-29.0)	
Yes	52 (36.9)	2.39 (1.47-3.89)	40.8 (32.9-48.8)	16.0
*Number of distressing somatic symptoms				
0	34 (23.8)	1	21.0 (14.9-27.1)	
1	34 (23.8)	1.56 (0.85-2.85)	28.2 (20.6-35.8)	
≥2	75 (52.4)	2.42 (1.41-4.14)	35.8 (29.4-42.1)	14.8
*Financial difficulties				
No	24 (16.9)	1	18.4 (12.2-24.9)	
Yes	118 (83.1)	2.44 (1.43-4.18)	33.0 (28.4-37.7)	14.6
*Working under time pressure				
No	8 (5.6)	1	12.0 (3.9-20.1)	
Yes	135 (94.4)	3.93 (1.64-9.44)	31.4 (27.2-35.5)	19.4
*Job dissatisfaction				
No	70 (49.0)	1	23.6 (19.0-28.2)	
Yes	73 (51.0)	2.14 (1.37-3.35)	37.4 (30.9-43.9)	13.8

^aPost regression tests :Hosmer-Lemeshow χ^2 p-value group (8)=0.47; group (10)=0.11; group (12)=0.16; ROC curve =75.1%.

^bAdjusted ORs of significant risk factors.

^cDifference in predicted prevalences of associated level/s of explanatory variables and relevant reference groups.

*Explanatory variables associated with knee pain with their respective predicted prevalences in the final model.

The predicted prevalences of knee pain show that working under time pressure would have the largest increase (19.4%) in the prevalence of knee pain in SA

workers. Age group (50 years and above) and past injuries would have increases of 16.9% and 16.0%, respectively. Job dissatisfaction has the smallest predicted increase (13.8%) among the variables positively associated with the knee pain.

3.4.1.18 Linear trend in the ORs of age group in the final model of knee pain in the past 12 months in the South African workers

The test for linear trend in the ORs of age group is presented in Table 3.24. The inclusion of age group as a categorical factor did not improve the fit of the final model

Table 3.24: The linear trend in the ORs of age group in the final model of knee pain in the SA workers

Explanatory variable	Knee pain in the past 12 months (N=143)		
	n (%)	^a Final model OR (95% CI)	^b Final model OR (95% CI)
Occupational group			
Nurses	81 (56.6)	1	1
Bank workers	62 (43.4)	0.61 (0.37-1.01)	0.61 (0.37-1.01)
*Age group (years)			
No	29 (20.7)	1	1
Yes	111 (79.3)	1.43 (1.13-1.81)	1.35 (1.05-1.75)
Sex			
Men	16 (11.2)	1	1
Women	127 (88.8)	1.57 (0.80-3.09)	1.54 (0.78-3.04)
Past injuries			
No	89 (63.1)	1	1
Yes	52 (36.9)	2.36 (1.46-3.82)	2.39 (1.47-3.89)
Number of distressing somatic symptoms			
0	34 (23.8)	1	1
1	34 (23.8)	1.61 (0.88-2.94)	1.56 (0.85-2.85)
≥2	75 (52.4)	2.48 (1.45-4.24)	2.42 (1.41-4.14)
Financial difficulties			
No	24 (16.9)	1	1
Yes	118 (83.1)	2.49 (1.46-4.25)	2.44 (1.43-4.18)
Working under time pressure			
No	8 (5.6)	1	1
Yes	135 (94.4)	3.91 (1.63-9.36)	3.93 (1.64-9.44)
Job dissatisfaction			
No	70 (49.0)	1	1
Yes	73 (51.0)	2.17 (1.39-3.39)	2.14 (1.37-3.35)

^aEffect of age taken as linear in the model.

^bAge entered in the model as a categorical factor.

*Explanatory variable showing results of linear trend when entered as linear and categorical in knee pain final model.

when the effect of age group was taken as linear. This was demonstrated by the likelihood ratio test p-value of 0.49. Therefore, the parsimonious model where age group was linear, can be adopted as the model that provides a better fit. It can be summarised as: the odds of reporting knee pain by the workers increased by 1.43 times from one age group to the next.

3.4.1.19 Summary of possible risk factors associated with MSD pain in the past 12 months in South African workers

The risk factors for MSD pain from the final models of all the pain sites used in the multiple regression analysis are presented in Table 3.25.

- Somatising tendency was the most consistent risk factor, followed by past injuries and job dissatisfaction.
- “Any” and neck pain were associated with most risk factors, followed by knee then low back, shoulder and upper limb pain.
- Shoulder and knee pain were associated with age group, and the relationships showed increasing linear trends.
- “Any”, low back and elbow pain increased with age group although the trends were not significant.
- Shoulder, wrist or hand and upper limb pain were associated with sex (women).
- Ethnic group was inconsistently associated with site specific pain.
- Bank workers were generally at a lower risk of “any” MSDs than nurses but at a higher risk of neck pain.
- BMI contributed very little in explaining MSDs.

- Surprisingly, physical workplace activities also contributed little in explaining MSDs.
- In general, the effect of most risk factors was inconsistent across the different pain sites.

Table 3.25: Statistically significant risk factors from final models of MSD pain in the past 12 months in South African workers

Risk factor	Pain site								**Total
	Any	Low back	Neck	Shoulder	Elbow	Wrist/hand	Upper limb	Knee	
*Number of distressing somatic symptoms									
0									
1	√	√							
≥2	√	√	√	√	√	√	√	√	8
*Past injuries									
Yes	√	√	√	√	-	-	√	√	
No									6
*Job dissatisfaction									
Yes	√	√	-	√	-	-	√	√	
No									5
*Sex									
Men	-	-	-		-			-	
Women				√		√	√		3
Ethnic group									
Sotho									
Nguni	-		-	-	-	√		-	
Other		√				√	√		3
*Age group (years)									
<30									
30-39			-				-		
40-49	↑	↑		√	↑			√	
≥50				√				√	2
*Occupational group									
Nurses		-		-	-	-	-	-	
Bank workers	-√		√						2
Financial difficulties									
Yes	-	-	√	-	-	-	-	√	
No									2
Frightening situation									
Yes	√	-	√	-	-	-	-	-	
No									2

*)=Risk factors showing consistent association with pain sites; **)Number of pain sites associated with a particular risk factor; √)=Positively associated; -√)=Negatively associated; -)=Not associated or not applicable; ↑)=OR increased with age.

Table 3.25: Statistically significant risk factors from final models of MSD pain in the past 12 months in South African workers cont'd

Risk factor	Pain site								**Total
	Any	Low back	Neck	Shoulder	Elbow	Wrists/hands	Upper limb	Knee	
Working under time pressure									
Yes	-	-	√	-		-	-	√	2
No									
BMI group									
Normal									1
Overweight	-	√	-	-	-	-	-	-	
Obese									
Smoking status									
Never smoked		-	-	-	-	-	-	-	1
Ever smoked	√								
Adverse beliefs about low back and arm pain									
Yes	√	-	-	-	-	-	-	-	1
No									
Lack of social support									
Yes	-	-	√	-	-	-	-	-	1
No									
*Repeated elbow bending > 1 hour									
Yes									1
No	-	-	-	-	√	-	-	-	
Mental health status									
Good									1
Intermediate	-	-	-	-		-	-	-	
Poor					√				
***Total	7	5	7	5	3	3	5	6	41 / 41

*)=Physically demanding work activity showing association with corresponding body site; **)=Number of pain sites associated with a particular risk factor; ***)=Number of risk factors associated with a particular pain site; √)=Positively associated; -)=Not associated or not applicable.

Chapter 4: Cross-sectional and follow-up studies of the South African public hospital nurses

This chapter focuses on one occupational group: the public hospital nurses. The contents of the chapter are organised into: Part 1) the cross-sectional component; and Part 2) the follow-up component.

Part 1: Cross-sectional study of the South African public hospital nurses

4.1 Introduction

The cross-sectional component comprised 251 nurses who were working in two public hospitals: Hospital A with 130 nurses and Hospital B with 121 nurses. The description of the nurses covering different dimensions of MSD exposures is presented first, followed by the occurrence of MSDs and the determination of possible risk factors associated with the development of MSDs.

4.2 Description of the South African public hospital nurses

The nurses were working in wards representing seven departments, with the largest percentage (29.0%) working in the Surgical Department. The percentages of nurses in Gynaecology and Obstetrics (21.0%) and Medical (20.0%) Departments were almost equal. So, were those in Orthopaedics (11.0%) and Theatre (10.0%). The smallest numbers were in Casualty (6.0%) and ICU (3.0%). Forty six percent of the nurses were professional nurses, 40.0% were enrolled nurses and 14.0% were staff nurses. Seventy point two percent of the nurses had been working in their current position for more than five years.

The nurses are described based on individual characteristics which include physical, psychosocial and psychological factors and workplace conditions covering physical and psychosocial factors.

4.2.1 Individual physical and psychosocial characteristics

The physical and psychosocial characteristics of the nurses are presented in Table

4.1. The mean age \pm SD was 39.9 ± 9.2 years with the youngest nurse being 22 years and the oldest 65 years. BMI was missing for 31 nurses but the mean for those with BMI \pm SD was 29.3 ± 7.2 ; range 17-69.

Table 4.1: Individual physical and psychosocial characteristics of the SA public hospital nurses (N=251)

Individual characteristic	Hospital A (N=130)	Hospital B (N=121)	Total
	n (%)	n (%)	N (%)
Physical			
Sex			
Men	3 (2.3)	6 (5.0)	9 (3.5)
Women	127 (97.7)	115 (95.0)	242 (96.4)
Total	130 (100.0)	121 (100.0)	251 (100.0)
Age group (years)			
<30	18 (13.9)	22 (18.2)	40 (15.9)
30-39	36 (27.7)	42 (34.7)	78 (31.1)
40-49	53 (40.8)	39 (32.2)	92 (36.6)
≥ 50	23 (17.7)	18 (14.9)	41 (16.3)
Total	130 (100.0)	121 (100.0)	251 (100.0)
BMI group			
Normal	30 (30.3)	39 (32.2)	69 (31.4)
Overweight	33 (33.3)	39 (32.2)	72 (32.7)
Obese	36 (36.4)	43 (35.5)	79 (35.9)
Total	99 (100.0)	121 (100.0)	220 (100.0)
Past injuries			
Yes	13 (10.1)	43 (35.8)	56 (22.5)
No	116 (89.9)	77 (64.2)	193 (77.5)
Total	129 (100.0)	120 (100.0)	249 (100.0)
Psychosocial			
Ethnic group			
Sotho ^a	65 (50.0)	74 (61.2)	139 (55.4)
Nguni ^b	65 (50.0)	22 (18.1)	87 (34.6)
Other ^c	-	25 (20.7)	25 (10.0)
Total	130 (100.0)	121 (100.0)	251 (100.0)

^aConsists of Pedi, Tswana and Sotho.

^bConsists of Xhosa and Zulu.

^cConsists of Afrikaner, Coloured, Indian, Tsonga and Venda.

Table 4.1: Individual physical and psychosocial characteristics of the SA public hospital nurses (N=251) cont'd

Individual characteristic	Hospital A (N=130)	Hospital B (N=121)	Total
	n (%)	n (%)	N (%)
Educational level			
High school	6 (4.6)	10 (8.3)	16 (6.4)
Tertiary	124 (95.4)	111 (91.7)	235 (93.6)
Total	130 (100.0)	121 (100.0)	251 (100.0)
Smoking status			
Never-smoked	127 (97.7)	106 (87.6)	233 (92.8)
Ever-smoked	3 (2.3)	15 (12.4)	18 (7.2)
Total	130 (100.0)	121 (100.0)	251 (100.0)

As expected, the majority of nurses (96.4%) were women. Most of them (68.6%) were in the overweight and obese BMI groups; 67.7% were in the 30-39 and 40-49 years age groups. More than half (55.4%) belonged to the Sotho ethnic group.

4.2.2 Individual psychological characteristics

The psychological characteristics reported by the nurses are shown in Table 4.2. A high percentage of nurses (72.1%) thought that workers who suffer from MSD pain should be compensated (deserve compensation). Just over two thirds of nurses (67.9%) had financial difficulties, more than half (56.2%) reported one or more distressing somatic symptoms, and 47.9% had experienced a frightening situation.

Table 4.2: Individual psychological characteristics of the SA public hospital nurses (N=251)

Individual psychological characteristic	Hospital A (N=130)	Hospital B (N=121)	Total
	n (%)	n (%)	N (%)
Deserve compensation ^a			
Yes	105 (81.4)	73 (61.9)	178 (72.1)
No	24 (18.6)	45 (38.1)	69 (27.9)
Total	129 (100.0)	118 (100.0)	247 (100.0)
Financial difficulties ^b			
Yes	85 (65.9)	84 (70.0)	169 (67.9)
No	44 (34.1)	36 (30.0)	80 (32.1)
Total	129 (100.0)	120 (100.0)	249 (100.0)
Number of distressing ^c somatic symptoms			
0	60 (46.2)	50 (41.3)	110 (43.8)
1	35 (26.9)	29 (24.0)	64 (25.5)
≥2	35 (26.9)	42 (34.7)	77 (30.7)
Total	130 (100.0)	121 (100.0)	251 (100.0)
Frightening situation ^d			
Yes	55 (42.6)	56 (47.1)	111 (44.8)
No	74 (57.4)	63 (52.9)	137 (55.2)
Total	129 (100.0)	119 (100.0)	248 (100.0)
Adverse beliefs about pain ^e			
Low back and arm			
Yes	73 (56.1)	44 (36.4)	117 (46.6)
No	57 (43.9)	77 (63.6)	134 (53.4)
Total	130 (100.0)	121 (100.0)	251 (100.0)
Arm			
Yes	60 (46.1)	34 (28.3)	94 (38.6)
No	70 (53.9)	86 (71.7)	156 (61.4)
Total	130 (100.0)	120 (100.0)	250 (100.0)
Low back			
Yes	56 (43.1)	34 (28.1)	90 (36.8)
No	74 (56.9)	87 (71.9)	161 (63.2)
Total	130 (100.0)	121 (100.0)	251 (100.0)
Mental health status ^f			
Good	76 (58.5)	37 (30.6)	113 (45.0)
Intermediate	26 (20.0)	47 (38.8)	73 (29.8)
Poor	28 (21.5)	37 (30.6)	65 (25.2)
Total	130 (100.0)	121 (100.0)	251 (100.0)

^aPeople with musculoskeletal pain should be compensated.

^bBeing in financial difficulties-slight or big problem .

^cNumber of at least moderately distressing somatic symptoms in the past seven days from a total of seven.

^dBeing in a frightening situation-slight or big problem .

^eBelief that low back and / or arm pain is caused by work.

^fClassified into three levels corresponding to approximate thirds of the observed distribution of scores in the study.

4.2.3 Physical workplace activities

The nurses reported physically demanding work activities in their jobs on an average day (Table 4.3), the most common being repeated elbow bending for more than an

Table 4.3: Physically demanding work activities of the SA public hospital nurses on an average day (N=251)

Physical work activity	Hospital A (N=130)	Hospital B (N=121)	Total
	n (%)	n (%)	N (%)
Repeated elbow bending >1 hour*			
Yes	123 (94.6)	91 (75.2)	214 (85.3)
No	7 (5.4)	30 (24.8)	37 (14.7)
Total	130 (100.0)	121 (100.0)	251(100.0)
Lifting ≥25 kg loads by hand**			
Yes	120 (92.3)	82 (67.8)	202 (80.5)
No	10 (7.7)	39 (32.2)	49 (19.5)
Total	130 (100.0)	121 (100.0)	251 (100.0)
Upper limb load ^a			
Yes	118 (90.8)	78 (65.0)	196 (78.4)
No	12 (9.2)	42 (35.0)	54 (21.6)
Total	130 (100.0)	120 (100.0)	250 (100.0)
Repeated wrist/hand movement >4 hours*			
Yes	113 (86.9)	78 (64.5)	191 (76.1)
No	17 (13.1)	43 (35.5)	60 (23.9)
Total	130 (100.0)	121 (100.0)	251 (100.0)
Physical load ^b			
Yes	89 (68.5)	51 (42.9)	181 (72.7)
No	41 (31.5)	68 (57.1)	68 (27.3)
Total	130 (100.0)	119 (100.0)	249 (100.0)
Working with hands above shoulder height >1 hour*			
Yes	91 (70.0)	43 (35.8)	134 (53.6)
No	39 (30.0)	77 (64.2)	116 (46.4)
Total	130 (100.0)	121 (100.0)	250 (100)
Kneeling or squatting >1 hour**			
Yes	26 (20.0)	40 (33.3)	66 (26.4)
No	104 (80.0)	80 (66.6)	184 (73.6)
Total	130 (100.0)	120 (100.0)	250 (100.0)
Use of keyboard >4 hours			
Yes	21 (16.2)	8 (6.7)	29 (11.6))
No	109 (83.9)	112 (93.3)	221 (88.4)
Total	130 (100.0)	120 (100.0)	250 (100.0)

*Reports of any two or more of the variables marked with 1 asterisk.

**Reports of any three or more of the variables marked with 1 and 2 asterisks.

hour, reported by 85.3% of nurses. This was followed by lifting loads of 25 kg and above by hand (80.5%), and repeated wrist or finger movements for more than four hours (76.1%). The use of a keyboard for more than four hours was the least common physically demanding work activity reported (11.6%).

4.2.4 Psychosocial aspects of work

The stressful psychosocial work conditions reported by the nurses are shown in

Table 4.4. The majority (79.7%) felt that they were working under time pressure,

Table 4.4: Stressful psychosocial work conditions of SA public hospital nurses (N=251)

Psychosocial work condition	Hospital A (N=130)		Hospital B (N=121)		Total	
		n (%)		n (%)	N (%)	
Working under time pressure ^a						
Yes		99 (76.2)		101 (84.2)		200 (79.7)
No		31 (23.8)		19 (15.8)		50 (20.3)
Total		130 (100.0)		120 (100.0)		250 (100.0)
Job dissatisfaction ^b						
Yes		50 (38.5)		36 (29.8)		86 (34.3)
No		80 (61.5)		85 (70.2)		165 (65.7)
Total		130 (100.0)		121 (100.0)		251 (100.0)
Job insecurity ^c						
Yes		28 (22.1)		43 (35.8)		71 (28.7)
No		99 (77.9)		77 (64.2)		176 (71.3)
Total		127 (100.0)		120 (100.0)		247 (100.0)
Lack of control ^d						
Yes		41 (31.5)		18 (15.0)		59 (23.6)
No		89 (68.5)		102 (85.0)		191 (76.4)
Total		130 (100.0)		120 (100.0)		250 (100.0)
Incentives ^e						
Yes		8 (6.3)		45 (38.1)		53 (21.6)
No		119 (93.7)		73 (61.9)		192 (78.4)
Total		127 (100.0)		118 (100.0)		245 (100.0)
Lack of social support ^f						
Yes		20 (15.5)		12 (10.1)		32 (13.4)
No		109 (84.5)		107 (89.9)		216 (86.6)
Total		129 (100.0)		119 (100.0)		248 (100.0)

^aA target amount of work or a number of articles done or finished in a day or working under time pressure trying to complete tasks by a fixed time.

^bVery dissatisfied or dissatisfied about the job taking everything into consideration.

^cFeel that job would be insecure or very insecure if off work for three months due to serious illness.

^dChoice in all of: how work is done; what is done at work; and work time table and breaks times-seldom or never.

^ePiecework or payment of a bonus if an agreed number of tasks are finished in a day.

^fAssistance or support from colleagues or supervisors-seldom or never.

Just over a third (34.3%) were not satisfied with their jobs as a whole when taking everything into consideration (job dissatisfaction); 28.7% felt that their job would be insecure or very insecure if off work for three months due to serious illness (job insecure) and 23.6% felt that they lacked control of their work.

4.3 Occurrence of MSDs in the South African public hospital nurses

The nurses answered questions relating to the occurrence of MSDs. Their responses were used to calculate the prevalence and identify features and factors associated with MSDs.

4.3.1 Prevalence of MSDs in the past 12 months

The prevalence of MSDs in the nurses is shown in Figure 4.1. The estimated prevalence (95% CI) was 84.1% (79.5%-88.6%). At 58.2% (146/251), low back pain was the most prevalent pain, followed by shoulder pain at 41.0% (103/251), neck pain at 39.8% (100/251), and knee pain at 32.3% (81/251).

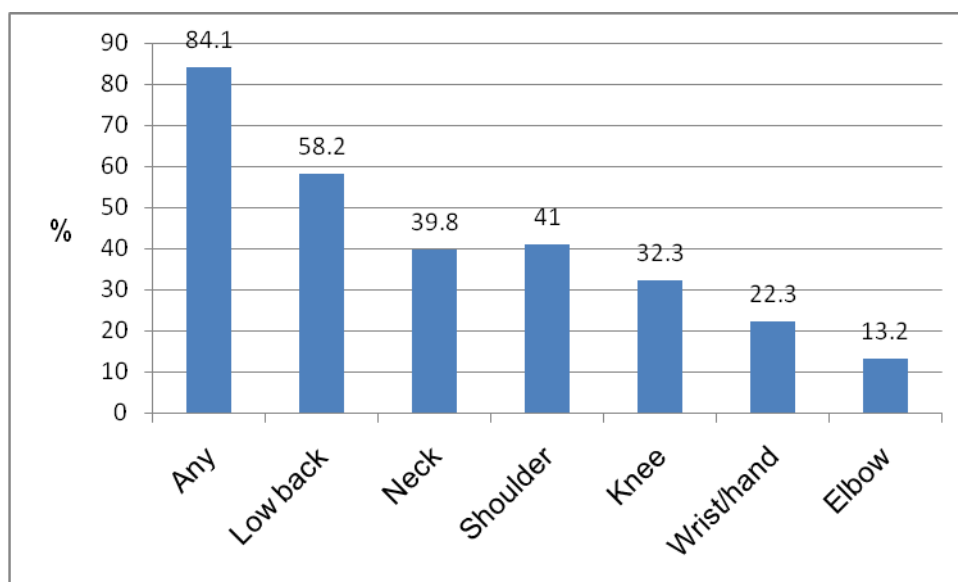


Figure 4.1:12-month prevalence of MSDs reported by the SA public hospital nurses

4.3.2 Features associated with MSDs

The nurses reported on the following features of MSDs: number of painful anatomical sites, number of days with pain, number of days away from work with pain and consulting a medical or alternative practitioner for pain.

4.3.2.1 Number of body sites affected by pain

The number of painful body sites reported by the nurses ranged from 1-6 sites (Figure 4.2). Two painful body sites were most common: reported by 25.5% (64/251) of the nurses. The prevalence (95% CI) of multi-site pain was 35.5% (29.5%-41.4%).

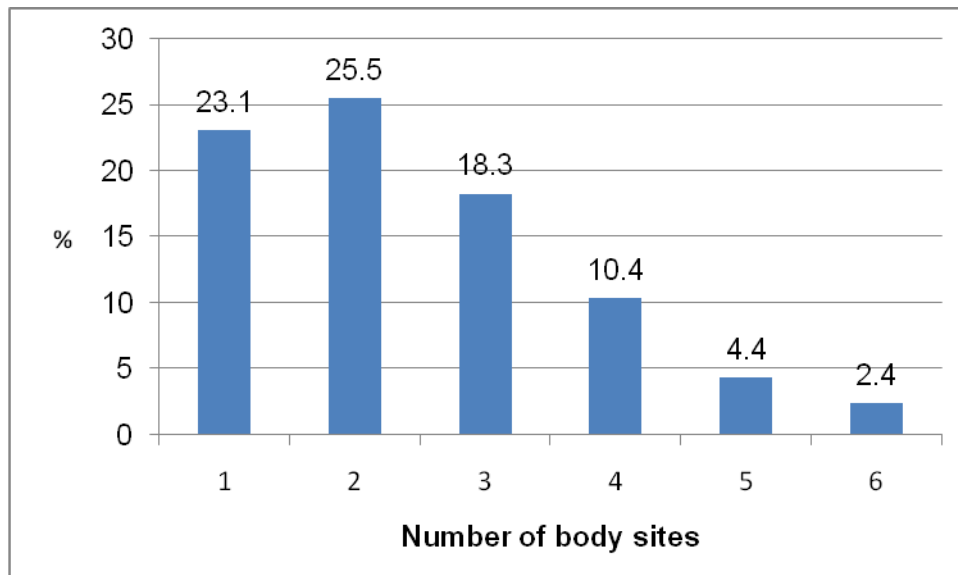


Figure 4.2: Number of painful body sites reported by the SA public hospital nurses

4.3.2.2 Number of days with pain

In Figure 4.3, the number of days with pain reported by the nurses is shown. Pain lasting for more than six days was the commonly reported duration of the six body sites, with the largest percentage 33.5% (84/251) for low back pain followed by 20.3% (51/251) for shoulder pain and 18.4% (46/251) for knee pain. Neck pain lasting from 1-6 days was more common than neck pain lasting for more than six

days. Pain occurring for 1-12 months was the least common in all the different body sites.

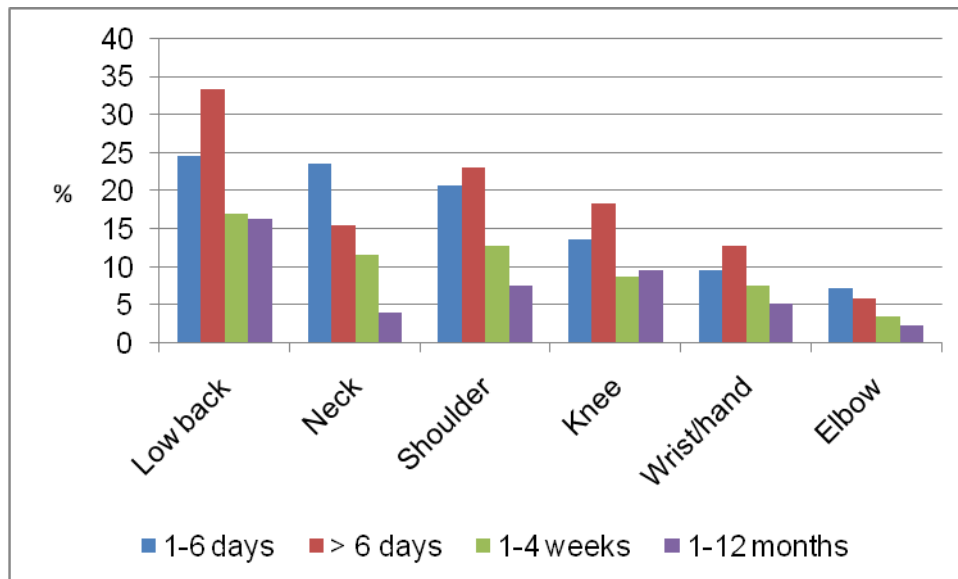


Figure 4.3: Number of days with site specific pain reported by the SA public hospital nurses

4.3.2.3 Number of days away from work with pain

The number of days that the nurses had been away from work due to site specific pain is shown in Figure 4.4. The number of days that was most common for all site specific pain was 1-5 days. Low back pain accounted for the largest percentage 19.9% (50/251) of the nurses reporting 1-5 days.

A total of 99 (39.6%) of the nurses had taken days away from work because of MSD pain. The largest percentage (27.6% (69/250)) had taken 1-5 days, 8.8% (22/250) had taken 6-30 days and 3.2% (8/250) had taken more than 30 days. A conservative estimate of the total number of days away from work in a year due to pain was 604.5 days that is, an average of 2.4 days per nurse.

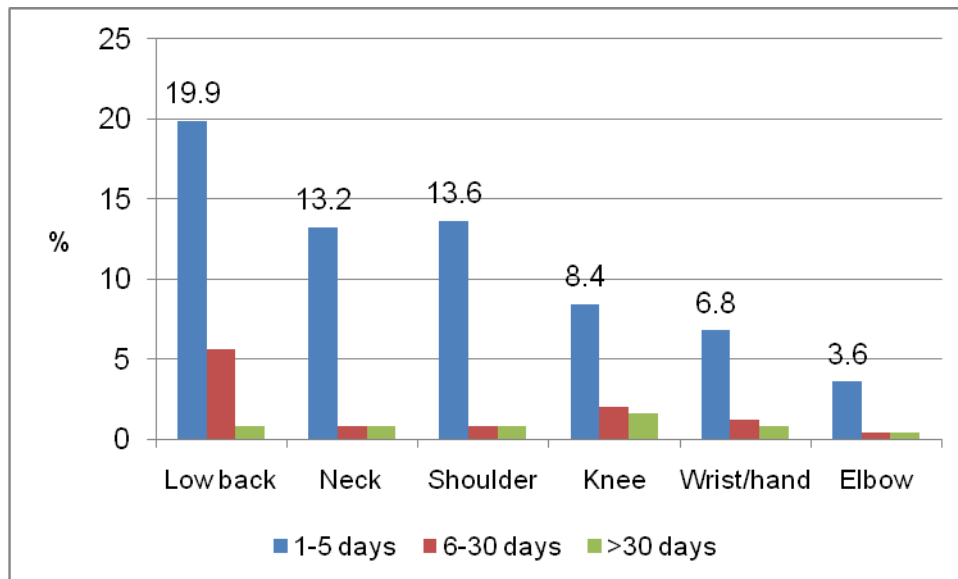


Figure 4.4: Number of days away from work with pain reported by the SA public hospital nurses

4.3.3.4 Consultation with healthcare providers for pain

The percentages of nurses who consulted among those who reported pain are shown in Figure 4.5. The majority (64.9% (137/211)) who reported pain had consulted for pain. A greater proportion of affected nurses consulted a medical or alternative practitioner for knee pain than low back pain: 62.9% vs 58.2%.

Surprisingly, the percentage of affected nurses who consulted for wrist/hand pain (57.1% (32/56)) exceeded those who consulted for shoulder pain (48.8% (50/103)).

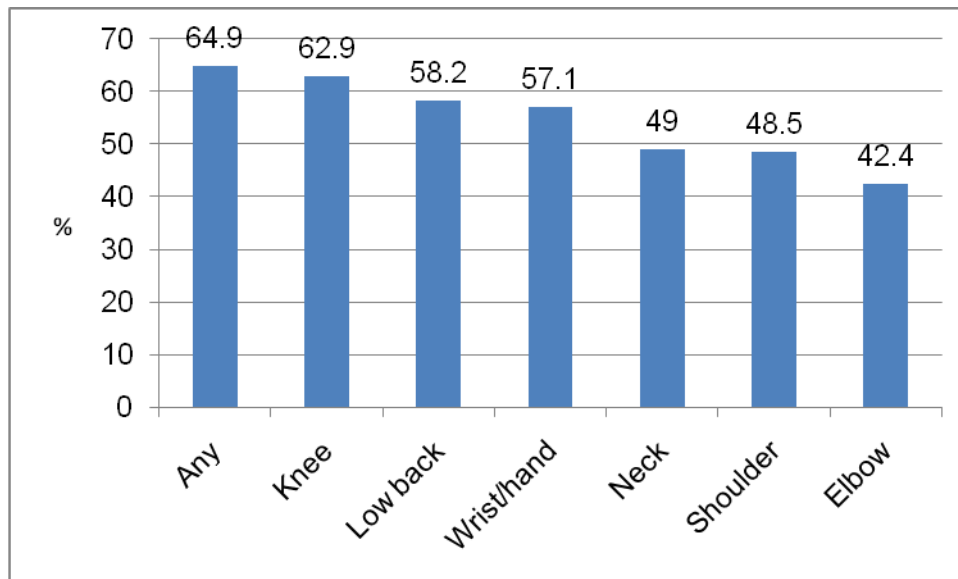


Figure 4.5: Consultation for pain reported by the SA public hospital nurses

4.4 Risk factors associated with MSDs in the South African public hospital nurses

The information presented in 3.4 is applicable in this subsection. However, the variables occupational group, sex and smoking status were excluded from the analyses. Occupational group was not applicable as the data were from one occupational group (nurses). In terms of sex and smoking status, very few subjects were men or had ever-smoked regularly in the study sample. These variables were therefore, excluded from further analyses. Multiple regression analysis was performed to identify associations between MSD risk factors and MSDs in the South African public hospital nurses.

4.4.1 Multiple regression analysis of MSD pain in the past 12 months with possible risk factors in the South African public hospital nurses

Binary logistic regression was used for partial, full and final models. The models are presented in tables summarizing the results of multiple regression analysis of “any”, low back, neck, shoulder, wrist or hand, upper limb and knee pain. Elbow pain was excluded from the analyses because there were not enough events for the selected

variables. Appendix J (table for “any” pain) shows all the variables that were tested for the full model.

4.4.1.1 Partial and full models of “any” pain in the past 12 months in the South African public hospital nurses

Partial and full models containing explanatory variables with ORs demonstrating associations with “any” pain are shown in Table 4.5. In the partial models, the

Table 4.5: Multiple regression of “any” pain in the past 12 months with possible risk factors in SA public hospital nurses: Partial and full models

Explanatory variable	“Any” pain in past 12 months (N=203)		
	n (%)	Partial model ^a OR (95% CI)	Full model ^b OR (95% CI)
Age group (years)			
<30	29 (14.3)	1	1
30-39	61 (30.0)	1.40 (0.51-3.80)	1.61 (0.44-5.79)
40-49	77 (37.9)	1.51 (0.57-3.99)	1.87 (0.54-6.40)
≥50	36 (17.7)	1.98 (0.58-6.72)	4.17 (0.94-18.35)
BMI group			
Normal	55 (27.1)	1	1
Overweight	62 (30.5)	1.06 (0.37-3.05)	0.71 (0.21-2.34)
Obese	61 (30.0)	0.43 (0.16-1.11)	0.30 (0.10-0.99)
Missing	25 (12.3)	0.88 (0.24-3.22)	0.38 (0.08-1.80)
Past injuries			
No	154 (76.6)	1	1
Yes	47 (23.4)	2.60 (0.87-7.73)	1.77 (0.52-5.97)
Deserve compensation			
No	53 (26.4)	1	1
Yes	148 (73.6)	2.00 (0.97-4.13)	1.73 (0.71-4.21)
*Frightening situation			
No	101 (50.5)	1	1
Yes	99 (49.5)	3.87 (1.69-8.89)	4.45 (1.69-11.70)
*Adverse beliefs about low back and arm pain			
No	98 (48.3)	1	1
Yes	105 (51.7)	2.84 (1.32-6.09)	2.82 (1.08-7.37)
*Number of distressing somatic symptoms			
0	78 (38.4)	1	1
1	54 (26.6)	2.11 (0.90-4.93)	1.35 (0.52-3.53)
≥2	71 (34.9)	8.54 (2.47-29.54)	5.62 (1.40-22.48)

^aAdjusted for age group; age group is presented unadjusted.

^bAdjusted for all the factors in the table.

*Explanatory variables associated with “any” pain in partial and/ or full models.

Table 4.5: Multiple regression of “any” pain in the past 12 months with possible risk factors in SA public hospital nurses: Partial and full models cont’d

Explanatory variable	“Any” pain in past 12 months (N=203)		
	n (%)	Partial model ^a OR (95% CI)	Full model ^b OR (95% CI)
Mental health status			
Good	88 (43.3)	1	1
Intermediate	61 (30.0)	1.33 (0.59-2.97)	2.91 (0.33-2.50)
Poor	54 (26.6)	1.85 (0.73-4.66)	3.76 (0.24-2.39)
*Working under time pressure			
No	35 (17.3)	1	1
Yes	167 (82.7)	2.68 (1.25-5.73)	1.79 (0.70-4.57)
*Job dissatisfaction			
No	125 (61.6)	1	1
Yes	78 (38.4)	3.52 (1.39-8.89)	2.47 (0.86-7.10)
*Job insecurity			
No	136 (68.3)	1	1
Yes	63 (31.7)	4.26 (1.43-12.61)	2.87 (0.84-9.80)

^aAdjusted for age group; age group is presented unadjusted.

^bAdjusted for all the factors in the table.

*Explanatory variables associated with “any” pain in partial and/ or full models.

variables that were positively associated with “any” pain were frightening situation, adverse beliefs about low back and arm pain, somatising tendency (two or more symptoms), working under time pressure, job dissatisfaction and job insecurity. The reporting of “any” pain increased with increasing age although the 95% CIs included one.

In the full model, three explanatory variables remained positively associated with “any” pain. These were frightening situation, adverse beliefs about low back and arm pain and somatising tendency (two or more symptoms). As in the partial models, the reporting of “any” pain increased with increasing age although the 95% CIs included one.

4.4.1.2 Final model and predicted prevalences of “any” pain in the past 12 months in the South African public hospital nurses

The final model of “any” pain is shown in Table 4.6. The explanatory variables that were positively associated with “any” pain were age group (50 years and above), frightening situation, adverse beliefs about low back and arm pain, somatising tendency (two or more symptoms) and job insecurity. The 95% CIs of these variables are wide and the OR point estimates should be treated cautiously.

Table 4.6: Multiple regression of “any” pain in the past 12 months with possible risk factors and predicted prevalences in SA public hospital nurses: Final model

Explanatory variable	“Any” pain in past 12 months (N=203)			
	n (%)	Final model		Predicted prevalence % (95% CI)
		OR (95% CI)		
*Age group (years)				
<30	29 (14.3)	1	74.8 (67.4-83.1)	
30-39	61 (30.0)	1.91 (0.59-6.17)	77.2 (70.7-83.7)	
40-49	77 (37.9)	2.11 (0.67-6.62)	85.9 (80.2-91.7)	
≥50	36 (17.7)	4.70 (1.15-19.10)	88.7 (81.3-96.0)	13.9
*BMI group				
Normal	55 (27.1)	1	79.8 (74.3-85.4)	
Overweight	62 (30.5)	0.87 (0.27-2.75)	85.7 (79.8-91.6)	
Obese	61 (30.0)	0.32 (0.11-0.91)	76.5 (69.2-83.8)	
Missing	25 (12.3)	0.42 (0.09-1.89)	81.1 (67.0-95.2)	-3.3
*Frightening situation				
No	101 (50.5)	1	75.1 (69.9-80.3)	
Yes	99 (49.5)	4.14 (1.78-10.92)	87.0 (82.6-91.4)	11.9
*Adverse beliefs about low back and arm pain				
No	98 (48.3)	1	76.4 (71.7-81.0)	
Yes	105 (51.7)	3.05 (1.23-7.57)	87.9 (83.2-92.7)	11.5
*Number of distressing somatic symptoms				
0	78 (38.4)	1	72.8 (66.4-79.1)	
1	54 (26.6)	1.57 (0.62-3.98)	81.6 (74.6-88.6)	
≥2	71 (35.0)	6.58 (1.76-24.47)	88.3 (83.5-93.0)	15.5
*Job insecurity				
No	136 (68.3)	1	78.9 (74.1-83.7)	
Yes	63 (31.7)	3.53 (1.07-11.59)	82.7 (77.8-87.6)	3.8

^aPost regression tests: Hosmer Lemeshow χ^2 P-value group (8)=0.73; group (10)=0.64; group (12)=0.97; ROC curve =82.2%.

^bAdjusted ORs of significant risk factors.

^cDifference in predicted prevalences of associated level/s of the explanatory variables and relevant reference groups.

*Explanatory variables associated with “any” pain with their respective predicted prevalences in the final model.

The BMI group “obese” was negatively associated with “any” pain.

The largest estimated increase (15.5%) in the prevalence of “any” pain in the SA public hospital nurses is associated with somatising tendency. Age group (50 years and above) and adverse beliefs about low back and arm pain would increase the prevalence by 11.9% and 11.5%, respectively. Surprisingly, the BMI group “obese” resulted in a decrease of the prevalence by 3.3%.

4.4.1.3 Partial and full models of low back pain in the past 12 months in the South African public hospital nurses

The partial and full models with explanatory variables and the ORs showing associations with low back pain are presented in Table 4.7. Adverse beliefs about

Table 4.7: Multiple regression of low back pain in the past 12 months with possible risk factors in SA public hospital nurses: Partial and full models

Explanatory variable	Low back pain in past 12 months (N=143)		
	n (%)	^a OR (95% CI)	^b OR (95% CI)
*Age group (years)			
<30	17 (11.9)	1	1
30-39	41 (28.7)	1.50 (0.68-3.33)	1.88 (0.76-4.68)
40-49	59 (41.3)	2.16 (0.99-4.71)	2.06 (0.87-4.98)
≥50	26 (18.2)	2.03 (0.82-5.04)	2.93 (1.07-8.03)
Frightening situation			
No	71 (50.4)	1	1
Yes	70 (49.6)	1.65 (0.97-2.82)	1.53 (0.83-2.81)
*Adverse belief about low back pain			
No	82 (57.3)	1	1
Yes	61 (42.7)	1.99 (1.13-3.49)	1.82 (0.96-3.44)
*Number of distressing somatic symptoms			
0	47 (32.9)	1	1
1	38 (26.6)	1.78 (0.93-3.42)	1.41 (0.70-2.82)
≥2	58 (40.6)	4.60 (2.31-9.13)	3.15 (0.70-2.82)
Mental health status			
Good	59 (41.3)	1	1
Intermediate	48 (33.6)	1.63 (0.90-3.17)	2.12 (0.62-2.59)
Poor	36 (25.2)	1.21 (0.64-2.31)	3.70 (0.33-1.49)

^aAdjusted for age group; age group is presented unadjusted.

^bAdjusted for all the factors in the table.

*Explanatory variables associated with low back pain in partial or full models.

Table 4.7: Multiple regression of low back pain in the past 12 months with possible risk factors in SA public hospital nurses: Partial and full models cont'd

Explanatory variable	Low back pain in past 12 months (N=143)		
	n (%)	Partial model ^a OR (95% CI)	Full model ^b OR (95% CI)
Working under time pressure			
No	24 (16.8)	1	1
Yes	119 (83.2)	1.69 (0.89-3.21)	1.28 (0.62-2.63)
Lack of social support			
No	117 (83.0)	1	1
Yes	24 (17.0)	2.20 (0.93-5.20)	1.83 (0.72-4.64)
Job dissatisfaction			
No	87 (60.8)	1	1
Yes	56 (39.2)	1.58 (0.90-2.78)	1.23 (0.64-2.36)
*Job insecurity			
No	94 (66.7)	1	1
Yes	47 (33.3)	1.93 (1.04-3.58)	1.42 (0.71-2.81)

^aAdjusted for age group; age group is presented unadjusted.

^bAdjusted for all the factors in the table.

*Explanatory variables associated with low back pain in partial or full models.

low back pain, somatising tendency (two or more symptoms) and job insecurity were positively associated with low back pain in the partial models. In the full model, age group (50 years and above) was the only variable positively associated with low back pain.

4.4.1.4 Final model and predicted prevalences of low back pain in the past 12 months in the South African public hospital nurses

The final model of low back pain and predicted prevalences are presented in Table 4.8. Somatising tendency (two or more symptoms) was the only variable that was positively associated with low back pain. The odds of reporting low back pain tended to increase with increasing age group although the 95% CIs included one.

Table 4.8: Multiple regression of low back pain in the past 12 months with possible risk factors and predicted prevalences in the SA public hospital nurses: Final model

Explanatory variable	Low back pain in past 12 months (N=143)			
	n (%)	Final model	Predicted prevalence	
		OR (95% CI)	% (95% CI)	^c Δ (%)
Age group (years)				
<30	17 (11.9)	1	49.6 (41.5-57.6)	
30-39	41 (28.7)	1.70 (0.72-4.04)	52.3 (44.3-60.3)	
40-49	59 (41.3)	2.12 (0.91-4.90)	36.8 (56.0-71.7)	
≥50	26 (18.2)	2.56 (0.96-6.82)	67.9 (56.5-79.4)	18.3
*Number of distressing somatic symptoms				
0	47 (32.9)	1	42.4 (35.1-49.7)	
1	38 (26.6)	1.72 (0.88-3.34)	58.8 (49.9-67.7)	
≥2	58 (40.6)	4.12 (2.05-8.27)	68.6 (62.1-75.1)	26.2

^aPost regression tests: Pearson Chi² p-value=0.59; ROC curve=67.4%.

^bAdjusted ORs of significant risk factors.

^cDifference in predicted prevalences of associated level/s of explanatory variables and relevant reference groups.

*Explanatory variable associated with low back pain with respective predicted prevalence in the final model.

The predicted prevalences of low back pain show that somatising tendency would increase the prevalence of low back pain by 26.2% in the nurses reporting two or more symptoms compared to those not reporting symptoms.

4.4.1.5 Partial and full models of neck pain in the past 12 months in the South African public hospital nurses

The partial and full models of neck pain appear in Table 4.9. They contain explanatory variables with ORs indicating associations with neck pain. Past injuries, financial difficulties, frightening situation and somatising tendency (two or more symptoms) were positively associated with neck pain in the partial models. The variable frightening situation remained positively associated with neck pain in the full model.

Table 4.9: Multiple regression of neck pain in the past 12 months with possible risk factors in SA public hospital nurses: Partial and full models

Explanatory variable	Neck pain in past 12 months (N=96)			
	n (%)	Partial model	Full model	
		^a OR (95% CI)	^b OR (95% CI)	
Age group (years)				
<30	11 (11.4)	1	1	
30-39	31 (32.3)	1.74 (0.75-4.05)	1.26 (0.49-3.23)	
40-49	40 (41.7)	1.85 (0.81-4.19)	1.53 (0.61-3.81)	
≥50	14 (14.6)	1.22 (0.47-3.18)	1.18 (0.41-3.37)	
*Past injuries				
No	67 (71.3)	1	1	
Yes	27 (28.7)	2.02 (1.07-3.80)	1.82 (0.91-3.63)	
*Financial difficulties				
No	22 (23.4)	1	1	
Yes	72 (76.6)	1.86 (1.02-3.37)	1.70 (0.88-3.26)	
*Frightening situation				
No	39 (41.9)	1	1	
Yes	54 (58.1)	2.38 (1.39-4.07)	2.22 (1.22-4.03)	
*Number of distressing somatic symptoms				
0	33 (34.4)	1	1	
1	28 (29.2)	1.66 (0.86-3.20)	1.71 (0.84-3.47)	
≥2	35 (36.4)	1.91 (1.03-3.56)	1.50 (0.74-3.03)	
Mental health status				
Good	38 (39.6)	1	1	
Intermediate	29 (30.2)	1.23 (0.66-2.29)	1.01 (0.49-2.05)	
Poor	29 (30.2)	1.64 (0.86-3.13)	1.32 (0.63-2.77)	
Working under time pressure				
No	14 (14.7)	1	1	
Yes	81 (84.3)	1.74 (0.87-3.47)	1.86 (0.85-4.05)	
Lack of control				
No	68 (70.8)	1	1	
Yes	28 (29.2)	1.66 (0.90-3.04)	1.68 (0.84-3.33)	

^aAdjusted for age group; age group is presented unadjusted.

^bAdjusted for all the factors in the table.

*Explanatory variables associated with neck pain in partial or full models.

4.4.1.6 Final model and predicted prevalences of neck pain in the past 12 months in the South African public hospital nurses

The final model and predicted prevalences of neck pain are shown in Table 4.10.

The variable, frightening situation continued to be associated with neck pain in the final model.

Table 4.10: Multiple regression of neck pain in the past 12 months with possible risk factors and predicted prevalences in the SA public hospital nurses: Final model

Explanatory variable	Neck pain in past 12 months (N=96)			
	n (%)	^a Final model	Predicted prevalence	
		^b OR (95% CI)	% (95% CI)	^c Δ (%)
Age group (years)				
<30	11 (11.4)	1	42.0 (34.0-50.0)	
30-39	31 (32.3)	1.49 (0.60-3.68)	45.9 (37.9-53.9)	
40-49	40 (41.7)	2.01 (0.85-4.77)	50.6 (42.4-58.9)	
≥50	14 (14.6)	1.32 (0.48-3.62)	42.3 (29.7-54.9)	0.3
*Frightening situation				
No	39 (41.9)	1	35.7 (29.8-41.6)	
Yes	54 (58.1)	2.61 (1.50-4.53)	56.9 (50.4-63.4)	21.2

^aPost regression tests: Pearson's χ^2 p-value=0.49; ROC curve=64.9.

^bAdjusted ORs of significant risk factors.

^cDifference in predicted prevalences of associated level/s of explanatory variables and relevant reference groups.

*Explanatory variable associated with neck pain with respective predicted prevalence in the final model.

An increase of 21.2% in the prevalence of neck pain would be attributed to frightening situation in the nurses.

4.4.1.7 Partial and full models of shoulder pain in the past 12 months in the South African public hospital nurses

The partial and full models of shoulder pain appear in Table 4.11. They contain explanatory variables with ORs representing associations with shoulder pain. In the partial models, the variables that were positively associated with shoulder pain were age group (40-49 years), past injuries, somatising tendency (two or more symptoms), job dissatisfaction and job insecurity. In the full model, age group (40-49 and 50 years and above) and past injuries were positively associated with shoulder pain.

Table 4.11: Multiple regression of shoulder pain in the past 12 months with possible risk factors in SA public hospital nurses: Partial and full models

Explanatory variable	Shoulder pain in past 12 months (N=101)		
	n (%)	Partial model	Full model
		^a OR (95% CI)	^b OR (95% CI)
*Age group (years)			
<30	11 (10.9)	1	1
30-39	25 (24.8)	1.23 (0.52-2.89)	1.53 (0.54-4.34)
40-49	47 (46.5)	2.52 (1.11-5.71)	4.09 (1.47-11.35)
≥50	18 (17.8)	1.84 (0.72-4.71)	4.01 (1.28-12.52)
BMI group			
Normal	29 (28.7)	1	1
Overweight	28 (27.7)	0.64 (0.31-1.32)	0.42 (0.17-1.00)
Obese	33 (32.7)	0.58 (0.28-1.22)	0.52 (0.22-1.23)
Missing	11 (10.9)	0.56 (0.21-1.43)	0.37 (0.12-1.11)
*Past injuries			
No	71 (71.7)	1	1
Yes	28 (28.3)	2.05 (1.08-3.89)	2.11 (1.01-4.42)
Deserve compensation			
No	29 (29.3)	1	1
Yes	71 (71.7)	1.00 (0.56-1.79)	0.92 (0.47-1.78)
Frightening situation			
No	49 (49.5)	1	1
Yes	50 (50.5)	1.52 (0.89-2.59)	1.38 (0.73-2.62)
*Number of distressing somatic symptoms			
0	37 (36.6)	1	1
1	25 (24.8)	1.07 (0.55-2.07)	0.89 (0.42-1.90)
≥2	39 (38.6)	2.01 (1.08-3.75)	2.04 (0.98-4.25)
Mental health status			
Good	42 (41.6)	1	1
Intermediate	27 (26.7)	0.93 (0.50-1.75)	2.65 (0.30-1.39)
Poor	32 (31.7)	1.79 (0.94-3.43)	3.10 (0.47-2.19)
Incentives			
No	73 (74.5)	1	1
Yes	25 (25.5)	1.69 (0.88-3.25)	1.26 (0.60-2.65)
Lack of social support			
No	83 (82.2)	1	1
Yes	18 (17.8)	1.71 (0.79-3.71)	1.50 (0.62-3.65)

^aAdjusted for age group; age group is presented unadjusted.

^bAdjusted for all the factors in the table.

*Explanatory variables associated with shoulder pain in partial and/ or full models.

Table 4.11: Multiple regression of shoulder pain in the past 12 months with possible risk factors in SA public hospital nurses: Partial and full models cont'd

Explanatory variable	Shoulder pain in past 12 months (N=101)			
	n (%)		Partial model	Full model
			^a OR (95% CI)	^b OR (95% CI)
*Job dissatisfaction				
No	55 (54.5)		1	1
Yes	46 (45.5)		2.20 (1.26-3.84)	1.70 (0.87-3.29)
*Job insecurity				
No	61 (61.6)		1	1
Yes	38 (38.4)		2.33 (1.29-4.23)	1.93 (0.95-3.92)

^aAdjusted for age group; age group is presented unadjusted.

^bAdjusted for all the factors in the table.

*Explanatory variables associated with shoulder pain in partial and/ or full models.

4.4.1.8 Final model and predicted prevalences of shoulder pain in the past 12 months in the South African public hospital nurses

The final model containing significant variables associated with shoulder pain and predicted prevalences are shown in Table 4.12. Age group (40-49 years), past

Table 4.12: Multiple regression of shoulder pain in the past 12 months with possible risk factors and predicted prevalences in SA public hospital nurses: Final model

Explanatory variable	Shoulder pain in past 12 months (N=101)				
	n (%)		Final model	Predicted prevalence	
			^b OR (95% CI)	% (95% CI)	^c Δ (%)
*Age group (years)					
<30	11 (10.9)		1	29.9 (22.5-37.2)	
30-39	25 (24.8)		1.19 (0.45-3.12)	30.5 (23.0-38.0)	
40-49	47 (46.5)		2.67 (1.09-6.54)	50.9 (42.7-59.2)	
≥50	18 (17.8)		2.44 (0.87-6.83)	57.4 (38.8-36.9)	21.0
*Past injuries					
No	71 (71.7)		1	34.7 (29.9-38.5)	15.5
Yes	28 (28.3)		2.16 (1.08-4.33)	50.2 (41.6-58.8)	
*Job dissatisfaction					
No	55 (54.5)		1	34.9 (29.6-40.3)	
Yes	46 (45.5)		1.86 (1.00-3.45)	44.7 (37.6-57.9)	9.8
*Job insecurity					
No	61 (61.6)		1	34.9 (29.1-40.7)	
Yes	38 (38.4)		1.96 (1.02-3.75)	42.9 (36.5-49.4)	8.0

^aPost regression tests: Hosmer Lemeshow Chi² p-value group 8=0.84; group 10=0.89; group 12=0.97; ROC curve =69.3.

^bAdjusted ORs of significant risk factors.

^cDifference in predicted prevalences of associated level/s of explanatory variables and relevant reference groups.

*Explanatory variables associated with shoulder pain with their respective predicted prevalences in the final model.

injuries, job dissatisfaction and job insecurity were positively associated with shoulder pain.

The predicted prevalences of shoulder pain show that age group (40-49 years) would increase the prevalence of shoulder pain by 21.0% in the nurses compared to the less than 30 years age group. Past injuries would result in 15.5% increase in the prevalence of shoulder pain.

4.4.1.9 Partial and full models of wrist or hand pain in the past 12 months in the South African public hospital nurses

The partial and full models of wrist or hand pain appear in Table 4.13. They contain variables that were positively associated with wrist or hand pain. Job dissatisfaction was the only variable associated with wrist or hand pain in the partial models. In the full model, ethnic group (other) was the only variable associated with wrist or hand pain.

Table 4.13: Multiple regression of wrist or hand pain in the past 12 months with possible risk factors in SA public hospital nurses: Partial and full models

Explanatory variables	Wrist or hand pain in past 12 months (N=55)		
	n (%)	Partial model ^a OR (95% CI)	Full model ^b OR (95% CI)
Age group (years)			
<30	6 (10.9)	1	1
30-39	16 (29.1)	1.45 (0.51-4.08)	1.52 (0.04-4.58)
40-49	24 (43.6)	1.85 (0.68-4.98)	1.84 (0.63-5.29)
≥50	9 (16.4)	1.45 (0.46-4.56)	1.41 (0.41-4.82)
*Ethnic group			
Sotho	26 (47.3)	1	1
Nguni	20 (36.4)	1.14 (0.58-2.23)	1.23 (0.60-2.52)
Other	9 (16.4)	2.34 (0.92-5.96)	2.73 (1.01-7.37)
Number of distressing somatic symptoms			
0	19 (34.5)	1	1
1	14 (25.5)	1.21 (0.55-2.67)	1.29 (0.56-2.94)
≥2	22 (40.0)	1.88 (0.92-3.82)	1.63 (0.76-3.48)

^aAdjusted for age group; age group is presented unadjusted.

^bAdjusted for all the factors in the table.

*Explanatory variables associated with wrist or hand pain in partial and full models.

Table 4.13: Multiple regression of wrist or hand pain in the past 12 months with possible risk factors in SA public hospital nurses: Partial and full models cont'd

Explanatory variables	Wrist or hand pain in past 12 months (N=55)			
	n (%)	Partial model	Full model	
		^a OR (95% CI)	^b OR (95% CI)	
Incentives				
No	38 (71.7)	1	1	
Yes	15 (28.3)	1.77 (0.86-3.63)	1.76 (0.82-3.77)	
Lack of social support				
No	43 (78.2)	1	1	
Yes	12 (21.8)	2.20 (0.98-4.91)	2.20 (0.94-5.13)	
*Job dissatisfaction				
No	29 (52.7)	1	1	
Yes	26 (47.3)	1.92 (1.03-3.64)	1.5 (0.75-2.97)	

^aAdjusted for age group; age group is presented unadjusted.

^bAdjusted for all the factors in the table.

*Explanatory variables associated with wrist or hand pain in partial and full models.

4.4.1.10 Final model and predicted prevalences of wrist or hand pain in the past 12 months in the South African public hospital nurses

The final model and predicted prevalences of wrist or hand pain are presented in

Table 4.14. Two variables demonstrated positive association with wrist or hand pain.

These were ethnic group (other) and lack of social support.

Table 4.14: Multiple regression of wrist or hand pain in the past 12 months with possible risk factors and predicted prevalences in SA public hospital nurses: Final model

Explanatory variable	Wrist or hand pain in past 12 months (N=55)			
	n (%)	^a Final model	Predicted prevalence	
		^b OR (95% CI)	% (95% CI)	^c Δ (%)
Age group (years)				
<30	6 (10.9)	1	22.9 (16.0-29.8)	
30-39	16 (29.1)	1.40 (0.48-4.08)	19.7 (13.1-26.3)	
40-49	24 (43.6)	1.81 (0.65-5.03)	29.7 (22.1-37.3)	
≥50	9 (16.4)	1.16 (0.35-3.85)	26.2 (14.9-37.4)	
				3.3
*Ethnic group				
Sotho	26 (47.3)	1	17.5 (12.2-22.7)	
Nguni	20 (36.4)	1.15 (0.58-2.30)	27.9 (20.7-35.2)	
Other	9 (16.4)	2.81 (1.07-7.39)	31.2 (23.1-39.3)	
				13.7
*Lack of social support				
No	43 (78.2)	1	23.3 (19.1-27.3)	
Yes	12 (21.8)	2.32 (1.02-5.27)	30.1 (20.1-40.2)	
				6.8

^aPost regression tests: Hosmer Lemeshow χ^2 p-value group 8=0.55; group 10=0.82; group 12=0.74; ROC curve =63.6.

^bAdjusted ORs of significant risk factors.

^cDifference in predicted prevalences of associated level/s of explanatory variables and relevant reference groups.

*Explanatory variables associated with wrist or hand pain with their respective predicted prevalences in the final model.

The prevalence of wrist or hand pain is predicted to increase by 13.7% in the ethnic group (other) of the nurses compared to the Sotho group.

4.4.1.11 Partial and full models of upper limb pain in the past 12 months in the South African public hospital nurses

The partial and full models of upper limb pain are presented in Table 4.15. They include variables with corresponding ORs representing associations with upper limb pain. In the partial models, the variables that showed positive associations with upper limb pain were frightening situation, somatising tendency (two or more symptoms), mental health status (poor), job dissatisfaction and job insecurity.

Table 4.15: Multiple regression of upper limb pain in the past 12 months with possible risk factors in SA public hospital nurses: Partial and full model

Explanatory variable	Upper limb pain in past 12 months (N=133)		
	n (%)	Partial model ^a OR (95% CI)	Full model ^b OR (95% CI)
*Age group (years)			
<30	17 (12.8)	1	1
30-39	38 (28.6)	1.27 (0.57-2.82)	1.39 (0.55-3.54)
40-49	56 (42.1)	1.88 (0.86-4.07)	2.60 (1.03-6.60)
≥50	22 (16.5)	1.36 (0.55-3.32)	2.89 (1.00-8.30)
BMI group			
Normal	38 (28.6)	1	1
Overweight	38 (28.6)	0.69 (0.33-1.41)	0.41 (0.17-0.94)
Obese	39 (29.3)	0.51 (0.24-1.05)	0.37 (0.16-0.84)
Missing	18 (13.5)	0.96 (0.38-2.44)	0.53 (0.18-1.52)
Past injuries			
No	98 (74.8)	1	1
Yes	33 (25.2)	1.69 (0.88-3.24)	1.74 (0.84-3.59)
*Frightening situation			
No	64 (48.9)	1	1
Yes	67 (51.1)	1.79 (1.06-3.03)	1.76 (0.95-3.26)
Adverse beliefs about arm pain			
No	76 (57.1)	1	1
Yes	57 (42.9)	1.50 (0.88-2.56)	1.34 (0.72-2.52)

^aAdjusted for age group; age group is presented unadjusted.

^bAdjusted for all the factors in the table.

*Explanatory variables associated with upper limb pain in partial or full models.

Table 4.15: Multiple regression of upper limb pain in the past 12 months with possible risk factors in SA public hospital nurses: Partial and full model cont'd

Explanatory variable	Upper limb pain in past 12 months (N=133)		
	n (%)	Partial model ^a OR (95% CI)	Full model ^b OR (95% CI)
*Number of distressing somatic symptoms			
0	45 (33.8)	1	1
1	34 (25.6)	1.45 (0.76-2.76)	1.24 (0.62-2.50)
≥2	54 (40.6)	3.56 (1.86-6.81)	3.24 (1.53-6.87)
*Mental health status			
Good	54 (40.6)	1	1
Intermediate	37 (27.8)	1.05 (0.58-1.93)	0.66 (0.32-1.37)
Poor	42 (31.6)	2.25 (1.15-4.38)	1.21 (0.57-2.59)
*Job dissatisfaction			
No	74 (55.6)	1	1
Yes	59 (44.4)	2.60 (1.47-4.61)	1.90 (1.00-3.61)
*Job insecurity			
No	84 (64.6)	1	1
Yes	46 (35.4)	2.22 (1.21-4.09)	1.63 (0.82-3.25)

^aAdjusted for age group; age group is presented unadjusted.

^bAdjusted for all the factors in the table.

*Explanatory variables associated with upper limb pain in partial or full models.

In the full model, age group (40-49 and 50 years and above) and somatising tendency (two or more symptoms) were the only variables positively associated with upper limb pain.

4.4.1.12 Final model and predicted prevalences of upper limb pain in the past 12 months in the South African public hospital nurses

The final model with significant explanatory variables indicating associations with upper limb pain and predicted prevalences are shown in Table 4.16. The explanatory variables which were positively associated with upper limb pain were somatising tendency (two or more symptoms) and job dissatisfaction. The odds of reporting upper limb pain by the nurses increased with age group, although the 95% CIs included one. BMI group (overweight) was negatively associated with upper limb pain.

Table 4.16: Multiple regression of upper limb pain in the past 12 months with possible risk factors and predicted prevalences in SA public hospital nurses: Final model

Explanatory variable	Upper limb pain in past 12 months (N=133)			
	n (%)	Final model		Predicted prevalence % (95% CI) ^c Δ (%)
		OR (95% CI)		
Age group (years)				
<30	17 (12.8)	1	48.5 (40.0-56.9)	
30-39	38 (28.6)	1.36 (0.55-3.33)	44.6 (36.6-52.5)	
40-49	56 (42.1)	2.45 (1.00-6.02)	62.7 (54.7-70.8)	
≥50	22 (16.5)	2.56 (0.93-7.07)	62.3 (50.2-74.5)	13.8
*BMI group				
Normal	38 (28.6)	1	52.9 (45.6-60.2)	
Overweight	38 (28.6)	0.49 (0.22-1.09)	56.0 (47.8-64.3)	
Obese	39 (29.3)	0.41 (0.18-0.89)	50.0 (41.6-58.5)	3.1
Missing	18 (13.5)	0.60 (0.21-1.67)		
*Number of distressing somatic symptoms				
0	45 (33.8)	1	39.8 (32.5-47.1)	
1	34 (25.6)	1.37 (0.69-2.68)	50.3 (41.3-59.3)	
≥2	54 (40.6)	3.43 (1.71-6.87)	66.9 (60.2-73.6)	27.1
*Job dissatisfaction				
No	74 (55.6)	1	48.3 (40.7-55.9)	
Yes	59 (44.4)	2.20 (1.19-4.05)	67.7 (57.7-77.7)	19.4

^aPost regression tests: Hosmer Lemeshow χ^2 P-value group (8) =0.34; group (10)=0.09; group (12)=0.33; ROC curve=70.4%.

^bAdjusted ORs of significant risk factors.

^cDifference in predicted prevalences of associated level/s of explanatory variables and relevant reference groups.

*Explanatory variables associated with upper limb pain with their respective predicted prevalences in the final model.

It is quite surprising that the predicted prevalence of upper limb pain decreased by 3.1% in the nurses who are in the “obese” BMI group versus those in the “normal” BMI group. Multiple comparisons are a likely explanation.

4.4.1.13 Partial and full models of knee pain in the past 12 months in the South African public hospital nurses

The partial and full models of knee pain are presented in Table 4.17. They contain explanatory variables with ORs demonstrating associations with knee pain. The variables that were positively associated with knee pain were past injuries, financial difficulties, frightening situation, somatising tendency (two or more symptoms), working under time pressure and job dissatisfaction. Ethnic group (Nguni) was

negatively associated with knee pain. All the variables that were associated with knee pain in the partial models remained associated with knee pain in the full model.

Table 4.17: Multiple regression of knee pain in the past 12 months with possible risk factors in SA public hospital nurses: Partial and full models

Explanatory variable	Knee pain in past 12 months (N=79)		
	n (%)	Partial model ^a OR (95% CI)	Full model ^b OR (95% CI)
Age group (years)			
<30	10 (12.7)	1	1
30-39	17 (21.5)	0.81 (0.33-2.02)	0.45 (0.15-1.38)
40-49	39 (49.4)	2.02 (0.87-4.67)	1.69 (0.61-4.68)
≥50	13 (16.4)	1.25 (0.47-3.33)	1.37 (0.44-4.29)
*Past injuries			
No	52 (67.5)	1	1
Yes	25 (32.5)	2.70 (1.40-5.23)	3.19 (1.44-7.10)
*Ethnic group			
Sotho	52 (65.8)	1	1
Nguni	20 (25.3)	0.39 (0.20-0.74)	0.42 (0.20-0.90)
Other	7 (8.9)	0.61 (0.23-1.61)	0.42 (0.14-1.27)
*Deserve compensation			
No	18 (22.8)	1	1
Yes	61 (77.2)	1.61 (0.85-3.05)	1.33 (0.64-2.76)
*Financial difficulties			
No	14 (17.9)	1	1
Yes	64 (82.1)	2.67 (1.36-5.24)	2.68 (1.23-5.83)
*Frightening situation			
No	36 (45.6)	1	1
Yes	43 (54.4)	1.86 (1.06-3.25)	1.46 (0.74-2.88)
*Number of distressing somatic symptoms			
0	22 (27.8)	1	1
1	21 (26.6)	1.68 (0.81-3.45)	1.29 (0.56-2.94)
≥2	36 (45.6)	3.54 (1.82-6.92)	2.62 (1.19-5.74)
Mental health status			
Good	29 (36.7)	1	1
Intermediate	30 (38.0)	1.97 (1.03-3.75)	1.46 (0.66-3.22)
Poor	20 (25.3)	1.36 (0.68-2.74)	0.80 (0.34-1.89)
*Working under time pressure			
No	7 (8.9)	1	1
Yes	72 (91.1)	3.84 (1.61-9.12)	4.27 (1.54-11.87)
*Job dissatisfaction			
No	42 (53.2)	1	1
Yes	37 (46.8)	2.11 (1.19-3.76)	2.17 (1.07-4.38)

^aAdjusted for age group; age group is presented unadjusted.

^bAdjusted for all the factors in the table.

*Explanatory variables associated with knee pain in partial and/ or full models.

4.4.1.14 Final model and predicted prevalences of knee pain in the past 12 months in the South African public hospital nurses

The final model and predicted prevalences of knee pain are shown in Table 4.18.

Past injuries, financial difficulties, somatising tendency (two or more symptoms) and working under time pressure were positively associated with knee pain. Job

Table 4.18: Multiple regression of knee pain in the past 12 months with possible risk factors and predicted prevalences in SA public hospital nurses: Final model

Explanatory variable	Knee pain in past 12 months (N=79)			
	n (%)	^a Final model ^b OR (95% CI)	Predicted prevalence % (95% CI)	^c Δ (%)
Age group (years)				
<30	10 (12.7)	1	19.4 (13.2-25.5)	
30-39	17 (21.5)	0.41 (0.14-1.20)	24.3 (17.5-31.1)	
40-49	39 (49.4)	1.32 (0.50-3.49)	38.7 (31.2-46.3)	
≥50	13 (16.4)	1.19 (0.39-3.60)	41.1 (29.8-52.8)	21.7
*Past injuries				
No	52 (67.5)	1	26.9 (21.2-32.8)	
Yes	25 (32.5)	3.38 (1.61-7.09)	50.3 (38.2-62.3)	23.4
*Financial difficulties				
No	14 (17.9)	1	18.7 (12.3-25.1)	
Yes	64 (82.1)	2.84 (1.34-6.05)	32.9 (28.2-37.5)	14.2
*Number of distressing somatic symptoms				
0	22 (27.8)	1	21.4 (15.2-27.6)	
1	21 (26.6)	1.42 (0.64-3.15)	28.4 (20.7-36.1)	
≥2	36 (45.6)	2.80 (1.33-5.86)	35.2 (28.9-41.4)	13.8
*Working under time pressure				
No	7 (8.9)	1	13.3 (4.6-21.9)	
Yes	72 (91.1)	4.22 (1.57-11.31)	31.0 (26.9-35.2)	17.7
Job dissatisfaction ^d				
No	42 (53.2)	1	23.7 (19.1-28.4)	
Yes	37 (46.8)	1.91 (0.99-3.65)	37.2 (30.6-43.7)	13.5

^aPost regression tests: Hosmer Lemeshow χ^2 p-value group (8) =0.47; group (10)=0.50; group (12)=0.55; ROC curve =78.4.

^bAdjusted ORs of significant risk factors.

^cDifference in predicted prevalences of associated level/s of explanatory variables and relevant reference groups.

^dReturned to the model LR test=0.0429.

*Explanatory variables associated with knee pain with respective predicted prevalences in the final model.

dissatisfaction was returned to the final model because the p-value of the LR test became significant when it was removed from the model.

Large increases in the predicted prevalence of knee pain in the nurses would come from past injuries and working under time pressure. The largest increase (23.4%) would be in the nurses who report past injuries and the next (17.7%) would be in the nurses who report working under time pressure.

4.4.1.15 Summary of possible risk factors associated with MSD pain in the past 12 months in the SA public hospital nurses

A list of risk factors from the final models of the pain sites used in the multiple regression is presented in Table 4.19.

- Somatising tendency was associated with most (four) pain sites.
- “Any” pain was associated with most (six) risk factors.
- “Any” and shoulder pain were associated with older age group, and low back and upper limb pain increased with increasing age group although the trends were not significant.
- Ethnic group was inconsistently associated with site specific pain.
- As with the combined data of nurses and bank workers, increased BMI and physical work activities contributed little in explaining pain.
- In general, the effect of most risk factors was inconsistent across pain sites.

Table 4.19: Statistically significant risk factors from final models of MSD pain in the past 12 months in SA public hospital nurses

Risk factors	Pain sites							**Total
	Any	Low back	Neck	Shoulder	Wrist/hand	Upper limb	Knee	
*Number of distressing somatic symptoms								
0								
1								
≥2	√	√	-	-	-	√	√	4
*Age group (years)								
<30								
30-39								
40-49		↑	-	√	-	↑	-	
≥50	√							2
Past injuries								
Yes	-	-	-	√	-	-	√	
No								2
Job dissatisfaction								
Yes	-	-	-	√	-	√	-	
No								2
Frightening situation								
Yes	√	-	√	-	-	-	-	
No								2
Job insecurity								
Yes	√	-	-	√	-	-	-	
No								2
Ethnic group								
Sotho								
Nguni	-	-	-	-		-	-	
Other					√			1
Financial difficulties								
Yes	-	-	-	-	-	-	√	
No								1

*)=Risk factors showing consistent association with pain sites; **)=Number of pain sites associated with a particular risk factor; √)=Associated ; -)=No association or not applicable; ↑)=OR increased with age

Table 4.19: Statistically significant risk factors from final models of MSD pain in the past 12 months in SA public hospital nurses cont'd

Risk factors	Pain sites							**Total
	Any	Low back	Neck	Shoulder	Wrist/hand	Upper limb	Knee	
Adverse beliefs about low back and arm pain								
Yes	√	-	-	-	-	-	-	1
No								
Working under time pressure								
Yes	-	-	-	-	-	-	√	1
No								
Lack of social support								
Yes	-	-	-	-	√	-	-	1
No								
BMI group								
Normal		-	-	-	-		-	2
Overweight						-√		
Obese	-√							
***Total	6	1	1	4	2	3	4	21 / 21

)=Number of risk factors associated with a particular pain site; *)=Number of risk factors associated with a particular pain site; √)=positively associated; -√)=Negatively associated; -)=No association or not applicable

Part 2: Follow-up study of the South African public hospital nurses

4.5 Introduction

After about a year, on average \pm SD 12.2 \pm 0.2 months, 189 nurses (75.3%) who had participated in the baseline cross-sectional study were successfully re-interviewed. In the following sub-sections, participation and response rates according to baseline MSD risk factors and 1-month MSD prevalence, MSD occurrence at the follow-up interview, and associated risk factors are summarised.

4.6 Participation and response rates according to baseline MSD risk factors in the South African public hospital nurses

In the next subsection, participation and response rates at the follow-up interview are presented based on MSD risk factors at baseline.

4.6.1 MSD risk factors

The nurses who completed the follow-up interview were very similar to those who completed the baseline interview with respect to all of the MSD risk factors considered in the study. Table 4.20 shows the similarity using physical and psychosocial characteristics of the nurses. The similarities in psychological characteristics, physical work conditions and psychosocial aspects of work are presented in Appendix K.

Table 4.20: Participation and response rates according to individual physical and psychosocial characteristics of SA public hospital nurses at baseline

Individual characteristic	Participation		Response rate
	Baseline (N=251)	Follow-up (N=189)	
	n (%)	n (%)	%
Physical			
Sex			
Men	9 (3.5)	6 (3.2)	66.7
Women	242 (96.4)	183 (96.8)	75.6
Total	251 (100.0)	189 (100.0)	75.3
Age group (years)			
<30	40 (15.9)	28 (14.8)	70.0
30-39	78 (31.1)	55 (29.1)	70.5
40-49	92 (36.6)	71 (37.4)	77.2
≥50	41 (16.3)	35 (18.5)	85.4
Total	251 (100.0)	189 (100.0)	75.3
BMI group			
Normal	69 (31.4)	49 (29.2)	71.0
Overweight	72 (32.7)	57 (33.9)	79.1
Obese	79 (35.9)	62 (36.9)	78.5
Total	220 (100.0)	168 (100.0)	76.4
Past injuries			
Yes	56 (22.5)	44 (23.3)	78.6
No	193 (77.5)	143 (76.5)	74.1
Total	249 (100.0)	187 (100.0)	75.1
Psychosocial			
Ethnic group			
Sotho ^a	139 (55.4)	106 (56.1)	76.3
Nguni ^b	87 (34.6)	64 (33.9)	73.6
Other ^c	25 (10.0)	19 (10.1)	76.0
Total	251 (100.0)	189 (100.0)	75.3
Educational level			
High school	16 (6.4)	12 (6.4)	75.0
Tertiary	235 (93.6)	177 (93.6)	75.3
Total	251 (100.0)	189 (100.0)	75.3
Smoking status			
Never-smoked	233 (92.8)	177 (93.6)	75.9
Ever-smoked	18 (7.2)	12 (6.4)	66.7
Total	251 (100.0)	189 (100.0)	75.3

^aConsists of Pedi, Tswana and Sotho.

^bConsists of Xhosa and Zulu.

^cConsists of Afrikaner, Coloured, Indian Tsonga and Venda.

4.7 Participation and response rates according to 1-month MSD prevalence at baseline in the South African public hospital nurses

The comparison of the participation of nurses at baseline and follow-up interviews

regarding the prevalence of site specific MSD pain during the 1-month prior to

baseline appears in Table 4.21. The results indicate that there were very small differences in the participation and response rates of nurses at baseline and follow-up interviews based on 1-month MSD prevalence at baseline. Thus, having MSD pain at baseline did not influence follow-up participation.

Table 4.21: Participation and response rate according to 1-month MSD prevalence of SA public hospital nurses at baseline

Pain site	1-month MSD prevalence		Response rate %	
	Baseline (N=251)	Follow-up (N=189)		
	n (%)	n (%)		
"Any"	Yes	144 (57.60)	105 (55.85)	72.9
	No	106 (42.40)	83 (44.15)	78.3
	Total	250 (100.0)	188 (100.0)	75.2
Low back	Yes	89 (35.46)	64 (32.86)	71.9
	No	162 (64.54)	125 (66.14)	77.2
	Total	251 (100.0)	188 (100.0)	74.9
Neck	Yes	52 (20.80)	39 (20.74)	75.0
	No	198 (79.20)	149 (79.26)	75.3
	Total	250 (100.0)	188 (100.0)	75.2
Shoulder	Yes	57 (22.71)	41 (21.69)	71.9
	No	194 (77.29)	148 (78.31)	76.3
	Total	251 (100.0)	189 (100.0)	75.3
Elbow	Yes	14 (5.58)	11 (5.82)	78.6
	No	237 (94.28)	178 (94.18)	75.1
	Total	251 (100.0)	189 (100.0)	75.3
Wrist/hand	Yes	35 (13.94)	26 (13.76)	74.3
	No	216 (86.06)	163 (86.24)	75.5
	Total	251(100.0)	189 (100.0)	75.3
Upper limb	Yes	76 (30.28)	56 (29.63)	73.7
	No	175 (69.72)	133 (70.37)	76.0
	Total	251 (100.0)	189 (100.0)	75.3
Knee	Yes	53 (21.12)	43 (22.75)	81.1
	No	198 (78.88)	146 (77.25)	73.7
	Total	251 (100.0)	189 (100.0)	75.3

4.8 Occurrence of MSDs at follow-up interview in the South African public hospital nurses

At the follow-up interview, the nurses were asked about site specific pain in the month before the follow-up interview. Their responses provided the 1-month prevalence of pain. This prevalence was compared with the 1-month prevalence of pain obtained at the baseline (Table 4.22).

Table 4.22: 1-month MSD prevalence in SA public hospital nurses at baseline and follow-up interviews (N=189)

Pain site	Baseline interview		Follow-up interview		McNemar test p-value	
	n	%	n	%		
"Any"	Yes	105	55.8	122	67.4	0.002
	No	83	44.2	59	32.6	
	Total	188	100.0	181	100.0	
Low back	Yes	64	33.9	78	41.3	0.08
	No	125	66.1	111	58.7	
	Total	189	100.0	189	100.0	
Neck	Yes	39	20.7	52	27.5	0.07
	No	149	79.3	137	72.5	
	Total	188	100.0	189	100.0	
Shoulder	Yes	41	21.7	54	28.7	0.09
	No	148	78.3	134	71.3	
	Total	189	100.0	188	100.0	
Elbow	Yes	11	5.8	19	10.2	0.08
	No	178	94.2	168	89.8	
	Total	189	100.0	187	100.0	
Wrist/hand	Yes	26	13.8	38	20.4	0.03
	No	163	86.2	148	79.6	
	Total	189	100.0	186	100.0	
Upper limb	Yes	56	29.6	76	40.9	0.009
	No	133	70.4	110	59.1	
	Total	189	100.0	186	100.0	
Knee	Yes	43	22.8	57	30.8	0.01
	No	146	77.2	128	69.2	
	Total	189	100.0	185	100.0	

It was observed that all the 1-month MSD prevalences at the follow-up interview were higher than those at baseline. The differences of wrist or hand, upper limb, knee and “any” pain were statistically significant. It is important to note that none of the nurses who participated at the follow-up interview had changed their jobs because of MSD pain.

4.8.1 Incident and persistent MSD pain in the South African public hospital nurses at follow-up interview

The results from the 1-month prevalence of pain at baseline and follow-up interview were used to determine incident (new onset) and persistent pain at follow-up interview. Eighty three nurses had had no pain at baseline (that is in the 1-month before the baseline) and were thus eligible for the development of incident pain in the 1-month prior to follow-up interview.

One hundred and five nurses had had pain at the baseline interview. These nurses were eligible for the development of persistent pain in the 1-month before the follow-up interview.

4.8.2 Incident MSD pain in the South African public hospital nurses

The occurrence of incident pain in the nurses is shown in Figure 4.6. Nearly half (47.6% (39/82)) of the nurses who did not have pain during the 1-month prior to baseline, developed pain in the 1-month before the follow-up interview. Incident low back pain had the highest occurrence (32.8% (41/125)) and incident elbow pain had the lowest (8.5% (15/176)).

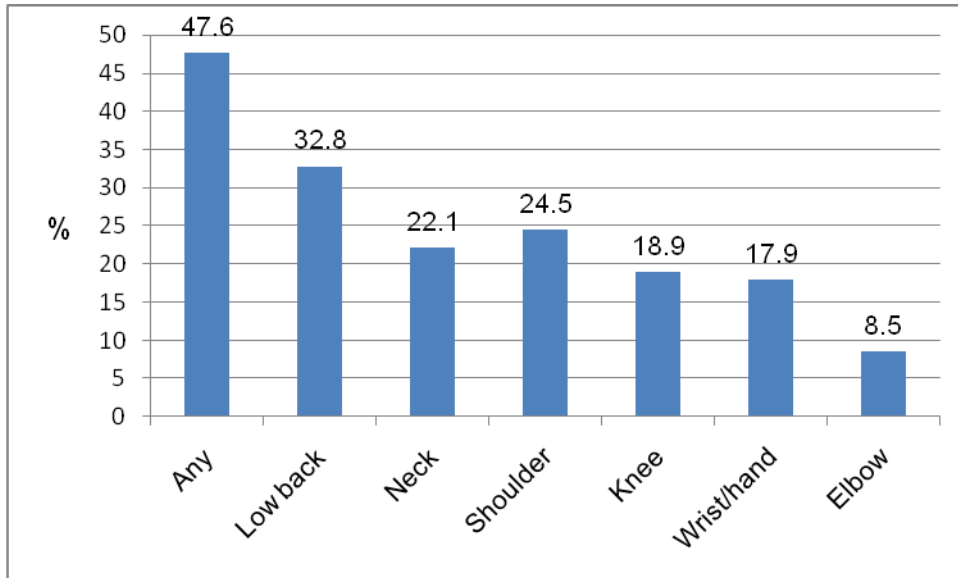


Figure 4.6: Incident pain in SA public hospital nurses

4.8.3 Persistent MSD pain in the South African public hospital nurses

The occurrence of persistent pain in the nurses is shown in Figure 4.7. Persistent pain was common with “any” pain having an occurrence of 83.7% (82/98).

Persistent knee pain had the highest site specific occurrence of 71.4% (30/42) and persistent elbow pain the lowest (36.4% (4/11)).

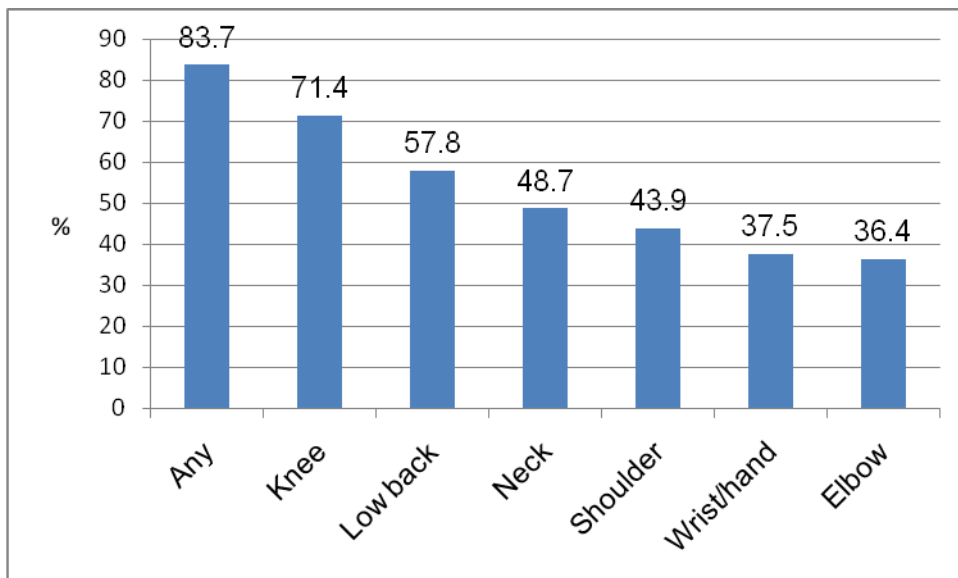


Figure 4.7: Persistent pain in the SA public hospital nurses

4.9 Risk factors associated with MSDs at follow-up interview in the South African public hospital nurses

The information presented in 4.4 applies here. The MSDs of interest at follow-up interview were incident and persistent pain. Multiple regression analysis was done to investigate the relationship between MSD risk factors and MSDs in the nurses.

4.9.1 Multiple regression of incident and persistent pain with possible risk factors in the South African public hospital nurses

Multiple regression analysis in the form of binary logistic regression was carried out for persistent “any” pain only. For persistent site specific and all incident pain, the number of events was not sufficient for the selected explanatory variables. The results of multiple regression analysis of persistent “any” pain have been summarised in tables of partial, full and final models. The tables show variables that satisfied the selection criterion of $p \leq 0.2$ for the full model. All the variables that were tested for the full model appear in Appendix L.

4.9.1.1 Partial and full models of persistent “any” pain in the South African public hospital nurses

The partial and full models are presented with ORs showing positive relationships with persistent “any” pain in Table 4.23. Somatising tendency (two or more symptoms) was the only variable that was positively associated with persistent “any” pain in the partial models and full models.

Table 4.23 Multiple regression of persistent “any” pain in the SA public hospital nurses:
Partial and full models

Explanatory variable	Persistent “any” pain (N=82)		
	n (%)	Partial model	Full model
		^a OR (95% CI)	^b OR (95% CI)
Age group (years)			
<30	14 (17.1)	1	1
30-39	19 (23.2)	0.33 (0.03-3.37)	0.18 (0.01-2.39)
40-49	33 (40.2)	0.39 (0.04-3.57)	0.16 (0.01-1.99)
≥50	16 (19.5)	0.22 (0.02-2.19)	0.42 (0.03-5.67)
BMI group			
Normal	17 (23.3)	1	1
Overweight	26 (35.6)	1.52 (0.37-6.14)	1.67 (0.33-8.29)
Obese	30 (41.1)	2.85 (0.62-13.05)	4.00 (0.63-25.37)
Adverse beliefs about arm and low back pain			
No	34 (41.5)	1	1
Yes	48 (58.5)	2.45 (0.80-7.52)	1.49 (0.37-5.99)
*Number of distressing somatic symptoms			
0	23 (28.0)	1	1
1	21 (25.6)	1.68 (0.45-6.27)	2.43 (0.46-12.80)
≥2	38 (46.3)	7.80 (1.48-41.06)	7.99 (1.16-55.11)
Incentives			
No	60 (75.9)	1	1
Yes	19 (24.1)	0.42 (0.12-1.39)	0.27 (0.06-1.16)
Working under time pressure			
No	9 (11.1)	1	1
Yes	72 (88.9)	2.45 (0.63-9.39)	1.61 (0.24-10.72)

^aAdjusted for age group; Age group is presented unadjusted.

^bAdjusted for all the variables in the table.

*Explanatory variable associated with persistent pain in partial and full models.

4.9.1.3 Final model and predicted prevalences of persistent “any” pain in the South African public hospital nurses

The final model of persistent “any” pain and predicted prevalences appear in Table 4.24. Somatising tendency (two or more symptoms) remained positively associated with persistent “any” pain in the final model. The predicted prevalence of

Table 4.24: Multiple regression of persistent “any” pain with possible risk factors and predicted prevalences in the SA public hospital nurses: Final model

Explanatory variable	Persistent “any” pain (N=82)			
	n (%)	^a Final model ^b OR (95% CI)	Predicted prevalence % (95% CI)	^c Δ (%)
Age group (years)				
<30	14 (17.1)	1	94.0 (82.8-105.2)	
30-39	19 (23.2)	0.27 (0.02-3.12)	78.2 (59.9-96.6)	
40-49	33 (40.2)	0.36 (0.03-3.61)	82.5 (70.2-94.7)	
≥50	16 (19.5)	0.55 (0.04-6.41)	81.4 (66.9-95.8)	-12.6
*Number of distressing somatic symptoms				
0	23 (28.0)	1	71.3 (55.3-87.4)	
1	21 (25.6)	1.86 (0.45-7.68)	79.2 (62.9-95.6)	
≥2	38 (46.3)	7.32 (1.34-39.88)	95.1 (88.5-101.8)	23.8

^aPost regression tests: Pearson Chi² -pvalue =0.90; ROC curve =71.8%.

^bAdjusted ORs of significant risk factors.

^cDifference in predicted prevalences of associated level/s of explanatory variables and relevant reference groups.

*Explanatory variable associated with persistent pain with respective predictive prevalence in the final model.

somatising tendency would increase the prevalence of persistent “any” pain in nurses reporting two or more distressing somatic symptoms compared to those not reporting symptoms.

Chapter 5: Cross-sectional study of the South African bank workers

5.1 Introduction

The cross-sectional study included 236 bank workers who were working in one of South Africa's big banks. In this chapter, the description of the bank workers' exposure to MSD risk factors, the occurrence of MSDs and identification of possible risk factors associated with MSDs are presented.

5.2 Description of the South African bank workers

The bank workers were working in open plan computerised office environment. Fifty point eight percent of the participating bank workers were from HLC while 49.2% were from CCC. They worked an average of 44 hours per week.

The information they provided on MSD risk factors is divided into individual characteristics and workplace conditions. The individual characteristics cover physical, psychosocial and psychological characteristics. Workplace conditions include physical workplace activities and psychosocial aspects of work.

5.2.1 Individual physical and psychosocial characteristics

The distributions of the physical and psychosocial characteristics are shown in Table 5.1. Just over two thirds (67.8%) of the workers were women. The mean BMI \pm SD was 20.1 ± 6.0 and BMI ranged from 15-44. BMI distribution had nearly equal percentages in the overweight (30.0%) and obese (29.0%) groups. The mean age \pm SD was 33.2 ± 9.6 years. The youngest worker was 19 years and the oldest 58 years. A large percentage of bank workers (43.9%) was younger than 30 years. Close to half (44.3%) had tertiary education and 46.4% belonged to the "other" ethnic group.

Table 5.1: Individual physical and psychosocial characteristics of SA bank workers (N=236)

Individual characteristic	N	%	Missing values
Physical			
Sex			
Men	76	32.2	
Women	160	67.8	
Total	236	100.0	0
BMI group			
Normal	117	41.0	
Overweight	64	30.0	
Obese	53	29.0	
Total	234	100.0	2
Age group (years)			
<30	101	43.9	
30-39	65	28.3	
40-49	46	20.0	
≥50	18	7.8	
Total	230	100.0	6
Past injuries			
Yes	71	30.1	
No	165	69.9	
Total	236	100.0	0
Psychosocial			
Educational level			
High school	131	55.7	
Tertiary	104	44.3	
Total	235	100.0	1
Ethnic group			
Sotho ^a	67	28.5	
Nguni ^b	59	25.1	
Other ^c	109	46.4	
Total	235	100.0	1
Smoking status			
Non-smoker	144	61.0	
Ex-smoker	28	11.9	
Current smoker	64	27.1	
Total	236	100.0	0

^aConsists of Pedi, Tswana and Sotho.

^bConsists of Xhosa and Zulu.

^cConsists of Afrikaner, Coloured, Indian, Tsonga and Venda.

5.2.2 Individual psychological characteristics

The psychological characteristics of bank workers are presented in Table 5.2. Three quarters (75.1%) reported having financial difficulties. Almost 72.0% reported one or

more distressing somatic symptoms, half (50.0%) had experienced a frightening situation and 27.5% believed that low back and arm pain is caused by work.

Table 5.2: Individual psychological characteristics of SA bank workers (N=236)

Individual psychological characteristic	N	%	Missing values
Financial difficulties ^a			
Yes	175	75.1	
No	58	24.9	
Total	233	100.0	3
Number of distressing somatic symptoms ^b			
0	66	28.2	
1	51	21.8	
2+	117	50.0	
Total	234	100.0	2
Deserve compensation ^c			
Yes	127	44.1	
No	100	55.9	
Total	227	100.0	9
Frightening situation ^d			
Yes	116	50.0	
No	116	50.0	
Total	232	100.0	4

^aBeing in financial difficulties-slight or big problem.

^bNumber of at least moderately distressing somatic symptoms in the past seven days from a total of seven.

^cPeople with musculoskeletal disorders deserve compensation.

^dBeing in a frightening situation-slight or big problem.

Table 5.2: Individual psychological characteristics of SA bank workers (N=236) cont'd

Individual psychological characteristic	N	%	Missing values
Adverse belief about pain ^e			
Low back and arm			
Yes	65	27.5	
No	171	72.5	
Total	236	100.0	0
Arm			
Yes	57	24.2	
No	179	75.8	
Total	236	100.0	0
Low back			
Yes	52	22.0	
No	184	78.0	
Total	236	100.0	0
Mental health status ^f			
Good	64	27.1	
Intermediate	66	28.0	
Poor	106	44.9	
Total	236	100.0	0

^eBelief that low back and /or arm pain is caused by work.

^fClassified into three levels corresponding to approximate thirds of the observed distribution of scores in the study sample.

5.2.3 Physical workplace activities

The bank workers reported on physically demanding work activities in their jobs on an average day. Their responses are presented in Table 5.3. As expected, all of them reported the use of a keyboard for more than 4 hours. Other physically demanding work activities reported by most of them, involved repeated elbow bending for more than an hour (79.5%) and repeated wrist or finger movement for more than four hours (78.8%). The least commonly reported work activities were lifting ≥ 25 kg of loads by hand (4.7%) and kneeling or squatting for more than an hour (1.3%).

Table 5.3: Physically demanding work activities on an average day in the jobs of SA bank workers (N=236)

Physical work activity		N	%	Missing values
Use of keyboard >4 hours	Yes	236	100	
	No	0	0	
	Total	236	100.0	0
Repeated elbow bending >1 hour*	Yes	186	79.5	
	No	48	20.5	
	Total	234	100.0	2
Repeated wrist/finger movement >4 hours*	Yes	183	78.8	
	No	49	21.1	4
	Total	232	100.0	
Upper limb load ^a	Yes	164	71.6	
	No	65	28.4	7
	Total	229	100.0	
Working with hands above shoulder height >1 hour*	Yes	62	26.6	
	No	171	73.4	
	Total	233	100.0	3
Physical load ^b	Yes	56	24.6	
	No	172	75.4	8
	Total	228	100.0	
Lifting ≥25 kg loads by hand**	Yes	11	4.7	
	No	224	95.3	
	Total	235	100.0	1
Kneeling or squatting >1 hour**	Yes	3	1.3	
	No	232	98.7	
	Total	235	100.0	1

^aReports of any two or more of the variables marked with 1 asterisk.

^bReports of any three or more of the variables marked with 1 and 2 asterisks.

5.2.4 Psychosocial aspects of work

Psychosocial work conditions that were perceived to be stressful by the bank

workers appear in Table 5.4. Most of them (83.1%) felt that they were working under

Table 5.4: Stressful psychosocial work conditions in the jobs of SA bank workers (N=236)

Psychosocial work condition	N	%	Missing values
Working under time pressure ^a			
Yes	196	83.1	
No	40	16.9	
Total	236	100.0	0
Job insecurity ^b			
Yes	156	66.4	
No	79	33.6	
Total	235	100.0	1
Incentives ^c			
Yes	121	52.4	
No	110	47.6	
Total	231	100.0	5
Job dissatisfaction ^d			
Yes	99	42.3	
No	135	57.7	
Total	234	100.0	2
Lack of control ^e			
Yes	89	38.0	
No	145	62.0	
Total	234	100.0	2
Lack of social support ^f			
Yes	47	20.4	
No	184	79.6	
Total	231	100.0	5

^aA target amount of work or a number of articles done or finished in a day or working under pressure to complete tasks by a fixed time.

^bFeel that job would be insecure or very insecure if off work for three months due to serious illness.

^cPiecework or payment of a bonus if an agreed number of tasks are finished in a day.

^dVery dissatisfied or dissatisfied about the job taking everything into consideration.

^eChoice in all of; how work is done; what is done at work; and work time table and break times-seldom or never.

^fAssistance or support from colleagues or supervisors-seldom or never.

time pressure and nearly two thirds (66.4) felt that their jobs would be insecure if they were to be away from work for three months due to illness. Just over half (52.4%) were receiving incentives and 42.3% were dissatisfied with their jobs.

5.3 Occurrence of MSDs in the South African bank workers

Just as the South African workers and nurses responded to questions about the occurrence of MSDs in 3.3 and 4.3, the bank workers also did the same. Their responses were used to obtain the prevalence and associated features of MSDs.

5.3.1 Prevalence of MSDs in the past 12 months

The prevalence of MSDs is summarized in Figure 5.1. The prevalence (95% CI) of “any” pain was estimated at 76.7% (71.3%-82.1%). Low back pain was the most prevalent pain at 55.5% (131/236) followed by neck at 52.9% (125/236) and shoulder pain at 36.6% (86/236). Elbow pain was the least prevalent pain at 15.7% (37/236).

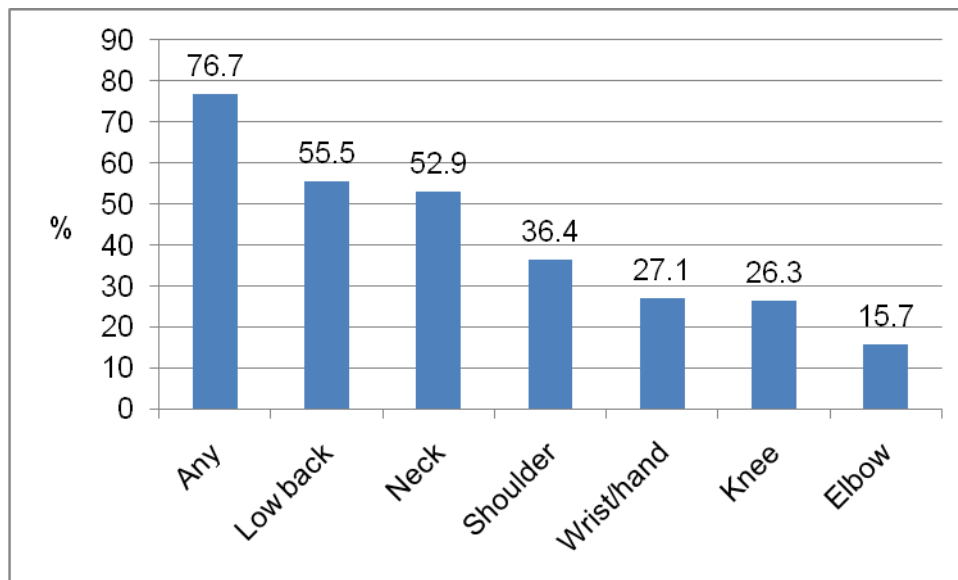


Figure 5.1: 12-month prevalence of MSDs reported by SA bank workers

5.3.2 Features associated with MSD pain

The bank workers reported on features associated with MSD pain such as number of body sites affected by pain, number of days with pain, number of days away from work with pain and consulting medical or alternative practitioners for pain.

5.3.2.1 Number of body sites affected by pain

The prevalence of pain according to the number of painful body sites is presented in Figure 5.2. The reporting of two body sites, at 19.5% (46/236), was most common.

The next common was three body sites at 18.2% (43/236) and one body site at 16.9% (40/236). The prevalence (95% CI) of multi-site pain was 40.2% (33.9%-46.6%).

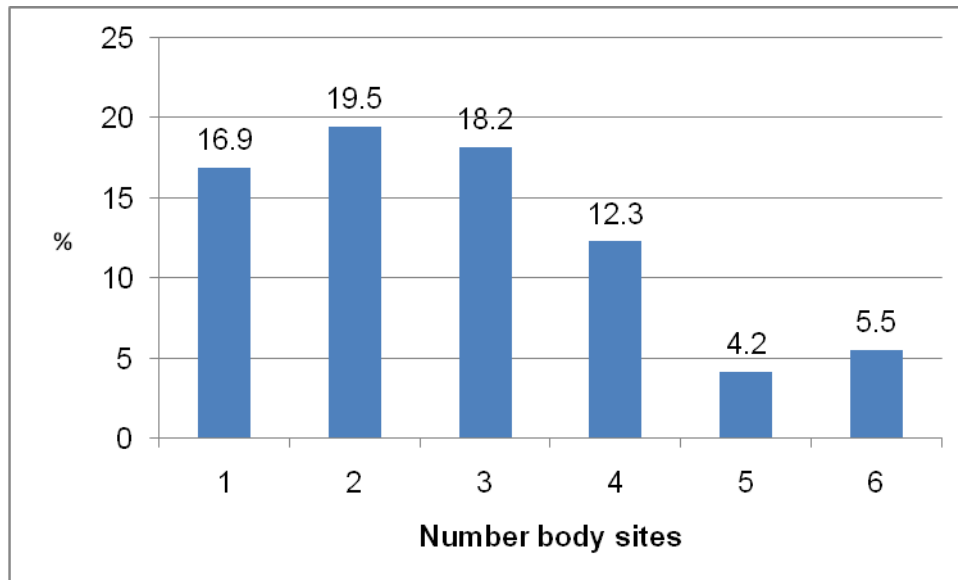


Figure 5.2: Number of painful body sites reported by SA bank workers

5.3.2.2 Number of days with pain

The number of days for which bank workers reported pain is depicted in Figure 5.3. Pain lasting for more than six days had the largest percentages in all the pain sites except wrists or hands which had the smallest percentage of 8.1% (19/236). Low back had the largest percentage of 33.9% (80/236) followed by neck (29.7% (70/236)) and shoulder (22.5% (53/236)). The pattern of the other time periods: 1-6 days; 1-4 weeks; and 1-12 months was similar in all the pain sites except wrists or hands. In all the other pain sites 1-6 days had the largest percentage followed by 1-4 weeks and 1-12 months.

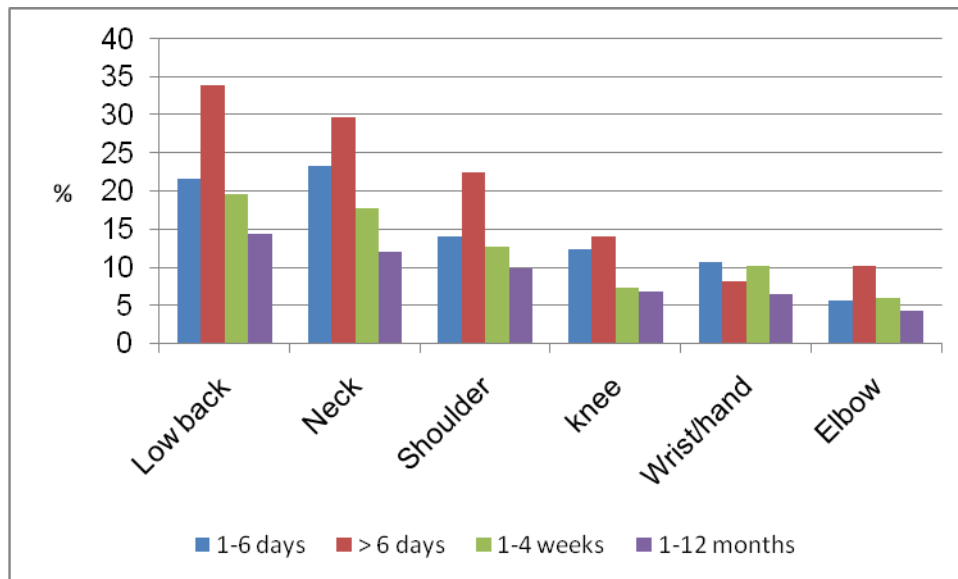


Figure 5.3: Number of days with pain reported by SA bank workers

5.3.2.3 Number of days away from work with pain

The responses of the bank workers about the number of days they had been away from work due to the pain are summarized in Figure 5.4. The figure clearly shows that 1-5 days had the largest percentage of bank workers who stayed away from work due to pain in all the pain sites. Twenty two point nine percent (54/236) stayed away from work because of low back pain; 19.9% (47/236) because of neck and 2.5% (21/236) because of wrist or hand pain.

The number that had been away from work because of “any” pain in the past 12 months was 38.1% (88/232). Of these, 27.6% (64/232) had taken 1-5 days, 8.6% (20/232) had taken 6-30 days and 1.7% (4/232) had taken more than 30 days of sick leave. A conservative estimate of the total number of days away from work due to pain in the past 12 months was 448 days. This is an average of 1.9 days per worker per year.

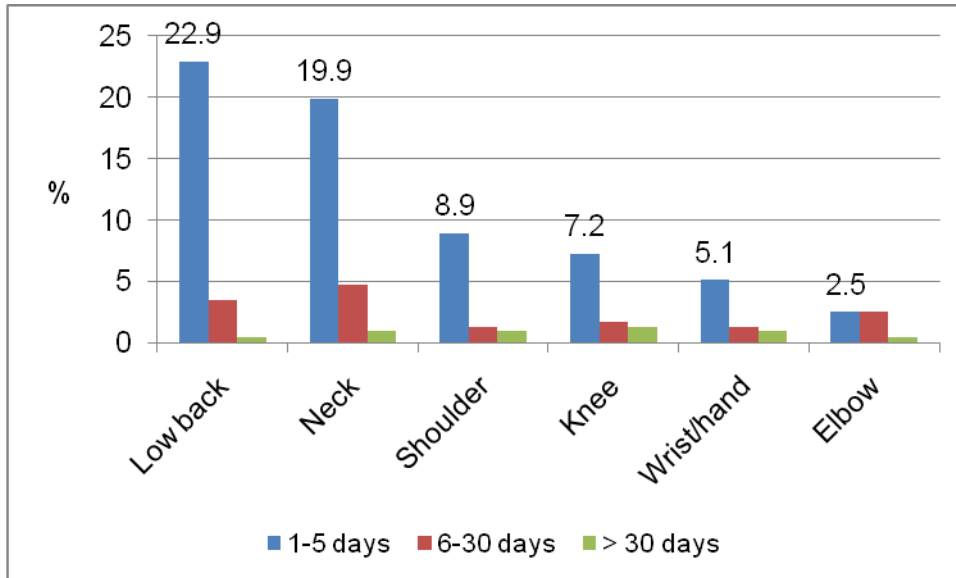


Figure 5.4: Number of days away from work reported by SA bank workers

5.3.2.4 Consultation with healthcare providers for pain

The percentages of bank workers who responded to the question about consulting medical or alternative practitioners for pain are shown in Figure 5.5. Just over half (51.4% (93/181)) of those who reported pain consulted for the pain. The percentage of the bank workers who had consulted for neck pain (49.6%) exceeded those who

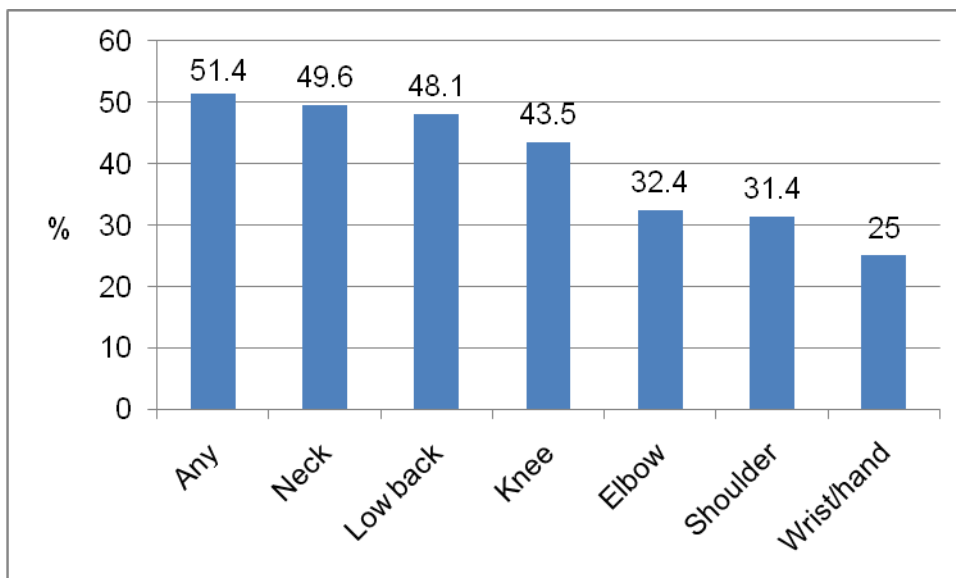


Figure 5.5: Consultation for pain in different body sites reported by SA bank workers

had consulted for low back pain (48.1%). The lowest percentage consulted for wrist or hand pain (25.0%).

5.4 Risk factors associated with MSDs in the past 12 months in the South African bank workers

The information provided in 3.4 still applies here with the exception of occupational group. It was excluded from the analyses as data were from one occupational group (bank workers). Multiple regression analysis was performed to establish if there is an association between MSD risk factors and MSDs in the South African bank workers.

5.4.1 Multiple regression of MSD pain with possible risk factors in the South African bank workers

Binary logistic regression was used for partial, full and final models. They are presented in tables summarizing the results of multiple regression analysis of “any”, low back, neck, shoulder, wrist or hand, upper limb and knee pain. Elbow pain was excluded from the analyses as there were not sufficient numbers of events for the selected explanatory variables. The tables show variables that satisfied the selection criterion for the full model ($p \leq 0.2$). The categories ex-smoker and current smoker were combined because of small numbers. Appendix M (table for ‘any’ pain) shows all the variables tested for the full model.

5.4.1.1 Partial and full models of “any” pain in the past 12 months in the South African bank workers

The partial and full models of “any” pain list explanatory variables with ORs showing associations with “any” pain. The models are shown in Table 5.5. The partial

Table 5.5: Multiple regression of “any” pain in the past 12 months with possible risk factors in SA bank workers: Partial and full models

Explanatory variable	“Any” pain in past 12 months (N=181)			
	n (%)	Partial model	Full Model	
		^a OR (95% CI)	^b OR (95% CI)	
Age group (years)				
<30	77 (43.8)	1	1	
30-39	45 (25.6)	0.67 (0.33-1.36)	0.66 (0.28-1.54)	
40-49	39 (22.1)	1.57 (0.60-4.09)	2.49 (0.73-8.48)	
≥50	15 (8.5)	1.45 (0.38-5.52)	1.35 (0.28-6.52)	
Sex				
Men	54 (29.8)	1	1	
Women	127 (70.2)	1.34 (0.69-2.59)	1.14 (0.53-2.44)	
BMI group				
Normal	83 (46.4)	1	1	
Overweight	53 (29.6)	2.12 (0.91-4.93)	1.73 (0.67-4.46)	
Obese	43 (24.0)	1.59 (0.67-3.74)	1.29 (0.49-3.35)	
*Past injuries				
No	117 (64.6)	1	1	
Yes	64 (35.4)	3.78 (1.57-9.05)	3.32 (1.27-8.72)	
Ethnic group				
Sotho	46 (25.4)	1	1	
Nguni	48 (26.5)	1.93 (0.82-4.51)	1.49 (0.57-3.86)	
Other	87 (48.1)	1.46 (0.70-3.05)	1.16 (0.48-2.74)	
*Smoking status				
Never-smoked	103 (56.9)	1	1	
Ever-smoked	78 (43.1)	2.03 (1.02-4.05)	2.28 (1.00-5.18)	
Frightening situation				
No	84 (47.2)	1	1	
Yes	94 (52.8)	1.91 (0.99-3.69)	0.94 (0.43-2.04)	
Adverse beliefs about low back and arm pain				
No				
Yes	126 (69.6)	1	1	
	55 (30.4)	2.06 (0.95-4.46)	1.67 (0.69-4.01)	
*Number of distressing somatic symptoms				
0	40 (22.1)	1	1	
1	40 (22.1)	2.08 (0.90-4.79)	2.50 (0.95-6.58)	
≥2	101 (55.8)	3.55 (1.71-7.38)	3.22 (1.36-7.64)	
*Mental health status				
Good	41 (22.7)	1	1	
Intermediate	49 (27.1)	1.69 (0.78-3.64)	1.07 (0.45-2.55)	
Poor	91 (50.2)	3.44 (1.58-7.49)	2.24 (0.89-5.61)	
Job dissatisfaction				
No	99 (55.0)	1	1	
Yes	81 (45.0)	1.67 (0.87-3.23)	1.35 (0.63-2.85)	

^aAdjusted for age and sex; Age and sex were mutually adjusted.

^bAdjusted for all the factors in the table.

*Explanatory variables associated with “any” pain in partial and/ or full models.

models showed past injuries, smoking status (ever-smoked), somatising tendency (two or more symptoms) and mental health status (poor) to be positively associated with “any” pain. In the full model, past injuries and somatising tendency (two or more symptoms) remained positively associated with “any” pain.

5.4.1.2 Final model and predicted prevalences of “any” pain in the past 12 months in the South African bank workers

The final model and predicted prevalences of “any” pain (Table 5.6) contains statistically significant explanatory variables having ORs associated with “any” pain.

Table 5.6: Multiple regression of “any” pain in the past 12 months with possible risk factors and predicted prevalences in SA bank workers: Final models

Explanatory variable	“Any” pain in past 12 months (N=181)			
	n (%)	Final model		Predicted prevalence % (95% CI) ^c Δ (%)
		^b OR (95% CI)		
Age group (years)				
<30	77 (43.8)	1	77.3 (70.4-84.2)	
30-39	45 (25.6)	0.71 (0.32-1.58)	76.9 (70.3-83.4)	
40-49	39 (22.1)	2.55 (0.80-8.11)	84.1 (78.0-90.1)	
≥50	15 (8.5)	1.66 (0.39-7.02)	87.3 (79.3-95.3)	10
Sex				
Men	54 (29.8)	1	72.4 (64.7-82.1)	
Women	127 (70.2)	1.17 (0.55-2.48)	81.9 (78.4-85.6)	9.5
*Past injuries				
No	117 (64.6)	1	77.1 (72.9-81.3)	
Yes	64 (35.4)	3.45 (1.37-8.68)	90.5 (85.2-95.8)	13.4
Smoking status ^d				
Never-smoked	103 (56.9)	1	79.0 (75.1-82.9)	
Ever-smoked	78 (43.1)	2.16 (0.99-4.73)	85.7 (78.8-92.6)	6.7
*Number of distressing somatic symptoms				
0	40 (22.1)	1	70.9 (64.4-71.5)	
1	40 (22.1)	2.56 (1.00-6.53)	81.8 (74.9-88.7)	
≥2	101 (55.8)	3.17 (1.40-7.19)	88.8 (84.2-93.4)	17.9
*Mental health status				
Good	41 (22.7)	1	78.6 (72.9-84.2)	
Intermediate	49 (27.1)	1.20 (0.52-2.76)	78.6 (72.0-85.2)	
Poor	91 (50.2)	2.49 (1.03-6.03)	84.6 (78.7-90.4)	6.0

^aPost regression tests: Hosmer Lemeshow χ^2 p-value group (8) =0.13; group (10); =0.67;group (12) =0.15; ROC curve =76.7%.

^bAdjusted ORs of significant risk factors.

^cDifference in predicted prevalences of associated level/s of explanatory variables and relevant reference groups.

^dReturned to model as LR test p-value=0.04.

*Explanatory variables associated with “any” pain with their respective predictive prevalences in the final model.

Past injuries, somatising tendency (one and two or more symptoms) and mental health status (poor) were positively associated with “any” pain. These variables increased the odds of reporting “any” pain by the bank workers.

Somatising tendency is estimated to increase the prevalences of “any” pain in bank workers by 17.9% in workers reporting two or more distressing somatic symptoms in relation to those not reporting symptoms. Past injuries is estimated to increase the prevalence of “any” pain by 13.4% in bank workers.

5.4.1.3 Partial and full models of low back pain in the past 12 months in the South African bank workers

The partial and full models of low back pain show explanatory variables with ORs that have associations with low back pain. The models are presented in Table 5.7. The variables that were positively associated with low back pain in the partial models were BMI group (overweight), past injuries, smoking status (ever-smoked), somatising tendency (one and two or more symptoms), and job dissatisfaction. The odds of reporting low back pain increased with age group though the 95% CIs included one.

Table 5.7: Multiple regression of low back pain in the past 12 months with possible risk factors in SA bank workers: Partial and full models

Explanatory variable	Low back pain in past 12 months (N=131)		
	n (%)	Partial model ^a OR (95% CI)	Full model ^a OR (95% CI)
Age group (years)			
<30	53 (41.7)	1	1
30-39	31 (24.4)	0.80 (0.42-1.51)	0.74 (0.34-1.59)
40-49	30 (23.6)	1.61 (0.76-3.38)	1.57 (0.61-4.02)
≥50	13 (10.2)	2.26 (0.74-6.88)	1.71 (0.46-6.34)
Sex			
Men	38 (29.0)	1	1
Women	93 (71.0)	1.18 (0.66-2.11)	1.15 (0.58-2.27)

^aAdjusted for age and sex; Age and sex were mutually adjusted.

^bAdjusted for all the factors in the table.

Table 5.7: Multiple regression of low back pain in the past 12 months with possible risk factors in SA bank workers: Partial and full models cont'd

Explanatory variable	Low back pain in past 12 months (N=131)			
	n (%)	Partial model	Full model	
		^a OR (95% CI)	^a OR (95% CI)	
*BMI group				
Normal	55 (42.6)	1	1	
Overweight	45 (34.9)	2.54 (1.24-5.16)	2.53 (1.11-5.74)	
Obese	29 (22.5)	1.08 (0.52-2.22)	0.86 (0.37-1.99)	
*Past injuries				
No	79 (60.3)	1	1	
Yes	52 (39.7)	3.17 (1.67-6.01)	2.99 (1.45-6.16)	
*Ethnic group				
Sotho	30 (22.9)	1	1	
Nguni	32 (24.4)	1.43 (0.70-2.92)	1.59 (0.70-3.61)	
Other	69 (52.7)	1.80 (0.94-3.45)	2.57 (1.16-5.65)	
*Smoking status				
Never-smoked	71 (54.2)	1	1	
Ever-smoked	60 (45.8)	1.82 (1.04-3.18)	1.45 (0.74-2.85)	
Financial difficulties				
No	28 (21.5)	1	1	
Yes	102 (78.5)	1.54 (0.83-2.84)	1.69 (0.82-3.50)	
*Number of distressing somatic symptoms				
0	27 (20.6)	1	1	
1	30 (22.9)	1.97 (0.92-4.19)	2.45 (1.02-5.90)	
≥2	74 (56.5)	2.37 (1.25-4.49)	2.60 (1.20-5.63)	
Mental health status				
Good	30 (22.9)	1	1	
Intermediate	36 (27.5)	1.41 (0.69-2.85)	0.72 (0.31-1.66)	
Poor	65 (49.6)	1.81 (0.94-3.48)	0.96 (0.43-2.12)	
Working under time pressure				
No	3 (2.3)	1	1	
Yes	128 (97.7)	2.90 (0.73-11.44)	5.19 (0.89-30.19)	
Lack of social support				
No	96 (76.2)	1	1	
Yes	30 (23.8)	1.58 (0.80-3.13)	1.35 (0.61-2.99)	
*Job dissatisfaction				
No	67 (51.1)	1	1	
Yes	64 (48.9)	1.97 (1.13-3.44)	2.28 (1.20-4.35)	

^aAdjusted for age and sex; Age and sex were mutually adjusted.

^bAdjusted for all the factors in the table.

*Explanatory variables associated with low back pain in partial and/ or full models.

In the full model, BMI group (overweight), past injuries, ethnic group “other”, somatising tendency (one and two or more symptoms) and job dissatisfaction were

the variables positively associated with low back pain. As in the partial model, the reporting of low back pain increased with increasing age but the 95% CIs included one.

5.4.1.4 Final model and predicted prevalences of low back pain in the past 12 months in the South African bank workers

The final model of low back pain provides explanatory variables with ORs showing associations with low back pain and respective predicted prevalences (Table 5.8).

Table 5.8: Multiple regression of low back pain in the past 12 months with possible risk factors and predicted prevalences in SA bank workers: Final model

Explanatory variable	Low back pain in past 12 months (N=131)			
	n (%)	^a Final model	Predicted prevalence	
		^b OR (95% CI)	% ((95% CI)	^c Δ (%)
Age group (years)				
<30	53 (41.7)	1	53.6 (45.2-61.9)	
30-39	31 (24.4)	0.65 (0.31-1.37)	50.9 (42.9-58.8)	
40-49	30 (23.6)	1.55 (0.62-3.87)	62.8 (54.7-71.0)	
≥50	13 (10.2)	1.81 (0.49-6.64)	65.9 (54.1-77.6)	12.3
Sex				
Men	38 (29.0)	1	51.2 (40.7-61.7)	
Women	93 (71.0)	1.11 (0.57-2.14)	58.2 (53.6-62.9)	7.0
*BMI group				
Normal	55 (42.6)	1	50.9 (42.0-59.9)	
Overweight	45 (34.9)	2.75 (1.26-6.03)	69.5 (58.1-80.8)	
Obese	29 (22.5)	0.89 (0.39-2.01)	48.6 (35.3-61.8)	18.6
*Past injuries				
No	79 (60.3)	1	53.0 (48.1-57.9)	
Yes	52 (39.7)	3.04 (1.51-6.11)	68.4 (60.3-76.4)	15.4
*Ethnic group				
Sotho	30 (22.9)	1	53.2 (46.7-59.7)	
Nguni	32 (24.4)	1.39 (0.63-3.07)	56.6 (48.9-64.3)	
Other	69 (52.7)	2.43 (1.16-5.08)	63.2 (55.2-71.3)	10.0
*Number of distressing somatic symptoms				
0	27 (20.6)	1	45.4 (38.1-52.7)	
1	30 (22.9)	2.04 (0.88-4.72)	57.9 (49.2-66.6)	
≥2	74 (56.5)	2.56 (1.22-5.36)	66.8 (60.2-73.4)	21.4
*Job dissatisfaction				
No	67 (51.1)	1	53.2 (47.8-58.7)	
Yes	64 (48.9)	2.09 (1.13-3.87)	62.8 (56.1-69.5)	9.6

^aPost regression tests: Hosmer Lemeshow χ^2 p-value group (8) =0.91; group (10) =0.67; group (12) =0.87; ROC curve=75.4.

^bAdjusted ORs of significant risk factors.

^cDifference in predicted prevalences of associated level/s of explanatory variables and relevant reference groups.

*Explanatory variables associated with low back pain with their respective predicted prevalences in the final model.

The following explanatory variables were positively associated with low back pain: BMI group (overweight); past injuries; ethnic group “other”; somatising tendency (one and two or more symptoms); and job dissatisfaction. All of these variables increased the odds of reporting low back pain by the bank workers. It was observed that increased odds of reporting of low back pain increased with age group category, though the 95% CIs included one.

The three variables with the largest predicted prevalences of low back pain are somatising tendency, BMI group and past injuries.

5.4.1.5 Partial and full models of neck pain in the past 12 months in the South African bank workers

The partial and full models of neck pain show explanatory variables with ORs associated with neck pain. The models are presented in Table 5.9. In the partial models the following variables were positively associated with neck pain: BMI group (overweight); past injuries; frightening situation; somatising tendency (two or more symptoms); mental health status (poor); working under time pressure; and lack of social support.

Table 5.9: Multiple regression of neck pain in the past 12 months with possible risk factors in SA bank workers: Partial and full models

Explanatory variable	n (%)	Neck pain in past 12 months (N=125)	
		Partial model ^a OR (95% CI)	Full model ^b OR (95% CI)
Age group (years)			
<30	51 (42.1)	1	1
30-39	32 (26.4)	0.91 (0.48-1.71)	1.26 (0.54-2.92)
40-49	28 (23.1)	1.39 (0.66-2.89)	0.73 (0.26-2.05)
≥50	10 (8.3)	1.14 (0.41-3.17)	0.56 (0.14-2.15)
Sex			
Men	35 (28.0)	1	1
Women	90 (72.0)	1.34 (0.75-2.38)	1.47 (0.72-2.98)

^aAdjusted for age and sex; Age and sex were mutually adjusted.

^bAdjusted for all the factors in the table.

Table 5.9: Multiple regression of neck pain in the past 12 months with possible risk factors in SA bank workers: Partial and full models cont'd

Explanatory variable	Neck pain in past 12 months (N=125)		
	n (%)	Partial model	Full model
		^a OR (95% CI)	^b OR (95% CI)
*BMI group			
Normal	53 (42.7)	1	1
Overweight	43 (34.7)	2.50 (1.24-5.03)	2.73 (1.15-6.46)
Obese	28 (22.6)	1.22 (0.59-2.49)	1.43 (0.58-3.51)
*Past injuries			
No	77 (61.6)	1	1
Yes	48 (38.4)	2.35 (1.28-4.31)	1.91 (0.90-4.04)
*Educational level			
High school	77 (62.1)	1	1
Tertiary	47 (37.9)	0.63 (0.35-1.12)	0.43 (0.20-0.93)
Smoking status			
Never-smoked	70 (56.0)	1	1
Ever smoked	55 (44.0)	1.49 (0.86-2.57)	1.22 (0.60-2.49)
Deserve compensation			
No	49 (40.5)	1	1
Yes	72 (59.5)	1.45 (0.82-2.54)	1.54 (0.76-3.13)
Financial difficulties			
No	25 (20.3)	1	1
Yes	98 (79.7)	1.68 (0.91-3.09)	1.63 (0.76-3.47)
*Frightening situation			
No	51 (41.5)	1	1
Yes	72 (58.5)	2.44 (1.39-4.27)	1.92 (0.97-3.82)
*Number of distressing somatic symptoms			
0	23 (18.4)	1	1
1	22 (17.6)	1.40 (0.65-3.01)	1.86 (0.73-4.71)
≥2	80 (64.0)	3.96 (2.06-7.64)	4.33 (1.88-9.99)
*Mental health status			
Good	24 (19.2)	1	1
Intermediate	36 (28.8)	1.69 (0.78-3.64)	1.78 (0.74-4.27)
Poor	65 (52.0)	3.44 (1.58-7.49)	1.41 (0.61-3.25)
*Working under time pressure			
No	2 (1.6)	1	1
Yes	123 (98.4)	5.14 (1.06-24.81)	4.51 (0.72-28.05)
*Lack of social support			
No	91 (74.0)	1	1
Yes	32 (26.0)	2.20 (1.10-4.40)	2.33 (0.95-5.69)
Job dissatisfaction			
No	66 (53.2)	1	1
Yes	58 (46.8)	1.53 (0.89-2.63)	1.40 (0.72-2.74)

^aAdjusted for age and sex; Age and sex were mutually adjusted.

^bAdjusted for all the factors in the table.

*Explanatory variables associated with neck pain in partial and/ or full models.

In the full model, only BMI group (overweight) and somatising tendency (two or more symptoms) were positively associated with neck pain and educational level (tertiary) was negatively associated with neck pain.

5.4.1.6 Final model and predicted prevalences of neck pain in the past 12 months in the South African bank workers

The final model of neck pain and predicted prevalences are presented in Table 5.10.

The variables that were positively associated with neck pain were BMI group

Table 5.10: Multiple regression of neck pain in the past 12 months with possible risk factors and predicted prevalences in SA bank workers: Final model

Explanatory variable	Neck pain in past 12 months (N=125)				
	n (%)	Final model		Predicted prevalence	
		^b OR (95% CI)	% (95% CI)	^c Δ (%)	
Age group (years)					
<30	51 (42.1)	1	41.9 (33.7-50.3)		
30-39	32 (26.4)	1.01 (0.47-2.18)	48.6 (40.7-56.5)		
40-49	28 (23.1)	0.74 (0.27-2.04)	49.4 (40.9-57.8)		
≥50	10 (8.3)	0.56 (0.15-2.10)	41.7 (29.2-54.3)		-0.2
Sex					
Men	35 (28.0)	1	44.7 (34.1-55.3)		
Women	90 (72.0)	1.34 (0.68-2.66)	46.3 (41.6-51.1)		1.6
*BMI group					
Normal	53 (42.7)	1	44.8 (35.8-53.8)		
Overweight	43 (34.7)	3.04 (1.35-6.80)	68.8 (57.7-79.8)		
Obese	28 (22.6)	1.41 (0.59-3.34)	52.5 (39.1-65.9)		24.0
*Educational level					
High school	77 (62.1)	1	54.7 (46.7-62.7)		
Tertiary	47 (37.9)	0.44 (0.22-0.87)	42.4 (37.3-47.5)		12.3
*Frightening situation					
No	51 (41.5)	1	37.4 (31.5-43.3)		
Yes	72 (58.5)	2.51 (1.33-4.75)	55.4 (49.0-61.8)		18.0
*Number of distressing somatic symptoms					
0	23 (18.4)	1	35.1 (27.9-42.3)		
1	22 (17.6)	1.46 (0.61-3.48)	43.7 (34.8-52.5)		
≥2	80 (64.0)	3.93 (1.83-8.46)	57.3 (50.5-64.3)		22.2
*Lack of social support					
No	91 (74.0)	1	44.5 (39.8-49.2)		
Yes	32 (26.0)	2.62 (1.15-5.98)	53.7 (43.0-64.3)		9.2

^aPost regression tests: Hosmer Lemeshow χ^2 p-value group (8) =0.21; group (10) =0.27; group (12)=0.12; ROC curve =76.4.

^bAdjusted ORs of significant risk factors.

^cDifference in the predicted prevalences of associated level/s of explanatory variables and relevant reference group.

*Explanatory variables associated with neck pain with their respective predicted prevalences in the final model.

(overweight), frightening situation, somatising tendency (two or more symptoms) and lack of social support. Educational level (tertiary) was still negatively associated with neck pain.

The predicted prevalences indicated that tertiary education would decrease the prevalence of neck pain by 12.3%. Increases (24.0%) in the prevalence of neck pain were predicted to occur in bank workers who are in the overweight BMI group in relation to those in the normal group, and two or more somatic symptoms increased the pain by 22.2%.

5.4.1.7 Partial and full model of shoulder pain in the past 12 months in the South African bank workers

The partial and full models of shoulder pain have explanatory variables with ORs showing associations with shoulder pain. The models are shown in Table 5.11. In the partial models: sex (women); past injuries; smoking status (ever-smoked); frightening situation; somatising tendency (two or more symptoms); and mental health status (poor) were positively associated with shoulder pain. Age group increased with the reporting of shoulder pain although the 95% CIs included one. Somatising tendency (two or more symptoms) remained positively associated with shoulder pain, in the full model. The reporting of shoulder pain increased with increasing age group though the 95% CIs included one.

Table 5.11: Multiple regression of shoulder pain in the past 12 months with possible risk factors in SA bank workers: Partial and full models

Explanatory variable	Shoulder pain in past 12 months (N=86)		
	n (%)	Partial model	Full model
		^a OR (95% CI)	^b OR (95% CI)
Age group (years)			
<30	32 (38.1)	1	1
30-39	20 (23.8)	0.87 (0.44-1.74)	0.85 (0.38-1.85)
40-49	22 (26.2)	1.63 (0.78-3.43)	1.53 (0.61-3.82)
≥50	10 (11.9)	2.38 (0.84-6.70)	2.12 (0.61-7.33)
*Sex			
Men	19 (22.1)	1	1
Women	67 (77.9)	1.90 (1.01-3.59)	1.66 (0.82-3.36)
BMI group			
Normal	33 (38.8)	1	1
Overweight	32 (37.6)	1.99 (0.98-4.01)	1.92 (0.88-4.17)
Obese	20 (23.5)	1.33 (0.53-2.43)	1.09 (0.47-2.52)
*Past injuries			
No	52 (60.5)	1	1
Yes	34 (39.5)	2.26 (1.23-4.17)	1.80 (0.92-3.52)
Ethnic group			
Sotho	19 (22.1)	1	1
Nguni	20 (23.3)	1.35 (0.62-2.93)	1.13 (0.49-2.59)
Other	47 (54.7)	1.59 (0.80-3.18)	1.42 (0.64-3.14)
*Smoking status			
Never-smoked	3 (50.0)	1	1
Ever-smoked	43 (50.0)	2.11 (1.19-3.74)	1.82 (0.94-3.54)
*Frightening situation			
No	38 (44.2)	1	1
Yes	48 (55.8)	1.84 (1.02-3.29)	1.26 (0.65-2.42)
*Number of distressing somatic symptoms			
0	15 (17.4)	1	1
1	18 (20.9)	1.86 (0.79-4.33)	1.85 (0.74-4.61)
≥2	53 (61.6)	2.97 (1.45-6.07)	2.73 (1.22-6.09)
*Mental health status			
Good	17 (19.8)	1	1
Intermediate	19 (22.1)	1.05 (0.47-2.32)	0.70 (0.30-1.65)
Poor	50 (58.1)	2.29 (1.13-4.61)	1.32 (0.60-2.91)

^aAdjusted for age and sex; Age and sex were mutually adjusted.

^bAdjusted for all the factors in the table.

*Explanatory variables associated with shoulder pain in partial and full models.

5.4.1.8 Final model and predicted prevalences of shoulder pain in the past 12 months in the South African bank workers

The final model of shoulder pain has explanatory variables with ORs associated with shoulder pain. The final model and predicted prevalences are presented in Table 5.12. Variables that were positively associated with shoulder pain in the final model were sex (women), past injuries, smoking status (ever-smoked) and somatising tendency (two or more symptoms). The reports of shoulder pain increased with increasing age group although the 95% CIs included one.

Table 5.12: Multiple regression of shoulder pain in the past 12 months with possible risk factors and predicted prevalences in SA bank workers: Final model

Explanatory variable	Shoulder pain in past 12 months (N=125)			
	n (%)	^a Final model ^b OR (95% CI)	Predicted prevalence % (95% CI)	^c Δ (%)
Age group (years)				
<30	51	1	32.1 (24.3-39.9)	
30-39	32	0.90 (0.43-1.88)	31.4 (23.9-38.8)	
40-49	28	1.88 (0.84-4.20)	48.6 (40.3-56.8)	
≥50	10	2.43 (0.81-7.33)	47.6 (35.2-59.9)	15.5
*Sex				
Men	35	1	26.4 (16.7-36.1)	
Women	90	2.00 (1.02-3.93)	41.2 (36.5-45.9)	14.8
*Past injuries				
No	52	1	34.7 (29.9-39.5)	
Yes	34	1.98 (1.04-3.74)	50.2 (41.6-58.9)	15.5
*Smoking status				
Never-smoked	43	1	37.2 (32.5-41.9)	
Ever-smoked	43	2.13 (1.16-3.91)	43.8 (34.4-53.2)	6.6
*Number of distressing somatic symptoms				
0	23	1	31.1 (24.4-37.8)	
1	22	2.02 (0.83-4.87)	35.8 (27.4-44.2)	
≥2	80	2.90 (1.37-6.13)	47.3 (40.4-54.2)	16.2

^aPost regression tests: Hosmer Lemeshow χ^2 p-value group (8)=0.64; group (10)=0.86; group (12)=0.76; ROC curve=71.7.

^bAdjusted ORs of significant risk factors.

^cDifference in predicted prevalences of associated level/s of explanatory variables and relevant reference groups.

*Explanatory variables associated with shoulder pain with their respective predicted prevalences in the final model.

In relation to predicted prevalences of shoulder pain, somatising tendency, past injuries and sex (women) would increase the prevalences of shoulder pain by more than 10% each.

5.4.1.9 Partial and full models of wrist or hand pain in the past 12 months in the South African bank workers

The partial and full models of wrist or hand pain contain explanatory variables with ORs showing associations with wrist or hand pain. The models are shown in Table 5.13. The variables that were positively associated with wrist or hand pain in the partial models were sex (women), ethnic group (Nguni and other) and somatising tendency (two or more symptoms). These variables remained associated with wrist or hand pain in the full model. Furthermore, in the full model, the odds ratios of wrist or hand pain increased with increasing age group although the 95% CIs included one.

Table 5.13: Multiple regression of wrist/hand pain in the past 12 months with possible risk factors in SA bank workers: Partial and full models

Explanatory variable	Wrist or hand pain in past 12 months (N=64)			
			Partial model	Full model
	n (%)		^a OR (95% CI)	^b OR (95% CI)
Age group (years)				
	<30	25 (41.6)	1	1
	30-39	11 (18.3)	0.55 (0.24-1.23)	0.56 (0.22-1.39)
	40-49	18 (30.0)	1.57 (0.72-3.40)	1.63 (0.67-3.99)
	≥50	6 (10.0)	1.30 (0.43-3.89)	1.83 (0.53-6.63)
*Sex				
	Men	12 (18.8)	1	1
	Women	52 (81.2)	2.18 (1.05-4.55)	2.72 (1.17-6.34)
*Ethnic group				
	Sotho	9 (14.1)	1	1
	Nguni	20 (31.3)	3.73 (1.49-9.33)	4.37 (1.59-11.98)
	Other	35 (54.7)	2.37 (1.01-5.59)	3.11 (1.20-8.08)
Frightening situation				
	No	26 (41.3)	1	1
	Yes	37 (58.7)	1.87 (0.98-3.55)	1.70 (0.84-3.44)
*Number of distressing somatic symptoms				
	0	8 (12.5)	1	1
	1	11 (17.2)	2.13 (0.74-6.10)	2.05 (0.68-6.19)
	≥2	45 (70.3)	4.64 (1.90-11.31)	3.72 (1.45-9.54)
Repeated wrist/hand movement > 4 hours				
	No	9 (14.3)	1	1
	Yes	54 (85.7)	1.78 (0.78-4.06)	2.00 (0.82-4.89)

^aAdjusted for age and sex; Age and sex were mutually adjusted.

^bAdjusted for all the factors in the table.

*Explanatory variables associated with wrist or hand pain in partial and full models.

5.4.1.10 Final model and predicted prevalences of wrist or hand pain in the past 12 months in the South African bank workers

The final model contains statistically significant explanatory variables that are associated with wrist or hand pain. The final model and predicted prevalences are shown in Table 5.14. Sex (women), ethnic group (Nguni and other) and somatising

Table 5.14: Multiple regression of wrist or hand pain in the past 12 months with possible risk factors and predicted prevalences in SA bank workers: Final model

Explanatory variable	Wrist or hand pain in past 12 months (N=64)			
	n (%)	^a Final model	Predicted prevalence	
		^b OR (95% CI)	% (95% CI)	^c Δ (%)
Age group (years)				
<30	25 (41.7)	1	23.6 (16.5-30.7)	
30-39	11 (18.3)	0.48 (0.20-1.17)	19.5 (13.1-25.9)	
40-49	18 (30.0)	1.47 (0.62-3.51)	28.4 (21.2-35.6)	
≥50	6 (10.0)	1.32 (0.40-4.31)	25.9 (15.1-36.8)	2.3
*Sex				
Men	12 (18.8)	1	15.5 (7.7-23.4)	
Women	52 (81.2)	2.53 (1.11-5.75)	26.0 (21.8-30.2)	10.5
*Ethnic group				
Sotho	9 (14.1)	1	17.4 (12.2-22.5)	
Nguni	20 (31.3)	3.75 (1.41-9.97)	27.7 (20.7-34.7)	10.3
Other	35 (54.7)	2.87(1.13-7.28)	30.9 (23.1-38.6)	13.5
*Number of distressing somatic symptoms				
0	8 (12.5)	1	15.3 (9.9-20.6)	
1	11 (17.2)	2.37 (0.80-7.00)	21.2 (13.9-28.5)	
≥2	45 (70.3)	4.37 (1.74-10.94)	33.9 (27.3-40.5)	18.6

^aPost regression tests: Hosmer Lemeshow χ^2 p-value group (8) =0.95; group (10) =0.99; group (12)=0.76; ROC curve =75.6.

^bAdjusted ORs of significant risk factors.

^cDifference in predicted prevalences of associated level/s of explanatory variables and relevant reference groups.

*Explanatory variables associated with wrist or hand pain with their respective predicted prevalences in the final model.

tendency (two or more symptoms) were the variables positively associated with wrist of hand pain in final model.

According to the predicted prevalences of wrist or hand pain, somatising tendency, sex (women) and ethnic group (Nguni and other) would increase the prevalence of wrist or hand pain in the bank workers by more than 10.0% relative to the reference level.

5.4.1.11 Partial and full models of upper limb pain in the past 12 months in the South African bank workers

The partial and full models of upper limb pain have explanatory variables with ORs showing associations with upper limb pain. The models appear in Table 5.15. In

Table 5.15: Multiple regression of upper limb pain in the past 12 months with possible risk factors in SA bank workers: Partial and full models

Explanatory variable	Upper limb pain in past 12 months (N=124)			
	n (%)	Partial model	Full model	
		^a OR (95% CI)	^b OR (95% CI)	
Age group (years)				
<30	53 (44.2)	1	1	
30-39	25 (20.8)	0.47 (0.24-0.92)	0.42 (0.19-0.90)	
40-49	30 (25.0)	1.25 (0.58-2.68)	1.37 (0.52-3.56)	
≥50	12 (10.0)	1.48 (0.50-4.38)	1.47 (0.40-5.34)	
*Sex				
Men	27 (21.8)	1	1	
Women	97 (78.2)	2.65 (1.45-4.84)	2.53 (1.28-5.00)	
BMI group				
Normal	54 (43.9)	1	1	
Overweight	39 (31.7)	1.60 (0.79-3.25)	1.47 (0.67-3.21)	
Obese	30 (24.4)	1.17 (0.56-2.46)	1.01 (0.44-2.29)	
*Past injuries				
No	78 (62.9)	1	1	
Yes	46 (37.1)	2.32 (1.23-4.38)	1.90 (0.95-3.82)	
*Ethnic group				
Sotho	26 (21.0)	1	1	
Nguni	34 (27.4)	2.45 (1.15-5.20)	2.05 (0.91-4.62)	
Other	64 (51.6)	1.94 (0.99-3.82)	1.81 (0.83-3.93)	
Smoking status				
Never-smoked	69 (55.6)	1	1	
Ever-smoked	55 (44.4)	1.54 (0.88-2.72)	1.41 (0.72-2.77)	
Frightening situation				
No	56 (45.5)	1	1	
Yes	67 (54.5)	1.60 (0.91-2.83)	1.11 (0.58-2.14)	
Adverse beliefs about arm pain				
No	90 (72.6)	1	1	
Yes	34 (27.4)	1.53 (0.80-2.91)	1.40 (0.68-2.89)	

^aAdjusted for age and sex; Age and sex were mutually adjusted..

^bAdjusted for all the factors in the table.

*Explanatory variables associated with upper limb pain in partial and/ or full models.

Table 5.15: Multiple regression of upper limb pain in the past 12 months with possible risk factors in SA bank workers: Partial and full models cont'd

Explanatory variable	Upper limb pain in past 12 months (N=124)		
	n (%)	Partial model	Full model
		^a OR (95% CI)	^b OR (95% CI)
*Number of distressing somatic symptoms			
0	22 (17.7)	1	1
1	26 (21.0)	1.96 (0.89-4.31)	2.01 (0.85-4.76)
≥2	76 (61.3)	3.58 (1.82-7.06)	3.13 (1.45-6.75)
*Mental health status			
Good	27 (21.8)	1	1
Intermediate	30 (24.2)	1.05 (0.47-2.32)	0.80 (0.36-1.79)
Poor	67 (54.0)	2.29 (1.13-4.61)	1.24 (0.56-2.72)
Job insecurity			
No	37 (29.8)	1	1
Yes	87 (70.2)	1.50 (0.84-2.69)	1.48 (0.76-2.87)

^aAdjusted for age and sex; Age and sex were mutually adjusted..

^bAdjusted for all the factors in the table.

*Explanatory variables associated with upper limb pain in partial and/ or full models.

the partial models, the variables that were positively associated with upper limb pain were sex (women), past injuries, ethnic group (Nguni), somatising tendency (two or more symptoms) and mental health status (poor). The reporting of upper limb pain increased with increasing age group though the 95% CIs included one. In the full model, sex (women) and somatising tendency (two or more symptoms) were the variables positively associated with upper limb pain. Again, the ORs of upper limb pain increased with increasing age group with 95% CIs including one.

5.4.1.12 Final model and predicted prevalences of upper limb pain in the past 12 months in the South African bank workers

The final model contains statistically significant explanatory variables which are associated with upper limb pain. The model and predicted prevalences are shown in Table 5.16. The variables that were associated with upper limb pain were sex

Table 5.16: Multiple regression of upper limb pain in the past 12 months with possible risk factors and predicted prevalences in SA bank workers: Final model

Explanatory variable	Upper limb pain in past 12 months (N=124)			
	n (%)	^a Final model	Predicted prevalence	
		^b OR (95% CI)	% (95% CI)	^c Δ (%)
Age group (years)				
<30	53 (44.2)	1	53.3 (45.2-61.5)	
30-39	25 (20.8)	0.43 (0.21-0.88)	44.6 (36.8-52.5)	
40-49	30 (25.0)	1.35 (0.59-3.10)	59.4 (51.4-67.3)	
≥50	12 (10.0)	1.53 (0.49-4.82)	57.6 (45.6-69.5)	4.3
*Sex				
Men	27 (21.8)	1	35.0 (24.9-45.1)	
Women	97 (78.2)	2.88 (1.51-5.49)	56.9 (52.2-61.6)	21.9
*Past injuries				
No	78 (62.9)	1	49.3 (44.4-54.2)	
Yes	46 (37.1)	2.12 (1.09-4.09)	64.1 (55.9-72.3)	14.8
*Number of distressing somatic symptoms				
0	22 (17.7)	1	39.8 (32.7-46.9)	
1	26 (21.0)	1.85 (0.82-4.17)	50.3 (41.5-59.0)	
≥2	76 (61.3)	3.28 (1.63-6.62)	66.9 (60.4-73.5)	27.1

^aPost regression tests: Hosmer Lemeshow χ^2 p-value group (8) =0.61; group (10) =0.05; group (12)=0.47; ROC curve=73.9%.

^bAdjusted ORs of significant risk factors.

^cDifference in predicted prevalences of associated level/s of explanatory variables and relevant reference groups.

*Explanatory variables associated with upper limb pain with their respective predicted prevalences in the final model.

(women), past injuries and somatising tendency (two or more symptoms). These variables increased the odds of reporting upper limb pain by the bank workers. As in the partial and full models, the reporting of upper limb pain increased with increasing age group although the 95% CIs included one.

Somatising tendency and sex (women) were the variables predicted to increase the prevalence of upper limb pain by more than 20%.

5.4.1.13 Partial and full models of knee pain in the past 12 months in the South African bank workers

The partial and full models demonstrating explanatory variables that are associated with knee pain are shown in Table 5.17. Past injuries, somatising tendency (two or

Table 5.17: Multiple regression of knee pain in the past 12 months with possible risk factors in SA bank workers: Partial and full models

Explanatory variable	Knee pain in past 12 months (N=62)		
	n (%)	Partial model	Full model
		^a OR (95% CI)	^b OR (95% CI)
*Age group (years)			
<30	18 (30.5)	1	1
30-39	18 (30.5)	1.67 (0.79-3.55)	2.03 (0.89-4.63)
40-49	15 (25.4)	1.98 (0.86-4.51)	2.53 (0.99-6.45)
≥50	8 (13.6)	1.50 (0.74-3.04)	3.91 (1.21-12.64)
Sex			
Men	14 (22.6)	1	1
Women	48 (77.4)	1.50 (0.74-3.04)	1.38 (0.65-2.94)
*Past injuries			
No	36 (58.1)	1	1
Yes	26 (41.9)	2.03 (1.06-3.88)	1.79 (0.90-3.57)
Ethnic group			
Sotho	12 (20.0)	1	1
Nguni	16 (26.7)	1.76 (0.74-4.20)	1.89 (0.75-4.71)
Other	32 (53.3)	1.51 (0.69-3.31)	2.11 (0.89-5.00)
*Financial difficulties			
No	10 (16.1)	1	1
Yes	52 (83.9)	2.02 (0.93-4.38)	2.44 (1.04-5.69)
*Number of distressing somatic symptoms			
0	12 (19.4)	1	1
1	13 (21.0)	1.65 (0.65-4.71)	1.56 (0.59-4.11)
≥2	37 (59.6)	2.21 (1.01-4.83)	1.96 (0.84-4.52)
*Job dissatisfaction			
No	27 (43.5)	1	1
Yes	35 (56.5)	2.64 (1.40-4.99)	3.02 (1.52-5.97)

^aAdjusted for age and sex; Age and sex were mutually adjusted.

^bAdjusted for all the factors in the table.

*Explanatory variables associated with knee pain in partial and/ or full models.

more symptoms) and job dissatisfaction were positively associated with knee pain in the partial models. In the full model, age group (50 years and above), financial difficulties and job dissatisfaction were the variables associated with knee pain.

5.4.1.13 Final model and predicted prevalences of knee pain in the past 12 months in the South African bank workers

The final model of knee pain and predicted prevalences are presented in Table 5.18.

The model shows explanatory variables that are positively associated with knee

pain. The variables that were associated with knee pain in the full model remained associated with knee pain in the final model. These were age group (40-49 and 50 years and above), financial difficulties, and job dissatisfaction.

Table 5.18: Multiple regression of knee pain in the past 12 months with possible risk factors and predicted prevalences in SA bank workers: Final model

Explanatory variable	n (%)	Knee pain in past 12 months (N=62)		
		^a Final model	Predicted prevalence	
		^b OR (95% CI)	% (95%CI)	^c Δ (%)
*Age group (years)				
<30	18 (30.5)	1	21.1 (14.3-27.9)	
30-39	18 (30.5)	2.09 (0.94-4.62)	25.4 (18.4-32.5)	
40-49	15 (25.4)	2.91 (1.19-7.10)	37.5 (29.6-45.5)	16.4
≥50	8 (13.6)	4.04 (1.32-12.38)	37.4 (25.3-49.5)	16.3
Sex				
Men	14 (22.6)	1	23.1 (13.4-32.8)	
Women	48 (77.4)	1.40 (0.67-2.91)	30.4 (25.9-34.7)	7.3
*Financial difficulties				
No	10 (16.1)	1	17.9 (11.6-24.2)	
Yes	52 (83.9)	2.26 (1.01-5.07)	33.7 (28.9-38.5)	15.8
*Job dissatisfaction				
No	27 (43.5)	1	22.9 (18.3-27.6)	
Yes	35 (56.5)	2.87 (1.49-5.51)	39.5 (32.6-46.4)	16.6

^aPost regression tests: Hosmer Lemeshow χ^2 p-value group (8) =0.41; group (10); =0.46; group (12) =0.66; ROC curve =71.4%.

^bAdjusted ORs of significant risk factors.

^cDifference in predicted prevalences of associated level/s of explanatory variables and relevant reference groups.

*Explanatory variables associated with knee pain with their respective predicted prevalences in the final model.

The variables age group, job dissatisfaction and financial difficulties had predicted prevalence differences ranging from 15.8% to 16.6%.

5.4.1.14 Summary of possible risk factors associated with MSD pain in the past 12 months in the SA bank workers

All the risk factors from the final models of pain sites used in the multiple regression analysis are presented in Table 5.19.

- Somatising tendency was associated with most pain sites (six) followed by past injuries (four).
- Low back pain had the largest (five) number of risk factors.
- Upper limb pain was associated with sex (women).
- Knee pain was associated with age group, and low back, shoulder and upper limb pain increased with increasing age group, although the trends were not significant.
- “Bank workers” was the only group in which sex was examined. Interestingly, “women” was positively associated with upper limb pain.
- In general, the effect of most risk factors was inconsistent across pain sites.

Table 5.19: Statistically significant risk factors from final models of MSD pain in the past 12 months in the SA bank workers

Risk factor	Pain site							**Total
	Any	Low back	Neck	Shoulder	Wrist/hand	Upper limb	Knee	
*Number of distressing somatic symptoms								
0							-	
1								
≥2	√	√	√	√	√	√		6
*Past injuries								
Yes	√	√	-	√	-	√	-	
No								4
*Sex								
Men	-	-	-				-	
Women				√	√	√		3
Job dissatisfaction								
Yes	-	√	-	-	-	-	√	
No								2
BMI group								
Normal							-	
Overweight	-	√	√	-	-	-		
Obese								2
Ethnic group								
Sotho							-	
Nguni	-		-	-	√			
Other		√			√	-		2
*Age group								
<30								
30-39	-	↑	-	↑	-	↑		
40-49							√	
≥50							√	1
Smoking status								
Never-smoked		-	-		-	-	-	
Ever- smoked	-			√				1

*)=Risk factors showing consistent association with pain sites; **)=Number of pain sites associated with a particular risk factor; √)=Associated; -)= Not associated or not applicable

Table 5.19: Statistically significant risk factors from final models of MSD pain in the past 12 months in the SA bank workers

Risk factor	Pain site							**Total
	Any	Low back	Neck	Shoulder	Wrist/hand	Upper limb	Knee	
Frightening situation	Yes No	- -	- -	√ -	- -	- -	- -	1
Lack of social support	Yes No	- -	- -	√ -	- -	- -	- -	1
Mental health status	Good Intermediate Poor	- - √	- -	- -	- -	- -	- -	1
Financial difficulties	Yes No	- -	- -	- -	- -	- -	√ -	1
Educational level	High school Tertiary	- -	- -	-√ -	- -	- -	- -	1
***Total		3	5	5	4	3	3	26 / 26

)=Number of pain sites associated with a particular risk factors; *)=Number of risk factors associated with a particular pain site; √)=Associated; -√)=Negatively associated; -)= Not associated or not applicable

Chapter 6: Discussion

6.1 Introduction

The research on which this thesis is based set out to investigate the exposure effect relationship between MSD pain in the low back, neck, shoulders, elbows, wrists or hands, upper limbs and knees, and potential work and non-work risk factors in two South African occupational groups, namely public hospital nurses and bank workers. In combined analyses, the two groups were referred to as South African (SA) workers. The data from each group were analysed separately. In this section, the summary and discussion of the results are presented.

The estimated 12-month prevalences (95% CI) of pain in at least one body site were high at 80.5% (77.0%-84.0%) in the SA workers, 84.1% (79.5%-88.6%) in the nurses and 76.7% (71.3%-82.1%) in the bank workers. The most prevalent MSD at a single site was pain in the low back and the least prevalent was pain in the elbows in all the three groups of workers. The second most prevalent MSDs was pain in the shoulders and neck in nurses and bank workers, respectively. Multi-site pain was the most frequently reported MSD, followed by pain in two sites. Most of the workers reporting MSDs reported consulting a medical or alternative practitioner for the pain. The average number of lost work days due to MSDs in the past year in the SA workers was estimated at 1052.5 days which is equivalent to 2.2 days per worker per year.

Incident and persistent MSDs were only investigated in the nurses. Incident MSDs (95% CI) were estimated at 47.6% (36.5%-58.6%). Having incident low back pain was reported by the largest percentage of nurses, followed by incident shoulder pain. Incident elbow pain was the least reported MSD. Persistent MSDs (95% CI) were

estimated at 83.7% (76.2%-91.1%). Persistent knee pain had the highest percentage followed by persistent low back pain. Persistent elbow pain had the lowest percentage.

Individual risk factors were more prominent than physical and psychosocial aspects of work. Somatising tendency was associated with prevalent and persistent MSDs. Somatising tendency demonstrated increasing linear trends with prevalent MSDs in a few body sites. In the SA workers and bank workers which are the groups that included sex, “women” was positively associated with pain in the upper limbs. Older age groups (40-49 and 50 years and older) were positively associated with MSDs in 1-2 body sites in the three groups of workers. In addition to these sites, in 2-4 body sites the ORs increased with increasing age although the trends were not significant. The ORs for pain in the shoulders and knees in the SA workers demonstrated linear trends. BMI contributed little in explaining MSDs in the three groups of workers. In nurses, obese and overweight BMI categories were negatively associated with pain in “any” body site and upper limbs, respectively which was unexpected. The occupational group “bank workers” was positively associated with pain in the neck but no positive association was found with pain in “any” body site compared to nurses. Ethnic group was inconsistent in its association with MSDs in the three groups of workers. “Other” (Afrikaner, Coloured, Indian, Tsonga and Venda) ethnic group was associated with pain in the upper limbs, low back and wrists or hands, in one, two and three groups of workers, respectively.

Finally, work risk factors encompassing physical and psychosocial aspects of work showed positive associations with MSDs in the SA workers only. These were repeated elbow bending for more than one hour on an average day and job

dissatisfaction. “Repeated elbow bending” was positively associated with pain in the elbows while job dissatisfaction was associated with pain in five body sites in the SA workers and two body sites each in nurses and bank workers. In general, the remaining risk factors were inconsistent across the body sites considered in the study.

6.2 Prevalences and body site localisation of MSDs

The estimated 12-month prevalences and body site localisation of MSDs in SA workers, public hospital nurses and bank workers are discussed. It has been noted that prevalences of “any” MSD pain tend to increase with the increasing number of body sites included in the studies. Hence, comparisons among studies need to take this into consideration, that is higher prevalences may be a function of studying many body sites.

6.2.1 South African workers

The prevalences of MSDs in the selected body sites of the SA workers is discussed in the context of other studies on workers, including nurses and office workers who use computers. The estimated 12-month prevalence of “any” MSDs in this study (80.5% vs 87.0% and 88.0%) was high so, was that of an unpublished SA study by Dyosi and Nyantumbu (2007), which included nurses and office workers, and another study conducted in New Zealand (Harcombe et al., 2009) on nurses, office workers and postal workers. In this study, body site specific MSD prevalences in the low back (56.9% vs 55.6% and 51.4%) and elbows (14.3% vs 1.9% and 16.8%) had similar patterns as those of unpublished SA and New Zealand studies with low back MSD being the most common and elbow MSD the least common. MSD prevalences of the other body sites: neck (46.2% vs 37.0% and 51.4%), shoulders (38.8% vs

44.4% and 44.3%), wrists or hands (24.6% vs 19.4% and 28.1%) and knees (29.4% vs 16.7% and 28.1%) did not show any particular pattern in this study and other two studies.

Body site specific MSD prevalences of the SA workers in this study showed a similar pattern to those of the CUPID studies (Matsudaira et al., 2011, Warnakulasuriya et al., 2012). The results were similar to these studies in respect of body sites, with pain in the low back (56.9% vs 27.3% and 22.9%) and elbows (14.3% vs 3.2% and 3.6%) being the most and least common respectively, and in the other body sites; neck (46.2% vs 29.4% and 13.9%), shoulders (38.8% vs 21.2% and 11.1%), wrists or hands (24.6% vs 6.3% and 8.5%) and knees (29.4% vs 12.0% and 17.7%) showing no particular pattern. However, the magnitude of the prevalences of the SA study was higher than those of the CUPID studies partly, due to the different period prevalences used and occupational groups included in the studies.

6.2.2 Public hospital nurses

The estimated 12-month prevalence (95% CI) of reported MSDs in at least one body site in the public hospital nurses in the SA study was high at 84.1% (79.5%-88.6%). This prevalence was within the range of 77.0%-89.5% reported by recent SA studies in public hospital nurses (Dyosi and Nyantumbu, 2007, Madiba et al., 2013, Kumalo, 2015). A study by Kumalo (2015) found a slightly lower prevalence (77.0%) while that of Madiba and colleagues (2013) found a prevalence of 84.0% which compares well with that of the current SA study. The study of Dyosi and Nyantumbu (2007) had a slightly higher prevalence of 89.5%.

Regarding the localisation of MSDs, the current study was in agreement with the SA studies in so far as pain in the low back having the highest prevalence (Botha and Bridger, 1998, Madiba et al., 2013) and elbows the lowest prevalence (Dyosi and Nyantumbu, 2007). In the current study, the prevalence for the localisation of pain in the shoulders ranked second while that of the neck ranked third which was similar to that reported by two SA studies (Dyosi and Nyantumbu 2007, Madiba et al. 2013). Botha and Bridger (1998) found the opposite, with the neck and shoulders ranking second and third, respectively. As in the current study, the remaining body sites of the other SA studies did not show any particular pattern in the localisation of pain. The broad similarities in the South African studies suggest that the findings of this thesis are reliable.

The prevalence in the SA study on nurses (84.1%) is encompassed in the range of prevalences from 70.0%-85.5% reported by the studies investigating MSDs in nurses from other countries. A Chinese study (Smith et al., 2004a) investigating 282 nurses reported a prevalence of 70.0%; a Japanese study (Smith et al., 2006), including 844 nurses, reported a prevalence marginally higher (85.5%) than that of the SA study. Two studies, one conducted in Iran and the other in Estonia, found prevalences that are comparable to the SA study. The Iranian study (Choobineh et al., 2006) included 641 nurses and found a prevalence of 84.4% while the Estonian study (Freimann et al., 2013) investigated 221 nurses and reported a prevalence of 84.0%.

The pattern of MSD localisation by body site in the SA study was similar to that found in studies conducted in other countries. Localisation of pain in the low back was the most common (Smith et al., 2004a, Choobineh et al., 2006, Smith et al., 2006, Freimann et al., 2013) while localisation in the elbows was the least common

(Choobineh et al., 2006, Freimann et al., 2013). As in the SA study, localisation of pain in the shoulders was second most common followed by neck (Smith et al., 2006) while the opposite was true in other studies, with the neck (Smith et al., 2004a, Freimann et al., 2013) being second and shoulders (Smith et al., 2004a, Choobineh et al., 2006) third. The remaining body sites did not follow a particular pattern. The preponderance of MSDs in the SA nurses and nurses from other countries is clear. The contributing factors may be due to the unabated exposures to MSD risk factors emanating from the nursing job and the susceptibility of nurses to the development of MSDs. Furthermore, the lack of a regulatory framework to deal with MSD risk factors in South Africa, particularly, in nursing, may be a hindrance in the prevention and control of MSDs in nurses.

6.2.3 South African bank workers

Taking into consideration the number of body sites studied in the SA study, the estimated 12-month prevalence (95% CI) of reported MSDs by SA bank workers in at least one body site was found to be high at 76.7% (71.3%-82.1%). The result obtained in an Egyptian study to determine the prevalence and work-related factors of neck and upper extremity MSDs in telecommunications workers was 28.3% (Fouad El-Bestar et al., 2011). In a Swedish study investigating the working conditions and MSD symptoms among employees in a call centre the prevalence was 77.2% (Norman et al., 2004).

In the SA bank workers, the low back (55.5%) had the highest prevalence followed by neck (52.9%) and shoulders (36.4%). The low back prevalence was higher than that (48.0%) obtained in the Swedish (Norman et al., 2004) and (27.0%-47.0%) United Kingdom (Sprigg et al., 2007) studies. The MSD prevalence in the neck was

lower than that (62.0%-67.0%) found in the Swedish studies (Norman et al., 2004, 2008). The MSD prevalence in the shoulders was also lower than the one (41.0%) reported in the Swedish study (Norman et al., 2004).

These results show high prevalences of upper extremity (neck and/or shoulders) and low back MSDs both in SA bank workers and workers from other countries. These MSDs may be due to the configuration of their workstations; work organisational factors and susceptibility of the workers to the development of MSDs. In the SA bank workers the lack of a regulatory framework in South Africa may be another reason for the observed results.

6.3 Characteristics of MSDs

The characteristics of MSDs covered duration of pain, number of body sites affected by pain and consequences of MSDs which included number of days away from work with pain and consulting healthcare providers.

6.3.1 South African workers

Pain lasting at least seven days, in each body site of interest in the study was reported by 8.0% of SA workers for pain in the elbow and 33.7% for pain in the low back. Approximately 66.7% of MSDs reported by the New Zealand workers in the past 12 months, the pain lasted for at least seven days (Harcombe et al., 2009). The percentage of SA workers reporting multi-site pain was more than threefold (37.8%) compared to 11.0% of Japanese workers (Matsudaira et al., 2011).

Besides experiencing pain, the SA workers also reported the impact of MSDs in their lives such as consulting for pain and sickness absence. Close to 60.0% of the SA workers consulted for MSDs with most of them consulting healthcare providers for pain in the knees and low back. A larger percentage (27.6%) of SA workers reported

taking up to five days away from work due to MSDs than the 15.0% of New Zealand workers (Harcombe et al., 2009). The difference in the proportions of SA (38.8%) and Japanese workers (5.4%) who took days away from work due to pain in “any” body site, was sevenfold.

The higher proportion of SA workers who consulted healthcare providers for pain as compared to workers from other countries may be partly due to the severity of the pain even though it was not determined in this study. Also, the higher levels of sickness absenteeism may be partly attributed to the pain being disabling thus preventing workers from going to work. Another possible explanation may be that workers may have taken advantage of paid sick leave as provided for by the Basic Conditions of Employment Act of 1997.

6.3.2 Public hospital nurses

In the SA nurses compared to American nurses classified as MSD cases (Trinkoff et al., 2002), the pain duration of more than six days in the low back (33.5% vs 31.8%) was higher, than that reported in the shoulders (20.3% vs 22.2%) and neck (15.5% vs 24.1%). The term “MSD case” incorporated pain, frequency, intensity and duration occurring at least one week or monthly in the past 12 months. The differences in the definition of the duration of pain in the two studies are more likely to have influenced the observed results.

Pain reported at three or more sites (35.5%) was the most common in the SA nurses and was comparable to that (35.8%) reported by the Estonian nurses (Freimann et al., 2013). The similarities in the measurement methods used in the SA and Estonian studies may have contributed to the observed outcome. The

consequences of MSDs in the SA nurses included consulting medical or alternative practitioners and taking days away from work because of pain. Of the SA nurses who reported pain in at least one body site, 64.9% consulted for the pain which was higher than the 42.6%, 31.0% and 30.3% reported by the Australian (Surawera et al., 2013), Iranian (Choobineh et al., 2006) and Nigerian (Tinubu et al., 2010) nurses.

The SA nurses who had reported MSDs also reported that MSDs caused them to take days away from work. A higher percentage (39.6% vs 22.5% and 18.4%) of the SA nurses took days away from work due to MSDs than Australian (Surawera et al., 2013) and Iranian (Choobineh et al., 2006) nurses. However, the average number of days (2.4 days) away from work taken by each SA nurse per year due to MSDs was similar to that taken by the Iranian nurses (Choobineh et al., 2006). In summary, the characteristics of MSDs in the SA nurses reaffirm what is already known from the literature that the social and economic cost of MSDs is substantial.

6.3.3 Bank workers

Pain lasting more than six days was common in all the body sites considered in the SA bank workers. Low back was most common (33.9%) followed by neck (29.7%) and shoulders (22.5%). The average (26.1%) of the combined neck and shoulder results is closer to 27.4% which is the combined result of neck and shoulder MSDs in the two call centres investigated in the Brazilian study (Ferreira and Saldiva, 2002). In this study, the duration of symptoms was greater than seven days with sickness absence of any duration in the current job of the operators which was less than a year.

The reporting of MSDs in two body sites was most common at 19.5%. Multi-site pain in this case, pain reported in more than one body sites was 59.7%. This result is

higher than the 50.0% of Italian call centre operators who reported pain in more than one body sites (d'Errico et al., 2010).

Sickness absence due to MSDs in the past year was 38.1% in the SA bank workers. This result was higher than that found in the Brazilian study where 20.9% of call centre operators were absent from work due to MSDs (Ferreira and Saldiva, 2002). More than half (51.4%) of the SA workers who reported MSDs consulted medical or alternative practitioners for pain. Of these workers, 49.4% consulted for pain in the neck which exceeded those who consulted for pain in the low back (48.1%). These results are higher than the 45.0% of call centre operators who consulted a physician in the Italian study and 39.0% who consulted for pain in the neck (d'Errico et al., 2010).

6.4 Risk factors for prevalent MSDs

Individual risk factors, physical and psychosocial work risk factors were associated with MSDs in SA workers. These were somatising tendency, past injuries, sex, age group, occupational group and repeated elbow bending for more than an hour in an average day and job dissatisfaction. Individual risk factors were associated with MSDs in public hospital nurses and bank workers. Somatising tendency and age group was associated with MSDs in public hospital nurses and somatising tendency, past injuries, sex and age group in SA bank workers. Physical and psychosocial work risk factors did little to explain MSDs in these two groups of workers.

6.4.1 Somatising tendency

6.4.1.1 South African workers

Somatising tendency was positively associated with MSDs in the SA workers. It showed linear trends in the effect of one and two or more distressing somatic

symptoms compared to no symptoms. The predicted prevalence of 24.9% would make somatising tendency the risk factor producing the second largest estimated increase of MSD prevalence in SA workers reporting two or more distressing somatic symptoms in relation to those reporting no symptoms, in this study.

The associations of somatising tendency with MSDs have been found in studies conducted in groups of workers in other countries. A Japanese study investigating the risk factors for MSDs in four groups of Japanese workers found consistent, positive and statistically significant associations of two or more distressing somatic symptoms in relation to no somatic symptoms in the past month with pain in all the body sites considered in the study (Matsudaira et al., 2011). Another study using the fifth European Working Conditions data, evaluated the role of risk factors for MSDs in 34 European countries including 27 occupational groups (Farioli et al., 2014). This study found consistent, positive and statistically significant associations between one and two or more distressing somatic symptoms in the past year and pain in the back and neck or upper limbs. The SA study is in congruence with these studies.

Before addressing the objectives, background data analysis showed that a number of factors namely, financial difficulties, frightening situation, adverse beliefs about the work-relatedness of MSDs, poor mental health status and time pressure at work were significantly associated with somatising tendency in the SA workers. These factors may have acted as triggers of somatising tendency. Somatising tendency can be explained by the concept of somatisation (Lipowski, 1988) which suggests that somatising tendency is psychogenic since the somatic symptoms occur without any demonstrable underlying pathology. Most MSDs are categorised as non-specific because similar to somatic symptoms, they have been found to occur without any

underlying pathology (Aptel et al., 2002, Buckle and Devereux, 2002, Punnett and Wegman, 2004, Coggon et al., 2012). This feature puts them in the same category as somatic symptoms and their association with somatising tendency characterises them as somatic symptoms (Baker et al., 1999). Based on the characterisation of MSDs as non-specific, it can be said that most of the MSDs reported by the SA workers were non-specific even though no clinical examination was performed to determine this. Also, it can be said that they belong to the somatic syndrome as stated by others (Vargas-Prada et al., 2016).

6.4.1.2 Public hospital nurses

Somatising tendency was positively and statistically associated with MSDs in the effect of two or more distressing somatic symptoms in relation to no symptoms. The predicted prevalences indicated that somatising tendency is estimated to increase the prevalence of MSDs in the nurses by up to 27.1%.

Studies in other countries investigating risk factors for MSDs in nurses have reported positive and statistically significant associations with somatising tendency. A study conducted among 1 111 Australian nurses found association with pain in the wrists or hands in the past month, the only body site investigated in the study (Surawera et al., 2013). In their study which included 221 Estonian nurses, Freimann and colleagues (2013) found associations with pain in more than one site and the neck in the past 12 months. Another study conducted among Brazilian (193) and Italian (588) nurses reported associations with pain in more than one site, low back, neck and shoulders in the past month (Carugno et al., 2012). The SA study is in accord with these studies.

In the SA study more than half of the nurses reported somatising tendency.

Somatisation has been linked with psychological distress and job stress (De Gucht et al., 2003). This may imply that somatisation in the SA nurses is influenced by individual psychological and adverse work organisational factors. These factors were adverse beliefs about the work-relatedness of MSDs, poor mental health, job insecurity and dissatisfaction, which were found to be associated with somatising tendency during background data analysis in this study.

6.4.1.3 South African bank workers

Somatising tendency was associated with MSDs in most body sites in the SA bank workers. It was predicted to increase the prevalence of MSDs by 27.1% in bank workers reporting two or more distressing somatic symptoms in relation to those reporting no symptoms. This would make somatising tendency the risk factor producing the largest estimated increase of MSD prevalence in this study. None of the reviewed studies on workers performing CTI tasks included somatising tendency among the risk factors studied.

In the SA bank workers, somatising tendency may have been influenced by psychological individual risk factors and psychosocial aspects of work based on background data analysis of the SA bank workers' data. These risk factors include frightening situation, poor mental health and time pressure at work.

6.4.2 Past injuries

6.4.2.1 South African workers

"Past injuries" was associated with MSDs in SA workers. A literature review on risk factors associated with MSDs found studies showing no association and those showing associations with past injuries (Malchaire et al., 2001). More recent studies

have, however, shown positive associations between past injuries and MSDs. A United States cross-sectional study using data from the General Social Survey was conducted to investigate pain in the upper extremity (arms) and low back (back) and associated risk factors in 1 484 US adults classified into eight occupational groups (Waters et al., 2007). The study showed strong associations between reports of sustaining injuries three times or more at work in the past year and pain in the back and arms. A similar study which included 10 body sites of MSDs (neck, shoulder, upper back, lower back, thigh/knee, leg, ankle, elbow, hand/wrist and finger) was conducted in China amongst 3 248 workers employed in nine industry types (Yu et al., 2012). The findings of this study also showed positive associations between past injuries and MSDs.

The increased odds of reporting MSDs related to “past injuries” by the SA workers, may reflect acquired vulnerability or lower tolerance in the affected body site (Cole and Rivilis, 2004). Injuries usually arise through traumatic damage to the tissues (Coggon et al., 2012). After the injury, an inflammatory response is initiated to replace or repair the injured tissues. Healing of the affected area would occur typically with the formation of scar tissue. The tolerance threshold level of this area to repeated strains from physical and psychosocial stresses may be lowered. As a result the area becomes more prone to MSDs (Barbe and Barr, 2006).

6.4.2.2 South African bank workers

“Past injuries” was also positively associated with MSDs in the SA bank workers. One of the reviewed studies which included “past injuries” in the risk factors studied, found an association with MSD symptoms in the neck or shoulders and elbows or wrists in 775 Italian call centre operators (d'Errico et al., 2010). One of the objectives

of the South African study was to assess the relationship between MSD symptoms in the upper limbs and work-related risk factors in the operators. The increased odds of reporting MSDs by the SA bank workers reflect the acquired vulnerability and low tolerance threshold level conferred by past injuries.

6.4.3 Sex

6.4.3.1 South African workers

Sex (women) was positively associated with MSDs in SA workers. These findings are in line with literature reviews such as the one by Malchaire and colleagues (2001). Another study by da Costa and Viera (2010) found “women” to have reasonable evidence of a causal relationship with MSDs in longitudinal studies. Similarly, Farioli and colleagues (2010) conducted a study of 43 816 workers to determine the role of individual, occupational and social risk factors in 27 occupational groups from 34 European countries. In this study, “men” was negatively associated with pain in the back and neck or upper limbs in the past year.

Other population based studies have shown associations between sex “women” and MSDs. One was conducted in Belgium amongst 3 829 Flemish and French speaking people to explore the influence of socio-cultural and work-related factors on pain in the low back (Skovron et al., 1994). Sex “women” was associated with a history and first episode of pain in the low back. A study based on the 1998 Quebec Health and Social Survey with 11 735 workers was conducted to compare two analytical strategies for a number of MSDs with a wide range of exposures (Messing et al., 2009). In the multiple regression analysis, “women” was significantly associated with pain in the neck, lower legs or calves and pain in the feet or ankles in the final model after controlling for the factors measured in the study.

Possible explanations for the sex differences in the odds of reporting MSDs in the SA workers can be categorised under anthropometric factors (Cole and Rivilis, 2004, Treaster and Burr, 2004), physical and psychosocial aspects of work (Treaster and Burr, 2004) and social responsibility (Messing et al., 2003, Treaster and Burr, 2004). The majority of women in the SA workers had abnormal BMI compared to the minority of men (64.6% vs 34.1%). The implication of body size of these women may be that during task performance the interaction with work activities and workstation subjects the body to biomechanical stresses (Stevenson et al., 1996) of the upper limbs in particular. This may lead to more frequent reporting of pain in the upper limbs by the women than men. There were significant differences in the reporting of repeated elbow bending for more than an hour in an average day (84.5% vs 15.5%), time pressure at work (80.9% vs 19.1%) and job insecurity (78.9% vs 21.1%) between women and men. These factors have been associated with pain in the upper limbs (Treaster and Burr, 2004). Women's work tends to overload the upper limbs and women may use different workstyles than those used by men and may react differently to psychosocial stressors such as time pressure than men (Treaster and Burr, 2004). As a result, they become more prone to developing pain in the upper limbs than men. Another possible explanation of the effect of sex "women" on the reporting of MSDs is the differences in social responsibility between women and men (Messing et al., 2003). SA women are more involved in the performance of household chores than men. Consequently the strain from using the upper limbs while cleaning the house, for instance, may be compounded by workplace exposures hence, the increase in reporting pain in the upper limbs. However, these exposures were not measured in this study. The effect of sex

“women” is estimated to increase the prevalence of MSDs in the SA workers by up to 19.0%.

6.4.3.2 South African bank workers

Sex (women) was positively associated with MSDs in the SA bank workers. Other studies investigating risk factors for MSDs in call centre workers found sex differences in the reporting of MSDs. A Swedish study assessing associations between exposures and MSD symptoms among 1 183 call centre operators found women to be at increased odds of reporting pain in the neck or shoulders and arms or hands than men operators (Norman et al., 2008). Similar results were obtained in another study conducted in Taiwan (Lin et al., 2009). The study explored the associations between perceived stress and multiple physical discomforts in telecommunications call centre operators. It found an association between MSD discomfort and sex “women”. Another study conducted in Italy to assess the relationship between pain in the upper limbs and potential risk factors in call centre operators reported increased odds for reporting pain in the neck or shoulders by women than men operators (d'Errico et al., 2010).

One of the explanations given by Norman and colleagues (2008) for the sex difference observed in their study was anthropometric factors. Similarly, in the SA bank workers, BMI presented a sex difference with 59.0% vs 41.0% of women bank workers having abnormal BMI compared to men. Furthermore, in the SA bank workers the sex difference was explained by the significantly higher reporting of repeated elbow bending for more than one hour in an average day by women bank workers (71.5%) than men (28.5%). Additional details about factors explaining sex differences in the previous section also apply in SA bank workers.

6.4.4 Age group

6.4.4.1 South African workers

Older age groups (40-49 and 50 years and above) were associated with MSDs and demonstrated linear trends in the SA workers. The relationship between age group and MSDs has been inconsistent across studies with only 40% of the studies showing associations between age and MSDs (Malchaire et al., 2001). The SA study is in agreement with that of Farioli and colleagues (2014) who found similar results in a study to explore the variation in MSDs between European countries and the extent to which they might be explained by, among others, personal risk factors using data from the fifth European Working Conditions Survey. In the Farioli and colleagues' study, although there were younger workers included in comparison with the SA study, older age groups in 10-year age bands between 25 and 64 years increased the odds of reporting pain in the back and neck or upper limbs respectively, in relation to the age group 15-24 years. Moreover, the ORs increased with increasing age groups. In contrast, a study investigating the determinants of MSDs among 3 479 workers from 60 factories in China found a negative association between MSDs and age group (Yu et al., 2012). The ORs showed inverse relationships between MSDs and age group in 10-year age bands between 25 and 45 years and above compared to less than or equal to 24 years age group. One of the explanations, was seniority which meant that they were less exposed to the hazards in the workplace. However, in the SA workers, the increase in the odds of MSDs with older age groups may represent cumulative exposure to MSD risk factors both at work and outside of work (Cole and Rivilis, 2004) although the extra work physical risk factors were not considered in this study.

6.4.4.2 Public hospital nurses

Age groups (40-49 and 50 years and above) was found to be associated with MSDs in the SA nurses. Associations with age group and MSDs have been reported by studies in other countries. For example, a study examining relationships between risk factors and MSDs in 351 Greek nurses reported an association with older age group as in our study (Alexopoulos et al., 2003). In this study age group greater than 40 years was associated with pain in the shoulders. Lagerström and colleagues (1996) reported an increase in odds of ongoing MSD symptoms in the neck, shoulders, hands and knees for every 10-year increase in age in 688 Swedish nurses. Every one year increase in age was found to be associated with shoulder MSD case in 1 163 American nurses (Trinkoff et al., 2003).

The result obtained from MSD association with the 40-49 years but not the 50 years and above age groups in the SA nurses is unusual. The expectation in this case would be that both age groups would be associated with MSD pain. The observed result may be spurious due to multiple comparisons in the 40-49 years age group from analysing many explanatory variables in the study. In the 50 years and above age group, it could have arisen from the lack of power in the study due to small numbers.

6.4.4.3 South African bank workers

Older age groups (40-49 and 50 years and above) was found to be positively and significantly associated with MSDs in the SA bank workers. They even showed linear trends with MSDs.

The reviewed studies showed inconsistent results with one showing association between MSDs and age group while two did not show associations. The Italian

study demonstrated an association between greater than 49 years age group and pain in the neck or shoulders (d'Errico et al., 2010). The Swedish and Taiwanese studies failed to show associations between age group and MSDs (Norman et al., 2008, Lin et al., 2009).

The associations of MSDs with older age groups in the SA bank workers are in line with the length of service they have had with the bank. About 59.6% of those aged 40 years and above had spent six years or more in their current positions in the bank compared to the 40.4% of those under 40 years. The older age groups (40 years and above) and longer service (6 years and above) of these SA bank workers suggest cumulative exposure at work and outside of work and their acquired vulnerability to the development of MSDs (Cole and Rivilis, 2004).

6.4.5 Occupational group

6.4.5.1 South African workers

Occupational group (bank workers) had lower odds of reporting pain in “any” body site but had increased odds of reporting pain in the neck compared to the nurses. Similar findings were reported in a study to assess the prevalence of MSDs and their associations with risk factors in four occupational groups which included computer operators and nurses in Sri Lanka (Warnakulasuriya et al., 2012). The nurses had increased odds of reporting pain in the low back and knees compared to computer operators whereas, in the SA study, the nurses had increased odds of reporting pain in all the body sites of interest compared to bank workers. Another study, similar to the SA study except that it investigated incident rather than prevalent MSDs, was conducted in Iranian nurses and office workers using computers (Sadeghian et al.,

2013). The study found that pain in the neck or shoulders was more common in office workers than in nurses, probably due to computer use.

“Occupational group” in the SA workers may indicate the differences in the MSD risk factors reported by the nurses and the bank workers. Lifting loads of 25 kg and above by hand, use of keyboard for more than four hours in an average day and somatising tendency were identified as possible factors responsible for the different patterns of MSD occurrence in nurses and bank workers. The reports of lifting loads of 25 kg and above by hand were higher in nurses than in bank workers (94.8% vs 5.26%) while the majority of bank workers reported the use of keyboard for more than four hours in an average day (89.1% vs 10.9%) and somatising tendency (72.0% vs 56.2%) compared to nurses.

6.5 Physical and psychosocial work risk factors

Physical and psychosocial work risk factors were associated with MSDs in SA workers only. These were repeated elbow bending for more than an hour in an average day and job dissatisfaction.

6.5.1 South African workers

A number of studies have found associations between physical work activities and MSDs. A New Zealand study which included nurses, postal workers and office workers reported associations between a total task score (eight physical work tasks combined to give a total task score) and pain in the low back, shoulders, elbows and wrists or hands (Harcombe et al., 2010). Another study conducted in four occupational groups, including nurses and office workers in Japan, examined prevalence and risk factors for MSDs (Matsudaira et al., 2011). Associations were found between pain in the low back, wrists or hands, and knees and respective risk

factors defined for each body site which were lifting weights of 25 kg by hand, use of keyboard or other repetitive movements of the wrists or fingers for at least four hours in total and kneeling or squatting for more than one hour in total. The observed patterns of reported MSDs in the different studies may reflect the differences in the physical work activities of the studied occupational groups (Warnakulasuriya et al., 2012).

Most of the SA workers (82.5%) reported repeated elbow bending for more than an hour on an average day but the corresponding body site (elbow) had the least reported prevalence of MSDs (14.3%) suggesting that repeated elbow bending may not be that important in the development of elbow pain in SA workers. Furthermore, the ORs of “repeated elbow bending” were high and the CIs were wide in all the different stages of multiple regression analysis probably due to small numbers of SA workers reporting pain in the elbows. For this reason, the point estimate for elbow pain may be unreliable.

The only psychosocial work-related risk factor associated with MSDs in the SA workers was job dissatisfaction. Studies have shown inconsistencies in the associations between MSDs and job dissatisfaction. A study examining the association between physical and psychosocial risk factors in three groups of New Zealand workers, reported a positive association between pain in the shoulders and job dissatisfaction (Harcombe et al., 2010). In contrast, a study to determine MSD prevalence and risk factors in four groups of Japanese workers failed to show an association between MSDs and job dissatisfaction (Matsudaira et al., 2011).

More than a third of the SA workers reported dissatisfaction with their jobs as a whole. Of these, a quarter of them had also reported lack of social support at work.

One of the sources of job dissatisfaction has been linked to adverse organisational aspects of work such as poor relationships with managers and colleagues (Sousa-Poza and Sousa-Poza, 2000). Lack of social support was identified as a possible source of job dissatisfaction in the SA workers despite being reported by the least number of workers compared to the other work organisational factors. In order to change the negative perceptions of the SA workers about their jobs, sources of job dissatisfaction need to be identified. However, this was outside the scope of this study.

6.6 Follow-up study on public hospital nurses

6.6.1 Incident MSDs

“Any” incident MSDs (95% CI) was estimated at 47.6% (36.5%-58.6%) in the SA nurses. This was higher than that reported in studies of nurses from other countries. A study of 971 Spanish workers comprising nurses and office workers found 4.2% of “any” incident MSDs from a total number of affected body sites reported by the workers (Vargas-Prada et al., 2013). Seventeen percent of the 518 Greek workers, including nurses, reported “any” incident MSDs at two or more body sites (Solidaki et al., 2012). An Iranian study to explore the predictors of incident and persistent MSDs in their workers reported 25.0% of incident pain in the neck or shoulders in the nurses (Sadeghian et al., 2013), whereas a study investigating incident pain and risk factors in the neck or shoulders in 1 239 English nurses reported 34.0% of incident pain in the neck or shoulders (Smedley et al., 2003).

Incident MSDs for the different body sites of the SA nurses varied according to the body site. Incident low back pain had the largest percentage (32.8%) followed by incident shoulder pain (24.5%) and incident neck pain (22.1%). A similar pattern

was found in a study of 2 624 American nurses although the magnitude of incident MSDs was lower (Trinkoff et al., 2006). Incident back pain which was not defined had the largest percentage (21.2%) followed by incident shoulder pain (17.3%) and incident neck pain (14.0%). The SA study had lower incident pain in the low back than that reported by a follow-up study conducted in England to examine the impact of handling patients on low back pain among 838 nurses. This English study found incident pain in the low back of 38.0% (Smedley et al., 1997). The variation of incident MSDs reported by the different studies can be partly attributed to the different measures used in the studies. But the unusually high incident rate in South African nurses (close to 50.0%) is notable and requires further investigation.

6.6.2 Persistent MSDs

“Any” persistent MSDs (95% CI) were found to be 83.7% (76.2%-91.1%) in the SA nurses. This was higher than that reported in studies from other countries. A study from Spain reported persistent MSDs of 41.1% in 971 Spanish workers who included nurses (Vargas-Prada et al., 2013). An Iranian study found 60.0% of persistent MSDs in 218 nurses (Sadeghian et al., 2013). Another study conducted in Swedish nurses, reported persistent MSDs ranging from 62.0%-69.0% in a three year follow-up study period (Josephson et al., 1997), whereas a study of 518 Greek workers which included nurses reported 62.0% of persistent MSDs (Solidaki et al., 2012).

The high “any” persistent MSDs in the SA nurses and in other studies may be partly explained by the fact that the risk factors at follow-up were more or less similar to those at baseline. This possibly made most of the the MSDs reported at baseline to persist. Another reason may be that the interventions were not applied; if applied they were ineffective thus not controlling or preventing the occurrence of persistent

MSDs. It is also possible that the psychological and cultural make up of the nurses may have predisposed them to persistent pain through propensity to report pain. It has been found that certain individuals have a propensity to report pain which does not change over short periods of time (Coggon et al., 2016). Lastly, the underlying pathophysiological mechanism of MSDs may result in permanent damage which would result in persistent pain.

Except for the knees, a body site infrequently investigated in nurses, persistent MSDs in the different body sites of the SA nurses was lower than that found in studies from other countries. In this study, persistent pain in the knees was the highest (71.4%) followed by low back (57.8%), neck (48.7%) and shoulders (43.9%). In a study conducted in Spain among 971 Spanish workers, which included nurses, persistent pain in the low back was reported to be 59.4% (Vargas-Prada et al., 2012). Persistent pain in the neck or shoulders in 218 Iranian nurses was 60.0% in a study exploring the predictors of incident and persistent pain in the neck or shoulders (Sadeghian et al., 2013). In a two year follow-up study investigating the temporal changes in incident, persistent, chronicity, and recovery from pain in the neck and shoulders in a group of 769 nursing home workers in the Netherlands found persistent pain in the neck ranging from 61.0%-64.7% and persistent pain in the shoulders ranging from 64.1% and 69.4% (Luime et al., 2005).

Persistent knee pain overtook persistent low back pain making it the most common and probably most important persistent MSD in SA nurses. This may be due to the morphology of the knees especially the cartilage and bones which may be more susceptible to permanent damage. Also, close to 70.0% of the nurses were in the

overweight and obese categories of BMI, which may have influenced persistent knee pain considering that knees are weight bearing joints.

6.6.3 Risk factors (predictors) for persistent MSDs

Only the predictors for persistent pain in “any” body site could be determined as guided by the the number of explanatory variables that could be included in the multiple regression analysis (Peduzzi et al., 1996).

6.6.3.1 Individual risk factors

The risk factor that emerged as a predictor of persistent pain in “any” body site in SA nurses was somatising tendency. It was the only variable positively and statistically associated with persistent pain in “any” body site. Somatising tendency was associated with persistent pain in “any” body site in the partial, full and final models in the effect of two or more distressing somatic symptoms compared to no symptoms. The odds ratios were high and the CIs were wide possibly signalling that the point estimate may be unreliable due to small sample size. However, predicted prevalences estimated that somatising tendency would increase persistent MSDs by 23.4% in nurses reporting two or more distressing somatic symptoms in comparison with those not reporting symptoms.

The positive finding of distressing somatic symptoms as predictors of persistent MSD in SA nurses corroborates the findings of studies from other countries. A study was conducted to explore the occupational and psychological risk factors for incident and persistent multi-site pain (pain occurring at two or more sites) in 518 Greek workers (Solidaki et al., 2012). The results of this study showed associations with multi-site persistent pain in these workers. A similar study exploring the role of psychological risk factors for incident and persistent pain in the low back in Spain found

associations with persistent pain in the low back in 971 Spanish workers. Vargas Prada et al., 2012, 2013). Another study using the data from the same study population showed association with disabling persistent MSDs (Vargas-Prada et al., 2013). However, one study from Iran failed to show an association with somatic symptoms and persistent pain in the neck or shoulders in 383 Iranian workers (Sadeghian et al., 2013).

The possible explanations for somatising tendency to be associated with MSDs in the SA nurses presented in section 6.4.1.2 suffice in explaining somatising tendency as a predictor of “any” persistent pain in SA nurses.

6.7 Ethnicity as a possible risk factor for MSDs in the study

Ethnicity in the SA study was represented by workers who belonged to three ethnic groups, namely Sotho, Nguni and “Other”. The “other” group comprised: Afrikaner, Coloured, Indian, Tsonga and Venda subjects. Ethnic group was inconsistently associated with MSDs in the SA workers (combined), nurses and bank workers. “Other” group was positively associated with pain in the wrists or hands in the combined dataset and in both groups separately. Pain in the low back was associated with SA workers and bank workers but not nurses; and pain in the upper limbs with the combined datasets only. Nguni group was associated with pain in the wrists or hands in the SA workers and bank workers.

The findings of this SA study are in line with those of a recent study conducted in the South African mining industry which used language as a proxy for ethnicity (Dias, 2014). The Dias study reported associations between Sotho and “other” languages with upper limb MSDs but no consistent associations were found. Studies which included ethnicity or race in their investigations of MSD risk factors have found

inconsistent results. Three of such studies have been conducted in the US. One of these studies examined the relationship between workplace factors and work-related MSDs in 498 telecommunications workers. The study found an association between “non-white” race and pain in the elbows and no association with other MSDs considered in the study in relation to white race. Non-white race comprised African-American, Hispanic, Asian and Native American (Hales et al., 1994). The next two studies showed negative associations between pain in the neck or shoulders and ethnicity (non-whites) in 632 newly employed computer users (Gerr et al., 2002) while in the other study negative association was between pain in the neck and back and race (non-whites) among 1 163 nurses (Trinkoff et al., 2003). The non-white groups were similar to those of the first study but included another group “other”. Hales and colleagues (1994) and Dias (2014) explained their positive findings as possible statistical artefacts due to multiple comparisons, while in the other studies no explanations were given.

The terms ethnicity and race have sometimes been used interchangeable although their meanings differ (Senior and Bhopal, 1994, Chaturvedi, 2001). Race in epidemiological studies has been discouraged because of its inaccurate and misleading use in classifying population groups according to biological variation based on genetic differences (Chaturvedi, 2001, Bradby, 2003). Ethnicity is increasingly the preferred term (Chaturvedi, 2001, Bradby, 2003) and has been used in the SA study as an initial descriptor of elements of culture in the identification of MSD risk factors. However, as a multi-dimensional social construct, the complexity and the challenges ethnicity presents in epidemiological studies is recognised. Of

particular importance is its method of measurement and constitution as it pertains to this SA study.

This SA study used self perception of ethnicity (Heath, 1991) as its measure. The groups of workers studied classified themselves as belonging to one of the ethnic groups considered in the study. This type of self classification may change with time due to various reasons. One of the reasons could be that when women get married they take up the self identification with their husbands' ethnicity which amount to conversion to the husband's ethnic group. This switch from one ethnic group to the other has implications for the constitution and identities of ethnic groups. This scenario invokes the history of the advent of the SA ethnic groups which were created by missionaries and colonial administrators in the nineteenth and twentieth centuries. Diverse groups of SA people were ordered under narrow linguistic lines, rendering them "static' and "homogeneous" (Braun and Hammonds, 2008). On the contrary, the uptake of the spouse's ethnic identity is one of the indicators of the dynamic nature and heterogeneity of the SA ethnic groups. The difficulty in measuring ethnicity and its heterogeneity has been identified as problematic in epidemiological studies (Senior and Bhopal, 1994, Chaturvedi, 2001) as ethnicity encompasses a wide range of exposures, both biological and environmental (Chaturvedi, 2001). The results of the SA study need to be interpreted in this light.

6.8 Strengths and limitations of the study

6.8.1 Strengths

The strengths of the SA study lie in its study design, response rates, its use of standardised and validated instruments, the number of explanatory variables selected, the inclusion of bank workers, and the use of predicted prevalences.

The study had baseline and follow-up components. The follow-up component has not been used before in studies on MSDs in SA occupational groups. This type of design is preferred because it satisfies the temporality criterion which makes it possible to better infer causality. Another source of strength came from the high response rates obtained from the participating nurses (89.4%) and bank workers (82.8%) in the baseline component of the study. The nurses' follow-up response rate was also fairly high at 75.3%.

The study used standardised and validated instruments. For instance, in the SA study as in other studies (Alexopoulos et al., 2003, Smith et al., 2005, Choobineh et al., 2010), the Standardised Nordic Questionnaire (Kuorinka et al., 1987) was used; a tool which has been validated and widely applied in many countries. The use of such instruments increases the internal validity of the study. In comparison with other studies on MSDs in SA occupational groups, this study examined the largest number (27) of explanatory variables as possible risk factors for MSDs in the groups of workers studied. These explanatory variables covered the important domains to ensure that confounding is addressed during the identification of risk factors. Additionally, it was for the first time in SA that MSDs were studied in bank workers involved in CTI tasks. Finally, the study presented the results as predictive prevalences which had not been done in MSD studies in SA before.

6.8.2 Limitations

Limitations could have arisen at three points in the study time line, that is, before the study sample was selected, during data collection and in analysis (Steineck and Ahlbom, 1992). The potential sources of bias are considered under the headings of confounding, misclassification, misrepresentation and analysis deviation.

6.8.2.1 Confounding

Confounding can be described as the distortion in the estimate of effect of the exposure factor of interest due to the influence of another factor that can increase or decrease the odds of reporting the outcome of interest (Driscoll, 2011). Although a large number of variables were adjusted for in the models, some potential determinants of MSDs were not measured in this study. If they were associated with explanatory variables of MSDs, they are potential confounders. Importantly, the physical risk factors outside of work, such as house chores, may have acted together with work-related risk factors, possibly influencing the odds of reporting upper limb pain by the women in the study in a positive direction. The sex difference in the reporting of upper limb pain by the women has been attributed to social responsibility by other researchers (Messing et al., 2003, Treaster and Burr, 2004). There is also a possibility that some of the workers might have been suffering from conditions that produce symptoms of pain, for example cardio-vascular diseases, which might have increased the odds of reporting MSD pain by these workers, if these diseases were associated with other stressors.

6.8.2.2 Misclassification

Misclassification refers to the erroneous classification of an individual, a value, or an attribute into a category other than that to which it should be assigned (Rothman et al., 2008). The probability of misclassification given the true value may vary between groups (differential misclassification) or may be the same in all study groups (nondifferential misclassification). In the SA study, misclassification may have occurred through information bias regarding exposure and outcome.

6.8.2.2.1 Exposure

In the SA study, differential misclassification of exposure could not be excluded.

This can be attributed to the retrospective ascertainment of exposure to MSD risk factors using questionnaires. Possibly the workers who reported MSD pain recalled the exposures more completely than the workers who did not report MSDs. This could have resulted in an increase of the point estimate. It is also possible that non-differential misclassification of exposure to physical risk factors at work played a role in the study. The questions used to elicit exposure to these risk factors in the workers asked about different parameters occurring on an average day. The answers to the questions were dichotomous that is, “yes” for exposure and “no” for no exposure. The dichotomous scale may not have been heterogeneous enough to have significant associations with the outcome. This may explain the few associations that were found between physical work risk factors and MSD pain in the study.

Misclassification of exposure to physical risk factors at work could have been reduced in the SA study, if exposure assessment had been done through observational methods or direct measurements (Riihimäki, 1999). But these methods are costly and could not be used in the SA study due to resource constraints.

6.8.2.2.2 Outcome

The ascertainment of the outcome using questionnaires raised the possibility of differential misclassification in the SA study in a similar way as that which may have occurred in the ascertainment of exposure. The workers were asked questions to ascertain MSDs as the outcome of interest. Since, the questions asked about pain

that occurred in the past 12 months, the workers had to rely on recall to answer these questions. Those exposed to particular risk factors, would tend to recall the outcome more readily than those without the said exposures (Driscoll, 2011), hence, the differential misclassification of outcome. This would tend to inflate the point estimate.

6.8.2.3 Misrepresentation

Misrepresentation occurs when the study subjects do not represent the target population, for example through selection bias which arises from the methods used to select the study participants from the target population, or if the study participants select themselves by agreeing to participate in the study (Pearce et al., 2007).

Systematic differences between the characteristics of the participants selected for the study and the characteristics of those not selected indicate that the study participants are not representative of the target population (Beaglehole et al., 1993).

In the SA study, the selection of the study hospitals and bank was based on ensuring that at least the main ethnic groups of South Africa were obtained. The study hospitals were typical of the SA public hospitals regarding the tasks performed by the nurses. Similarly, the study bank was typical of the four SA big banks in relation to CTI tasks. External validity may be an issue for the nurses group in that the study hospitals were large tertiary academic hospitals; working conditions may differ between these hospitals and smaller less well resourced hospitals. Similarly, the bank was one of the big four SA banks which are well resourced and working conditions may differ between the study bank and other banks not belonging to the big four banks. Consequently, caution is required in generalising the findings to all hospital and bank settings. But it is reassuring that the findings of this study are

consistent with other local and international studies, suggesting that the findings are generalisable.

Nurses were invited to participate in the study and those who were able to leave their nursing stations volunteered to participate as the study was conducted during working hours. In a similar manner, the bank workers were invited to take part in the study. Selection bias could have been introduced if the nurses and bank workers participated because they had MSDs. This would tend to increase the estimates of MSD frequencies in the study. Again, it is reassuring that the findings of this study were in accord with those of CUPID studies.

Workers who suffer from MSDs may leave their jobs for jobs with lower exposures. In severe cases, the workers may become relegated from the labour market due to disability from MSDs (Menzel et al., 2004). In the baseline component of the SA study, such a scenario may have happened, leaving behind a relatively healthy workforce. This phenomenon is known as the “healthy worker effect” and tends to underestimate the disease estimate which in this case would be the MSD prevalence. This phenomenon seems unlikely in the SA study as none of the nurses who participated at follow-up had changed their jobs because of MSDs.

The participation and response rates of nurses at baseline and follow-up were compared regarding MSD risk factors measured at baseline and the occurrence of MSDs in the past month. The results showed minor differences between the two measurement periods. However, when considering the nurses who participated at follow-up only, the prevalence of MSDs in the past month at follow-up was consistently higher than at baseline.

Studies investigating the predictors of incident and persistent MSD pain have done similar comparisons of participation and response rates based on MSD risk factors at baseline and found similar results as those of the SA study (Palmer et al., 2008, Sadeghian et al., 2013). Furthermore both studies, when it came to arm pain (Palmer et al., 2008) and neck or shoulder pain (Sadeghian et al., 2013) the comparisons were similar. This was contrary to the results of the SA study. The explanation for the results of the SA study is unclear.

6.8.2.4 Analysis deviation

Analysis deviation may arise during data analysis due to errors in data processing or modelling (Steineck and Ahlbom, 1992). In the SA study, multiple regression modelling and missing data were identified as possible sources of analysis deviation. Binary logistic regression was used to determine the association between MSDs and explanatory variables as possible risk factors for MSDs. The advantages of using logistic regression are that a large number of explanatory variables can be considered at the same time and it is flexible in the way in which terms in the model are treated. In the logistic regression the OR has been used to estimate the prevalence ratio. However, it has been found to overestimate the ORs of common conditions. A study by Lagerström (1996), demonstrated that although the prevalence ratios were generally lower than the odds ratios, the interpretation of the results was similar, that is both ratios showed an association if there was one. It is important to note that one of the objectives of the SA study was to determine the associations between the explanatory variables and MSDs in the workers studied and not the strength of the relationship between the two.

In the initial stages of data collection in the SA study, it was found that 33 workers did not know their body weights and heights, hence the physical measurement of these parameters rather than reliance on questionnaire data. This led to 33 missing values for the BMI. In the logistic regression, the BMI was entered into the full model excluding the missing values and again in the full model including the missing values in a separate category to determine if there would be a change in the ORs. The changes were minor and did not alter the structure or significance of the individual variables in the final model. A Swedish study with 36 missing values for the variable “work demands”, performed a similar check and obtained results similar to those found in the SA study (Lagerström et al., 1996).

6.9 Contribution to existing knowledge

- The SA study is unique and innovative in that it has generated and presented predicted prevalences alongside odds ratios which has not been done in studies on MSDs in nurses and/or bank workers in South Africa and elsewhere. The predicted prevalences provide an alternative interpretation of the results which is easy to understand compared to the odds ratios.
- The combination of baseline components of two occupational groups the nurses and bank workers (SA workers) in this study is novel in SA. The results produced MSD prevalences and risk factors associated with MSDs.
 - The estimated prevalence of MSDs in the SA workers was found to be 80.5% (77.0%-84.0%).
 - The risk factors associated with prevalent MSDs were somatising tendency, past injuries, job dissatisfaction, sex, age group,

occupational group and repeated elbow bending for more than an hour on an average day.

- For the first time in SA, a study on MSDs in nurses including baseline and follow-up was conducted yielding risk factors associated with prevalent MSDs, incident and persistent MSDs and a risk factor associated with persistent MSDs.
 - The risk factor associated with prevalent MSDs was somatising tendency and age group.
 - The estimated Incident MSDs was 47.6% (36.5%-58.6%) and persistent MSDs 83.7% (76.2%-91.1%).
 - The risk factors associated with persistent MSDs was somatising tendency.
- MSDs in bank workers who perform CTI tasks were studied for the first time in SA. The results included MSD prevalence and risk factors associated with prevalent MSDs.
 - The estimated prevalence of MSDs was 76.7% (71.3%-82.1%).
 - The risk factors associated with prevalent MSDs were somatising tendency, past injuries, sex and age group.
- Ethnicity, uncommonly studied in South Africa, was found to be inconsistent with MSDs in the groups of workers studied.

6.10 Conclusions

The findings of this study have highlighted that the two occupational groups studied are high risk groups for MSDs. High prevalences of MSDs were found with low back pain having the highest prevalence. In comparison, the nurses were at high risk of “any” MSDs while bank workers were at high risk of neck MSD which suggests differences in the jobs performed by these workers. MSDs caused workers to stay away from work and consult healthcare providers. These have implications for productivity at work and healthcare utilisation which are known to be drivers of the economic cost of MSDs. Somatising tendency and older age groups were the risk factors associated with MSDs in both occupational groups, thus indicating their importance in the development of MSDs in the these groups. Ethnicity did not show convincing evidence about its association with MSDs in this study.

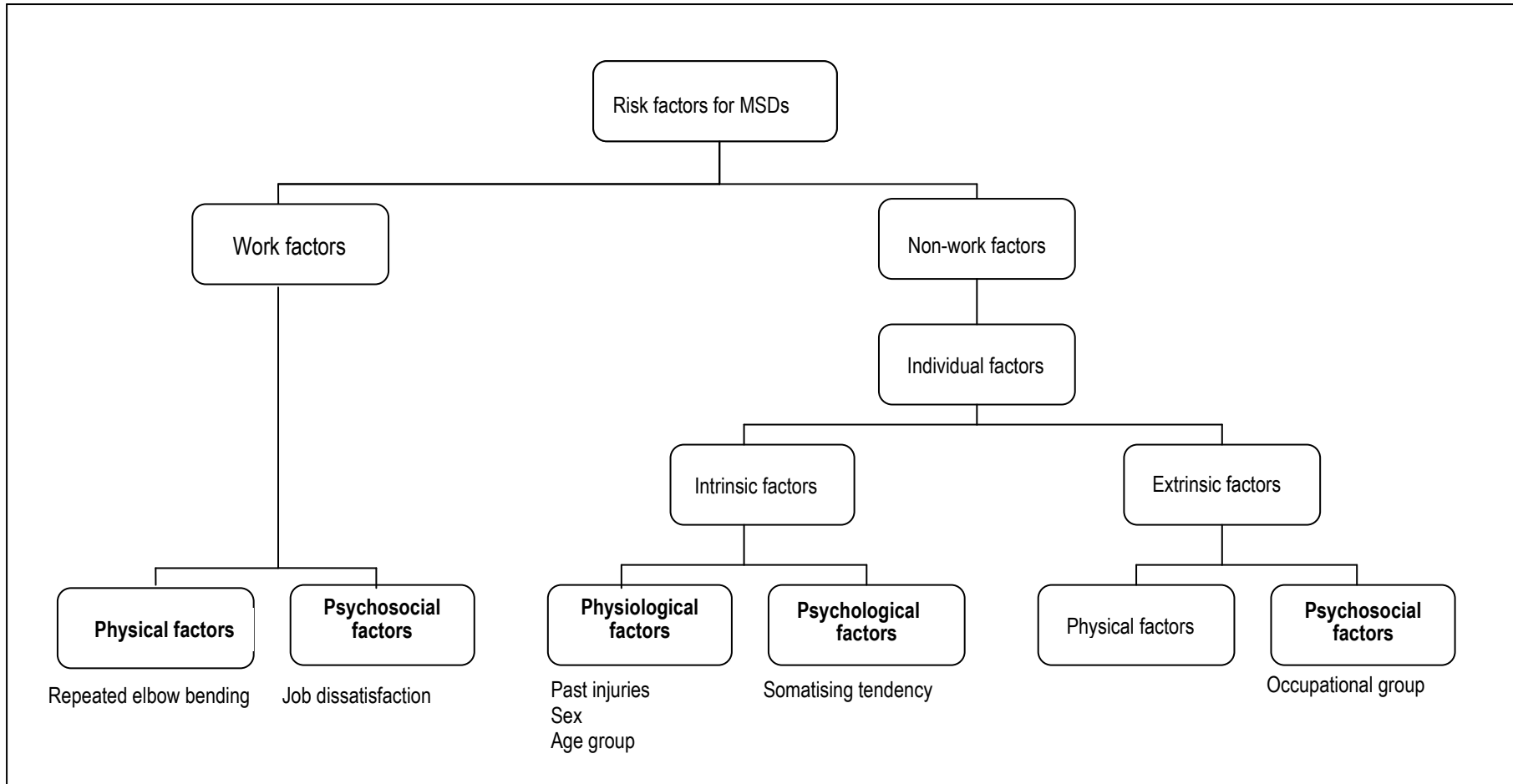


Figure 6.1: Dimensions of MSD risk factors identified in the South African study

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Appendix A: Search strategy for literature on MSDs in hospital nurses and workers involved in CTI tasks

Google scholar

“~musculoskeletal risk factors” and “musculoskeletal*” and “nurses*”

“~risk factors” and “musculoskeletal*” and “call centre workers” or “bank workers” or “computer telephone interactive tasks”

“~prevalence” and musculoskeletal*” and “nurses*”

“~prevalence” and “musculoskeletal*” and “call centre workers” or “bank workers” or “telecommunications workers”

“course musculoskeletal*” and “nurses*”

“~incident” and “musculoskeletal*” and “nurses*”

“~persistent” and “musculoskeletal*” and “nurses*”

“~follow-up” and “musculoskeletal*” and “nurses*”

PubMed

("epidemiology"[Subheading] OR "epidemiology"[All Fields] OR "prevalence"[All Fields] OR "prevalence"[MeSH Terms]) AND ("musculoskeletal diseases"[MeSH Terms] OR ("musculoskeletal"[All Fields] AND "diseases"[All Fields]) OR "musculoskeletal diseases"[All Fields] OR ("musculoskeletal"[All Fields] AND "disorders"[All Fields]) OR "musculoskeletal disorders"[All Fields]) AND ("pain"[MeSH Terms] OR "pain"[All Fields]) AND discomfort[All Fields] AND ("nurses"[MeSH Terms] OR "nurses"[All Fields])

("epidemiology"[Subheading] OR "epidemiology"[All Fields] OR "prevalence"[All Fields] OR "prevalence"[MeSH Terms]) AND ("musculoskeletal diseases"[MeSH Terms] OR ("musculoskeletal"[All Fields] AND "diseases"[All Fields]) OR "musculoskeletal diseases"[All Fields] OR ("musculoskeletal"[All Fields] AND "disorders"[All Fields]) OR "musculoskeletal disorders"[All Fields]) AND ("pain"[MeSH Terms] OR "pain"[All Fields]) AND discomfort[All Fields] AND ("telecommunications"[MeSH Terms] OR "telecommunications"[All Fields]) AND ("manpower"[Subheading] OR "manpower"[All Fields] OR "workers"[All Fields])

"musculoskeletal diseases"[MeSH Terms] OR ("musculoskeletal"[All Fields] AND "diseases"[All Fields]) OR "musculoskeletal diseases"[All Fields] OR ("musculoskeletal"[All Fields] AND "disorders"[All Fields]) OR "musculoskeletal disorders"[All Fields]) AND ("pain"[MeSH Terms] OR "pain"[All Fields]) AND discomfort[All Fields] AND ("risk factors"[MeSH Terms] OR ("risk"[All Fields] AND

"factors"[All Fields] OR "risk factors"[All Fields] AND ("nurses"[MeSH Terms] OR "nurses"[All Fields])

("musculoskeletal diseases"[MeSH Terms] OR ("musculoskeletal"[All Fields] AND "diseases"[All Fields]) OR "musculoskeletal diseases"[All Fields] OR ("musculoskeletal"[All Fields] AND "disorders"[All Fields]) OR "musculoskeletal disorders"[All Fields]) AND ("pain"[MeSH Terms] OR "pain"[All Fields]) AND discomfort[All Fields] AND ("risk factors"[MeSH Terms] OR ("risk"[All Fields] AND "factors"[All Fields]) OR "risk factors"[All Fields]) AND centre[All Fields] AND ("manpower"[Subheading] OR "manpower"[All Fields] OR "workers"[All Fields])

("musculoskeletal diseases"[MeSH Terms] OR ("musculoskeletal"[All Fields] AND "diseases"[All Fields]) OR "musculoskeletal diseases"[All Fields] OR ("musculoskeletal"[All Fields] AND "disorders"[All Fields]) OR "musculoskeletal disorders"[All Fields]) AND ("pain"[MeSH Terms] OR "pain"[All Fields]) AND discomfort[All Fields] AND ("risk factors"[MeSH Terms] OR ("risk"[All Fields] AND "factors"[All Fields]) OR "risk factors"[All Fields]) AND ("telecommunications"[MeSH Terms] OR "telecommunications"[All Fields])

incident[All Fields] OR (persisten[All Fields] AND ("pain"[MeSH Terms] OR "pain"[All Fields]) AND discomfort[All Fields] AND ("risk factors"[MeSH Terms] OR ("risk"[All Fields] AND "factors"[All Fields]) OR "risk factors"[All Fields]) AND ("nurses"[MeSH Terms] OR "nurses"[All Fields]))

ScienceDirect

{“risk factors”} “determinants” or “explanatory variable” or “independent variable” or “association” and “musculoskeletal*” and “nurses*”

{“risk factors”} or “determinants” or “explanatory variable” or “independent variable” or “association” and “musculoskeletal*” and “call centre workers*” or “bank workers” or “telecommunications workers” or computer telephone interactive tasks”

“prevalence” or “course” or “incident” or “persistent” or {“follow-up”} and “musculoskeletal*” and “nurses*”

“prevalence” and “musculoskeletal*” and “call centre workers*” or “bank workers” or “telecommunications workers” or computer telephone interactive tasks”

Appendix B: National Academies Press permission letter



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May 12, 2015

Reference #: 05191500

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National Institute for Occupational Health
No.25 Hospital Street
Constitution Hill
Johannesburg 2000, South Africa

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Barbara Murphy

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Appendix C: Study information sheet

Musculoskeletal Disorders and Associated Factors in Nurses and Bank Workers in South Africa Information Sheet for Nurses and Bank Workers

Good day, my name is Busisiwe Nyantumbu a researcher from the National Institute for Occupational Health (NIOH). I am doing research on musculoskeletal disorders to obtain a doctorate from the University of Witwatersrand. Musculoskeletal disorders have been found to be a major problem in developed countries. Here in South Africa, there is lack of information about musculoskeletal disorders. The purpose of the study is to determine the occurrence of musculoskeletal disorders and their risk factors in nurses, and bank workers.

You are requested to participate in this study. The benefits of the study to you are that feedback sessions about the study will be given in the form of findings of the study and best practice methods.

Your participation is not going to advantage or disadvantage you if you choose to participate or not to participate. Participation is voluntary. If you agree to participate, we request that you sign a consent form. Participation in the study involves:

- 1) Answering questions from a baseline questionnaire and
- 2) Follow up questionnaire 12 months later. Filling in of questionnaires takes \pm 30 minutes.

Questions from a baseline questionnaire deal with personal information, occupational activities, psychosocial aspects of work, somatic symptoms, musculoskeletal symptoms and their characteristics and contact details for follow up. Questions from a follow up questionnaire deal with personal information, any change of job from the time you answered the baseline questionnaire until follow up and reasons for the change. It also asks about musculoskeletal symptoms in the past month.

The information that you will provide will be safeguarded for confidentiality purposes. Your name will not be written on the questionnaire but codes will be used. The findings of the study will be compiled in a report where no names will be written but group results will be presented. Presentations of the findings will be arranged for management of your company and workers' representatives. Should you have any questions and concerns about the study you can raise them now or contact me later at the National Institute for Occupational Health, PO Box 4788, Johannesburg, 2000, Tel: (011) 712 6470 Fax: (011) 712 6531, Email: busisiwe.nyantumbu@nioh.nhls.ac.za

Appendix D: Study consent form

Musculoskeletal Disorders and Associated Factors in Nurses and Bank Workers in South Africa Consent Form

I give my consent to answer questions from the baseline and follow-up questionnaires on the study about musculoskeletal disorders.

I understand that:

Participation in the study is voluntary.

I may withdraw from the study at any time if I so wished.

My responses will be kept confidential and no information that may identify me will be included in the report or thesis

Name:

Signature:

.....

.....

Date:

Contact details for follow-up

Your contact details:

Work Telephone number :.....

Work Fax number :.....

Home Telephone number :.....

Home Fax number :.....

Cell number :.....

Email address :.....

Your relative's contact details:

Name:..... Relationship.....

Work Telephone number.....

Work Fax number.....

Home Telephone number.....

Home Fax number.....

Cell number.....

Email address.....

Appendix E: Baseline questionnaire

Questionnaire Number

SOUTH AFRICAN SURVEY OF WORK AND HEALTH BASELINE

Please fill in the date that you complete this form

Date:
day month year

SECTION ONE: ABOUT YOURSELF

1. Please fill in your date of birth
day month year
2. and your sex male female
3. How would you describe your ethnic group?
Afrikaner Nguni Sotho Other
Specify _____ Specify _____ Specify _____
4. What is the highest level of education you have finished/
High school College Technikon University
5. What is your height? cms
What is your weight? kg
- 6a) Have you ever smoked regularly (ie at least once per day for a month or longer)? No Yes
- b) If YES, do you still smoke regularly? No Yes

SECTION TWO: YOUR WORK

7. What is your main occupation? _____

8. How long have you done this job?
 Less than 1 year 1-5 years More than 5 years

9. How many hours per week do you normally work in this job? hours

10. Does an **average working day** in the job involve any of the following?
(Please tick No or Yes for each question)

No **Yes**

a) Use of a keyboard or typewriter for more than four hours in total?

b) Other tasks involving repeated movements of the wrist or fingers for more than 4 hours in total?

c) Repeated bending and straightening of your elbow for longer than one hour in total?

d) Working for longer than one hour in total with your hands above shoulder height?

e) Lifting weights of 25 Kg (56 lbs) or more by hand?

f) Kneeling or squatting for longer than one hour in total?

g) Piecework in which you are paid according to the number of articles or tasks you or your team make or finish in the day?

h) A target number of articles or tasks that you or your team are expected to make or finish in the day?

i) Payment of a bonus if you make or finish more than an agreed number of articles/tasks in the day?

j) Working under pressure to complete tasks by a fixed time?

11. In your job, do you have a choice in deciding:

	<i>Often</i>	<i>Sometimes</i>	<i>Seldom</i>	<i>Never/ Almost Never</i>
How you do your work?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
What you do at work?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Your work timetable and breaks?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

12. When you have difficulties in your work, how often do you get help and support from your colleagues or supervisor/manager?

often sometimes seldom never N/A

13. How satisfied have you been with your job as a whole, taking everything into consideration?

very satisfied satisfied dissatisfied very dissatisfied

14. How safe do you feel your job would be if you had a significant illness that kept you off work for three months?

very safe safe rather unsafe very unsafe

15. Do you have any other job(s)?

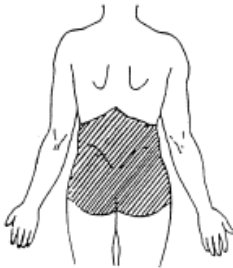
No Yes

If *yes*, what are your other job(s)?

SECTION THREE: ACHES AND PAINS

LOW BACK PAIN IN PAST 12 MONTHS

- 16a) Have you had low back pain in the area shown below which lasted for more than a day at any time during the past 12 months? *(Do not include pain associated only with menstrual periods, pregnancy or during a course of a feverish illness)*



No

Yes

If **NO**, please go to question 18. If **YES**, please continue

- b) If you add together all the days on which you have had low back pain, during the past 12 months, how long a period would that make?

1-6 days

1-4 weeks

1-12 months

- c) Have you consulted a doctor or a medical person or alternative practitioner because of low back pain during the past 12 months?

No

Yes

- d) During the past 12 months on how many days did low back pain prevent you from going to work?

0 days

1-7 days

8-30 days

More than 30 days

LOW BACK PAIN IN PAST MONTH

We are particularly interested in any back pain you may have had during the past month

- 17 Have you had low back pain in the area shown above which lasted for more than a day at any time during the past month? *(Do not include pain associated only with menstrual periods, pregnancy or during a course of a feverish illness)*

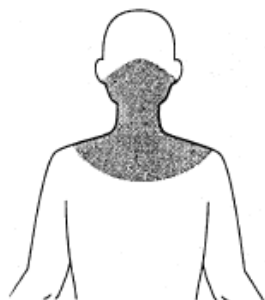
No

Yes

If **NO**, please go to question 18. If **YES**, please continue

NECK PAIN IN PAST 12 MONTHS

- 18a) Have you had pain in the neck in the area shown below which lasted for more than a day at any time during the past 12 months?



No

Yes

If *NO*, please go to question 20. If *YES*, please continue

- b) If you add together all the days on which you have had neck pain, in the past 12 months, how long a period would that make?

1-6 days

1-4 weeks

1-12 months

- c) Have you consulted a doctor or a medical person or alternative practitioner because of neck pain during the past 12 months?

No

Yes

- d) During the past 12 months on how many days did neck pain prevent you from going to work?

0 days

1-7 days

8-30 days

More than 30 days

NECK PAIN IN THE PAST MONTH

We are particularly interested in any neck pain you may have had during the past month

- 19 Have you had pain in the neck in the area shown above which lasted for more than a day at any time during the past month?

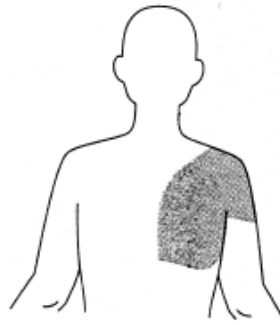
No

Yes

If *NO*, please go to question 20. If *YES*, please continue

SHOULDER PAIN IN PAST 12 MONTHS

- 20 a) Have you had pain in the shoulder in the area shown below which lasted for more than a day at any time during the past 12 months?



- No Right shoulder only Left shoulder only Both shoulders

If *NO*, please go to question 22. If *YES* please continue

- b). If you add together all the days on which you have had shoulder pain, in the past 12 months, how long a period would that make?

- 1-6 days 1-4 weeks 1-12 months

- c) Have you consulted a doctor or a medical person or alternative practitioner because of shoulder pain during the past 12 months? No Yes

- d). During the past 12 months on how many days did shoulder pain prevent you from going to work?

- 0 days 1-7 days 8-30 days More than 30 days

SHOULDER PAIN IN THE PAST MONTH

We are particularly interested in any shoulder pain you may have had during the past month

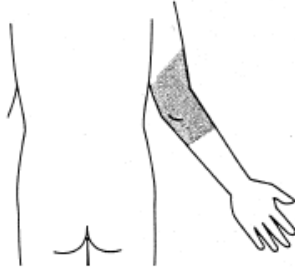
- 21) Have you had pain in the shoulder in the area shown above which lasted for more than a day at any time during the past month?

- No Right shoulder only Left shoulder only Both shoulders

If *NO*, please go to question 31. If *YES* please continue

ELBOW PAIN IN THE PAST 12 MONTHS

22 Have you had pain in the elbow in the area shown below which lasted for more than a day at any time during the past 12 months?



- No
- Right elbow only
- Left elbow only
- Both elbows

If *NO*, please go to question 24. If *YES* please continue.

b). If you add together all the days on which you have had elbow pain, in the past 12 months, how long a period would that make?

- 1-6 days
- 1-4 weeks
- 1-12 months

c) Have you consulted a doctor or a medical person or alternative practitioner because of elbow pain during the past 12 months? No Yes

d). During the past 12 months on how many days did elbow pain prevent you from going to work?

- 0 days
- 1-7 days
- 8-30 days
- More than 30 days

ELBOW PAIN IN THE PAST MONTH

We are particularly interested in any elbow pain you may have had during the past month

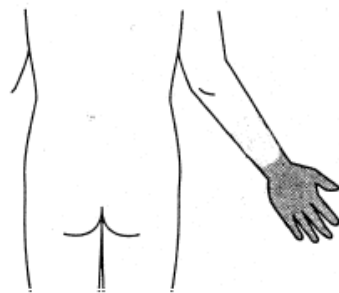
23 Have you had pain in the elbow in the area shown above which lasted for more than a day at any time during the past month?

- No
- Right elbow only
- Left elbow only
- Both elbows

If *NO*, please go to question 24. If *YES* please continue.

WRIST AND HAND PAIN IN PAST 12 MONTHS

- 24a) Have you had pain in the wrist or hand in the area shown below which lasted for more than a day at any time during the past 12 months?



- No
- Right hand or wrist only
- Left hand or wrist only
- Both hands or wrists

If *NO*, please go to question 26. If *YES* please continue.

- b) If you add together all the days on which you have had wrist/hand pain, in the past 12 months, how long a period would that make?

1-6 days

1-4 weeks

1-12 months

- c) Have you consulted a doctor or a medical person or alternative practitioner because of wrist/hand pain during the past 12 months? No Yes

- d) During the past 12 months on how many days did wrist/hand pain prevent you from going to work?

0 days

1-7 days

8-30 days

More than 30 days

WRIST AND HAND PAIN IN THE PAST MONTH

We are particularly interested in any wrist/hand pain you may have had during the past month

- 25 Have you had pain in the wrist or hand in the area shown above which lasted for more than a day at any time during the past month?

- No
- Right hand or wrist only
- Left hand or wrist only
- Both hands or wrists

If *NO*, please go to question 26. If *YES* please continue.

KNEE PAIN IN THE PAST 12 MONTHS

26a) Have you had pain in the knee in the area shown below which lasted for more than a day at any time during the past 12 months?



- No
- Right knee only
- Left knee only
- Both knees

If *NO*, please go to question 28. If *YES* please continue.

b). If you add together all the days on which you have had knee pain, in the past 12 months, how long a period would that make?

- 1-6 days 1-4 weeks 1-12 months

c) Have you consulted a doctor or a medical person or alternative practitioner because of knee pain during the past 12 months? No Yes

d). During the past 12 months on how many days did knee pain prevent you from going to work?

- 0 days 1-7 days 8-30 days More than 30 days

KNEE PAIN IN THE PAST MONTH

We are particularly interested in any knee pain you may have had during the past month

27 Have you had pain in the knee in the area shown above which lasted for more than a day at any time during the past month?

- No
- Right knee only
- Left knee only
- Both knees

If *NO*, please go to question 28. If *YES* please continue.

SECTION FOUR: YOUR HEALTH MORE GENERALLY

PAST 7 DAYS

28. Below is a list of problems people sometimes have. Please read each one carefully and circle the number that best describes HOW MUCH THAT PROBLEM HAS DISTRESSED OR BOTHERED YOU DURING THE PAST 7 DAYS INCLUDING TODAY

Circle only one number for each problem and do not skip any items

	<i>Not at all</i>	<i>A little bit</i>	<i>Moderately</i>	<i>Quite a bit</i>	<i>Extremely</i>
a) Faintness or dizziness	0	1	2	3	4
b) Pains in the heart or chest	0	1	2	3	4
c) Nausea or upset stomach	0	1	2	3	4
d) Trouble getting your breath	0	1	2	3	4
e) Numbness or tingling in parts of your body	0	1	2	3	4
f) Feeling weak in parts of your body	0	1	2	3	4
g) Hot or cold spells	0	1	2	3	4

29. Based on your views and what the doctor and others have told you about pain in the arm, shoulder and hand, how strongly do you agree with this statement?

These problems are caused by work people do.

Completely disagree

Disagree

Unsure

Agree

Completely agree

30. Based on your views and what the doctor and others have told you about low back pain, how strongly do you agree with this statement?

These problems are caused by work people do.

Completely disagree

Disagree

Unsure

Agree

Completely agree

PAST 12 MONTHS

31. Over the past 12 months, on how many days in total have you been prevented from going to work because of

a) a problem with your back, neck shoulder, elbow, wrist, hand or knees

0 days

1-7 days

More than 7 days

More than 30 days

32. Have you had injury in any part of your body?

No

Yes

a) When were you injured? During past 12 months

More than 12 months ago

b) Which part of your body was injured?

Low back

Neck

Shoulder

Elbow

Wrist/hand

Knee

33. Have you been in any situation that was extremely frightening or horrifying?

no problem

Slight problem

Big problem

34. Have you had any difficulties relating to finance?

No problem

Slight problem

Big problem

35. Do people with pain in the shoulders, arm, hands or low back deserve money in compensation?

No

Yes

Appendix F: Follow-up questionnaire

Questionnaire Number

SOUTH AFRICAN SURVEY OF WORK AND HEALTH FOLLOW-UP

Please fill in the date that you complete this form

Date:
day month year

SECTION ONE: ABOUT YOURSELF

1. Please confirm your date of birth
day month year
2. *and* your sex male female

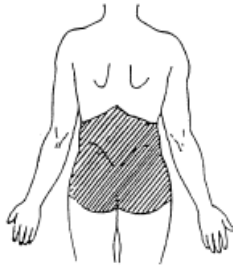
SECTION TWO: YOUR CURRENT WORK

- 3a) Do you still have the same main job as when we last questioned you about a year ago? No Yes
If *YES*, please go to question 4. If *NO*, please continue
- b) Did you leave that job because of medical problems with your back, neck, elbow, shoulder, wrist, hand or knee? No Yes
- c) And do you have another job now? No Yes

SECTION THREE: ACHES AND PAINS

LOW BACK PAIN IN PAST MONTH

- 4 Have you had low back pain in the area shown below which lasted for more than a day at any time during the past month? *(Do not include pain associated only with menstrual periods, pregnancy or during a course of a feverish illness)*



No

Yes

NECK PAIN IN THE PAST MONTH

- 5 Have you had pain in the neck in the area shown below which lasted for more than a day at any time during the past month?

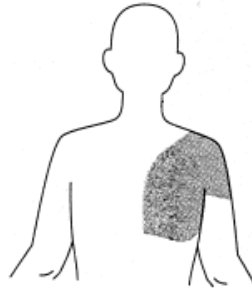


No

Yes

SHOULDER PAIN IN THE PAST MONTH

6. Have you had pain in the shoulder in the area shown below which lasted for more than a day at any time during the past month?



No

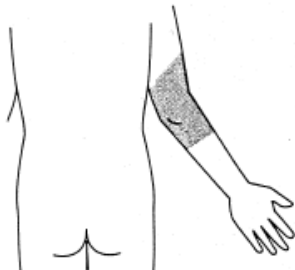
Right shoulder only

Left shoulder only

Both shoulders

ELBOW PAIN IN THE PAST MONTH

7. Have you had pain in the elbow in the area shown below which lasted for more than a day at any time during the past month?



No

Right elbow only

Left elbow only

Both elbows

WRIST AND HAND PAIN IN THE PAST MONTH

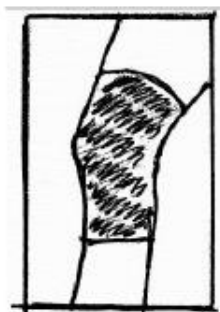
8. Have you had pain in the wrist or hand in the area shown below which lasted for more than a day at any time during the past month?



- No
- Right hand or wrist only
- Left hand or wrist only
- Both hands or wrists

KNEE PAIN IN THE PAST MONTH

9. Have you had pain in the knee in the area shown below which lasted for more than a day at any time during the past month?



- No
- Right knee only
- Left knee only
- Both knees

Appendix G: University of Pretoria ethics certificate

The Research Ethics Committee, Faculty Health Sciences, University of Pretoria complies with ICH-GCP guidelines and has US Federal wide Assurance.

- FWA 00002567, Approved dd 22 May 2002 and Expires 20 Oct 2016.
- IRB 0000 2235 IORG0001762 Approved dd 22/04/2014 and Expires 22/04/2017.



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Health Sciences Research Ethics Committee

9/10/2015

Approval Certificate New Application

Ethics Reference No.: 145/2008

**Title: Musculoskeletal Disorders and Associated Factors in Nurses and Bank Workers in South Africa.
NEW TITLE dd 9/10/2015**

Dear Ms B Nyantumbu

The **New Title** as supported by documents specified in your cover letter dd 14/09/2015 for your research received on the 15/09/2015, was approved, by the Faculty of Health Sciences Research Ethics Committee.

Please note the following about your ethics approval:

- Please remember to use your protocol number (145/2008) on any documents or correspondence with the Research Ethics Committee regarding your research.
- Please note that the Research Ethics Committee may ask further questions, seek additional information, require further modification, or monitor the conduct of your research.

Ethics approval is subject to the following:

- The ethics approval is conditional on the receipt of 6 monthly written Progress Reports, and
- The ethics approval is conditional on the research being conducted as stipulated by the details of all documents submitted to the Committee. In the event that a further need arises to change who the investigators are, the methods or any other aspect, such changes must be submitted as an Amendment for approval by the Committee.

We wish you the best with your research.

Yours sincerely

Dr R Sommers; MBChB; MMed (Int); MPharMed.

Deputy Chairperson of the Faculty of Health Sciences Research Ethics Committee, University of Pretoria

The Faculty of Health Sciences Research Ethics Committee complies with the SA National Act 61 of 2003 as it pertains to health research and the United States Code of Federal Regulations Title 45 and 46. This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South African Medical Research Council Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes 2004 (Department of Health).

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♦ Web: //www.healthethics-up.co.za

♦ Fax:012-3541367 Fax2Email: 0866515924

♦ H W Snyman Bld (South) Level 2-34

♦ E-Mail: fsethics@up.ac.za

♦ Private Bag x 323, Arcadia, Pta, S.A., 0007

Appendix H: University of Witwatersrand ethics certificate



HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M1404115

NAME: Ms B Nyantumbu
(Principal Investigator)

DEPARTMENT: National Institute for Occupational Health
National Health Laboratory Services

PROJECT TITLE: Musculoskeletal Disorders and Associated
Factors in Nurses, Bank and Postal Workers
in South Africa (Previously M060814)


DATE CONSIDERED: Ad hoc

DECISION: Renewal Approved

CONDITIONS:

SUPERVISOR: Dr D Kielkowski

APPROVED BY:



Professor PE Cleaton-Jones, Chairperson, HREC (Medical)

DATE OF APPROVAL: 12/05/2014

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Secretary in Room 10004, 10th floor, Senate House, University.

I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a**

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix I: Variables tested for full model in SA workers

Table 1: Selection of variables for full model in SA workers: "Any" pain in the past 12 months

Risk factor	"Any" pain in past 12 months (N=392)		
	n (%)	^a OR (95% CI)	P-value
Occupational group			
Nurses	211 (53.8)	1	
Bank workers	181 (46.2)	0.70 (0.42-1.17)	0.182
Age group (years)			
<30	109 (28.2)	1	
30-39	110 (28.4)	0.86 (0.48-1.53)	0.617
40-49	117 (30.2)	1.34 (0.70- 2.58)	0.366
≥50	51 (13.2)	1.53 (0.64-3.68)	0.335
Sex			
Male	62 (15.8)	1	
Female	330 (84.2)	1.22 (0.66-2.25)	0.509
*BMI group			
Normal	143 (36.5)	1	
Overweight	117 (29.8)	1.68 (0.89-3.18)	0.107
Obese	104 (26.5)	0.85 (0.47-1.55)	0.605
Missing	28 (7.1)	1.19 (0.41-3.46)	0.739
Ethnic group			
Sotho	163 (41.6)	1	
Nguni	119 (30.4)	1.17 (0.67-2.02)	0.569
Other	110 (28.0)	1.38 (0.74-2.56)	0.307
*Educational level			
Tertiary	270 (69.1)	1	
High school	121 (30.9)	0.65 (0.35-1.19)	0.169
*Smoking status			
Never smoked	296 (75.5)	1	
Ever smoked	96 (24.5)	2.45 (1.28-4.70)	0.007
*Past injuries			
No	274 (70.3)	1	
Yes	116 (29.7)	3.43 (1.74-6.76)	0.000
*Mental health status			
Good	132 (33.7)	1	
Intermediate	111 (28.3)	1.53 (0.96-2.42)	0.068
Poor	149 (38.0)	1.54 (0.99-2.41)	0.055
*Number of distressing somatic symptoms			
0	122 (31.1)	1	
1	95 (24.2)	1.48 (0.86-2.57)	0.154
≥2	175 (44.6)	2.83 (1.56- 5.12)	0.001
*Adverse beliefs about low back and arm pain			
No	231 (58.9)	1	
Yes	161 (41.1)	2.26 (1.32-3.87)	0.003
*Deserve compensation			
No	128 (33.4)	1	
Yes	255 (66.6)	1.67 (1.02-2.73)	0.040
*Frightening situation			
No	189 (48.8)	1	
Yes	198 (51.2)	2.61 (1.58-4.31)	0.000
*Financial difficulties			
No	105 (27.1)	1	
Yes	283 (72.9)	1.49 (0.91-2.43)	0.106

Physical load	No	189 (49.2)	1	0.866
	Yes	195 (50.8)	0.95 (0.56-1.62)	
Incentives	No	242 (63.4)	1	0.529
	Yes	140 (36.6)	1.17 (0.71-1.94)	
*Working under time pressure	No	43 (11.0)	1	0.007
	Yes	348 (89.0)	2.42 (1.27-4.62)	
Lack of control	No	271 (69.5)	1	0.812
	Yes	119 (30.5)	1.06 (0.64-1.76)	
Lack of social support	No	320 (83.1)	1	0.565
	Yes	65 (16.9)	1.20 (0.63-2.29)	
*Job dissatisfaction	No	230 (58.8)	1	0.003
	Yes	161 (41.2)	2.18 (1.30-3.66)	
*Job insecurity	No	200 (51.5)	1	0.028
	Yes	188 (48.5)	1.76 (1.06-2.94)	

^a Adjusted for occupational group, age group, and sex; occupational group, age group and sex were mutually adjusted

*Variables with p-values ≤ 0.2 selected for inclusion in the full model for "any" pain in the past 12 months with adjustment variables included irrespective of the p-value:

BMI group, educational level, smoking status, past injuries, mental health status, number of somatic symptoms, adverse beliefs about low back and arm pain, deserve compensation, frightening situation, financial difficulties, working under time pressure, job dissatisfaction, job insecurity.

Appendix J: Variables tested for full model in SA nurses

Table 1: Selection of variables for full model in SA public hospital nurses:
“Any” pain in past 12 months

Risk factor	“Any” pain in past 12 months (N=203)		
	n (%)	^a OR (95% CI)	P-value
Age group (years)			
<30	29 (14.3)	1	
30-39	61 (30.0)	1.40 (0.51-3.809)	0.507
40-49	77 (37.9)	1.51 (0.57-3.99)	0.399
≥50	36 (17.7)	1.98 (0.58-6.72)	0.270
*BMI group			
Normal	55 (27.1)	1	
Overweight	62 (30.5)	1.06 (0.37-3.05)	0.902
Obese	61 (30.0)	0.43 (0.16-1.11)	0.084
Missing	25 (12.3)	0.88 (0.24-3.22)	0.850
*Past injuries			
No	154 (76.6)	1	
Yes	47 (23.4)	2.60 (0.87-7.73)	0.085
Ethnic group			
Sotho	110 (54.2)	1	
Nguni	70 (34.5)	0.80 (0.38-1.66)	0.556
Other	23 (11.3)	2.14 (0.46-9.86)	0.326
*Deserve compensation			
No	53 (26.4)	1	
Yes	148 (73.6)	2.00 (0.97-4.13)	0.058
Financial difficulties			
No	61 (30.3)	1	
Yes	140 (69.7)	1.57 (0.76-3.24)	0.220
*Frightening situation			
No	101 (50.5)	1	
Yes	99 (49.5)	3.87 (1.69-8.89)	0.001
*Adverse beliefs about low back and arm pain			
No	98 (48.3)	1	
Yes	105 (51.7)	2.84 (1.32-6.09)	0.007
*Number of distressing somatic symptoms			
0	78 (38.4)	1	
1	54 (26.6)	2.11 (0.90-4.93)	0.083
≥2	71 (35.0)	8.54 (2.47-29.54)	0.001
*Mental health status			
Good	88 (43.3)	1	
Intermediate	61 (30.0)	1.33 (0.59-2.97)	0.482
Poor	54 (26.6)	1.85 (0.73-4.66)	0.191
Physical load			
No	56 (27.7)	1	
Yes	146 (72.3)	1.08 (0.50-2.33)	0.842
Incentives			
No	154 (77.8)	1	
Yes	44 (22.2)	1.61 (0.62-4.18)	0.319
*Working under time pressure			
No	35 (17.3)	1	
Yes	167 (82.7)	2.68 (1.25-5.73)	0.011
Lack of control			
No	155 (76.4)	1	
Yes	48 (23.6)	0.98 (0.43-2.24)	0.978

Lack of social support				
	No	172 (85.6)	1	
	Yes	29 (14.4)	1.99 (0.56-6.99)	0.281
*Job dissatisfaction				
	No	125 (61.6)	1	
	Yes	78 (38.4)	3.52 (1.39-8.89)	0.008
*Job insecurity				
	No	136 (68.3)	1	
	Yes	63 (31.7)	4.26 (1.43-12.61)	0.009

^aAdjusted for age group (age group presented without adjustment).

*Variables with p-values ≤ 0.2 selected for inclusion in the full model of "any" pain in the past 12 months with adjustment variable included irrespective of the p-value: Age group, BMI group, past injuries, deserve compensation, frightening situation, adverse beliefs about low back and arm pain, number of distressing somatic symptoms, mental health status, working under time pressure, job dissatisfaction and job insecurity.

Appendix K: Participation and response rates

Table 1: Participation and response rates according to psychological characteristics of SA public hospital nurses at baseline

Psychological characteristic	Baseline (N=251)	Follow-up (N=189)	Response rate
	n (%)	n (%)	%
Deserve compensation ^a			
Yes	178 (72.1)	138 (74.2)	77.5
No	69 (27.9)	48 (25.8)	69.6
Total	247 (100.0)	186 (100.0)	75.3
Financial difficulties ^b			
Yes	169 (67.9)	134 (71.3)	79.3
No	80 (32.1)	54 (28.7)	67.5
Total	249 (100.0)	188 (100.0)	75.5
Number of distressing somatic symptoms ^c			
0	110 (43.8)	85 (44.9)	77.3
1	64 (25.5)	47 (24.9)	73.4
≥2	77 (30.7)	57 (30.2)	74.0
Total	251 (100.0)	189 (100.0)	75.3
Frightening situation ^d			
Yes	111 (47.9)	87 (46.5)	78.4
No	137 (52.1)	100 (53.5)	72.9
Total	248 (100.0)	187 (100.0)	75.4
Adverse belief about pain ^e			
Low back and arm			
Yes	117 (46.6)	87 (46.1)	74.4
No	134 (53.4)	102 (53.9)	76.1
Total	251 (100.0)	189 (100.0)	75.3
Arm			
Yes	94 (38.6)	71 (37.6)	75.5
No	156 (61.4)	118 (62.4)	75.6
Total	250 (100.0)	189 (100.0)	75.6
Low back			
Yes	90 (36.8)	62 (32.8)	68.9
No	161 (63.2)	127 (62.2)	78.9
Total	251 (100.0)	189 (100.0)	75.3
Mental health status ^f			
Good	113 (45.0)	83 (43.9)	73.5
Intermediate	73 (29.8)	55 (29.1)	75.3
Poor	65 (25.2)	51 (26.9)	78.5
Total	251 (100.0)	189 (100.0)	75.3

^aPeople with musculoskeletal disorders deserve compensation.

^bBeing in financial difficulties-slight or big problem.

^cNumber of at least moderately distressing somatic symptoms in the past seven days from a total of seven.

^dBeing in a frightening situation-slight or big problem.

^eBelief that low back and/or arm pain is caused by work.

^fClassified into three levels corresponding to approximate thirds of the observed distribution of scores in the study sample

Table 2: Participation and response rates according to physical work activities of SA public hospital nurses at baseline

Physical work activity	Baseline (N=251)	Follow-up (N=189)	Response rates
	n (%)	n (%)	%
Repeated elbow bending >1 hour*			
Yes	214 (85.3)	165 (87.3)	77.1
No	37 (14.7)	24 (12.7)	64.9
Total	251(100.0)	189 (100.0)	75.3
Lifting ≥25 kg loads by hand**			
Yes	202 (80.5)	154 (81.5)	76.2
No	49 (19.5)	35 (18.5)	71.4
Total	251 (100.0)	189 (100.0)	75.3
Repeated wrist/finger movement >4 hours*			
Yes	191 (76.1)	148 (78.3)	77.5
No	60 (23.9)	41 (21.7)	68.5
Total	251 (100.0)	189 (100.0)	75.3
Hands above shoulder height >1 hour*			
Yes	134 (53.6)	99 (52.7)	73.9
No	116 (46.4)	89 (47.3)	76.6
Total	250 (100)	188 (100.0)	75.2
Kneeling or squatting >1 hour**			
Yes	66 (26.4)	52 (27.7)	78.8
No	184 (73.6)	136 (72.3)	73.9
Total	250 (100.0)	188 (100.0)	75.2
Use of keyboard >4 hours			
Yes	29 (11.6))	22 (11.7)	75.9
No	221 (88.4)	166 (88.3)	75.1
Total	250 (100.0)	188 (100.0)	75.2

^aReports of any two or more of the variables marked with 1 asterisk.

^bReports of any three or more of the variables marked with 1 and 2 asterisks.

Table 3: Participation and response rates according to psychosocial work conditions of South African public hospital nurses at baseline

Psychosocial work condition	Baseline (N=251)		Follow-up (N=189)		Response rate
		n (%)		n (%)	%
Lack of social support ^a					
Yes		32 (13.4)		24 (12.8)	75.0
No		216 (86.6)		163 (87.2)	75.5
Total		248 (100.0)		187 (100.0)	75.4
Working under time pressure ^b					
Yes		200 (79.7)		152 (80.9)	76.0
No		50 (20.3)		36 (19.2)	72.0
Total		250 (100.0)		188 (100.0)	75.2
Lack of control ^c					
Yes		59 (23.6)		43 (22.9)	72.9
No		191 (76.4)		145 (77.1)	75.9
Total		250 (100.0)		188 (100.0)	75.2
Job dissatisfaction ^d					
Yes		86 (34.3)		65 (34.4)	75.6
No		165 (65.7)		124 (65.6)	75.2
Total		251 (100.0)		189 (100.0)	75.3
Job insecurity ^e					
Yes		71 (28.7)		53 (28.3)	74.6
No		176 (71.3)		134 (71.7)	76.1
Total		247 (100.0)		187 (100.0)	75.7
Incentives ^f					
Yes		53 (21.6)		38 (20.8)	71.7
No		192 (78.4)		145 (79.2)	75.5
Total		245 (100.0)		183 (100.0)	74.7

^aAssistance or support from colleagues or supervisors-seldom or never.

^bA target amount of work or a number of articles done or finished in a day or working under pressure to complete tasks by a fixed time.

^cChoice in all of; how work is done; what is done at work; and work time table and break times-seldom or never.

^dVery dissatisfied or dissatisfied about the job taking everything into consideration.

^eFeel that job would be insecure or very insecure if off work for three months due to serious illness.

^fPiecework or payment of a bonus if an agreed number of tasks are finished in a day.

Appendix L: Variables tested for full model in SA nurses

Table 1: Selection of variables for full model in SA public hospital nurses: Persistent “any” pain

Risk factors	Persistent “any” pain (N=82)		
	n (%)	^a OR (95% CI)	P-value
Age group (years)			
<30	14 (17.1)	1	
30-39	19 (23.2)	0.33 (0.03-3.37)	0.356
40-49	33 (40.2)	0.39 (0.04-2.12)	0.407
≥50	16 (19.5)	0.22 (0.02-2.19)	0.201
*BMI group			
Normal	17 (23.3)	1	
Overweight	26 (35.6)	1.52 (0.37-6.14)	0.554
Obese	30 (41.1)	2.85 (0.62-13.05)	0.176
Past injuries			
No	55 (68.8)	1	
yes	25 (31.2)	1.53 (0.43-5.37)	0.501
Ethnic group			
Sotho	50 (61.0)	1	
Nguni	21 (25.6)	0.76 (0.21-2.71)	0.683
Other	11 (13.4)	1.15 (0.20-6.45)	0.872
Deserve compensation			
No	19 (23.5)	1	
Yes	62 (76.5)	1.80 (0.57-5.71)	0.314
Financial difficulties			
No	20 (24.7)	1	
Yes	61 (75.3)	0.69 (0.16-2.93)	0.622
Frightening situation			
No	38 (46.9)	1	
Yes	43 (53.1)	1.21 (0.38-3.83)	0.743
*Adverse beliefs about back and arm pain			
No	34 (41.5)	1	
Yes	48 (58.5)	2.45 (0.80-7.52)	0.115
*Number of distressing somatic symptoms			
0	23 (28.0)	1	
1	21 (25.6)	1.68 (0.45-6.27)	0.434
≥2	38 (46.3)	7.80 (1.48-41.06)	0.015
Mental health			
Good	31 (37.8)	1	
Intermediate	27 (32.9)	1.17 (0.32-4.18)	0.809
Poor	24 (29.3)	1.30 (0.33-5.05)	0.705
Physical load			
No	24 (29.3)	1	
Yes	58 (70.7)	1.09 (0.33-3.54)	0.885
*Incentives			
No	60 (75.9)	1	
Yes	19 (24.1)	0.42 (0.12-1.39)	0.156
*Working under time pressure			
No	9 (11.1)	1	
Yes	72 (88.9)	2.45 (0.63-9.39)	0.191
Lack of control			
No	61 (74.4)	1	
Yes	21 (25.6)	2.31 (0.48-11.18)	0.294
Lack of social support			
No	69 (85.2)	Dropped and 12	-

	Yes	12 (14.8)	observations not used	
Job dissatisfaction	No	46 (56.1)	1	
	Yes	36 (43.9)	1.25 (0.40-3.87)	0.697
Job insecurity	No	52 (65.0)	1	
	Yes	28 (35.0)	1.03 (0.30-3.50)	0.958

^a Adjusted for age group; age group is presented unadjusted.

*Variables with p-values ≤ 0.2 selected for inclusion in the full model for persistent "any" pain with age group included irrespective of the p-value: BMI group, adverse beliefs about low back and arm pain, number of distressing somatic symptoms, incentives, working under time pressure.

Appendix M: Variables tested for full model in SA bank workers

Table 1: Selection of variables for full model in SA bank workers: "Any" pain in past 12 months

Risk factor	"Any" pain in past 12 months (N=181)		
	n (%)	^a OR (95% CI)	P-value
Age group (years)			
<30	77 (43.8)	1	
30-39	45 (25.6)	0.67 (0.33-1.36)	0.270
40-49	39 (22.2)	1.57 (0.60-4.09)	0.347
≥50	15 (8.5)	1.45 (0.38-5.52)	0.579
Sex			
Male	54 (29.8)	1	
Female	127 (70.2)	1.34 (0.69-2.59)	0.380
*BMI group			
Normal	83 (46.4)	1	
Overweight	53 (29.6)	2.12 (0.91-4.93)	0.080
Obese	43 (24.0)	1.59 (0.67-3.74)	0.287
*Past injuries			
No	117 (64.6)	1	
Yes	64 (35.4)	3.78 (1.57-9.05)	0.003
*Ethnic group			
Sotho	46 (25.4)	1	
Nguni	48 (26.5)	1.93 (0.82-4.51)	0.129
Other	87 (48.1)	1.46 (0.70-3.05)	0.308
Educational level			
High school	106 (58.9)	1	
Tertiary	74 (41.1)	0.73 (0.37-1.44)	0.378
*Smoking status			
Never-smoked	103 (56.9)	1	
Ever-smoked	78 (43.1)	2.03 (1.02-4.05)	0.042
Deserve compensation			
No	75 (42.6)	1	
Yes	101 (57.4)	1.36 (0.69-2.68)	0.359
Financial difficulties			
No	42 (23.5)	1	
Yes	137 (76.5)	1.38 (0.69-2.76)	0.356
*Frightening situation			
No	84 (47.2)	1	
Yes	94 (52.8)	1.91 (0.99-3.69)	0.052
*Adverse beliefs about low back and arm pain			
No	126 (69.6)	1	
Yes	55 (30.4)	2.06 (0.95-4.46)	0.066
*Number of distressing somatic symptoms			
0	40 (22.1)	1	
1	40 (22.1)	2.08 (0.90-4.79)	0.083
≥2	101 (55.8)	3.55 (1.71-7.38)	0.001
*Mental health status			
Good	41 (22.7)	1	
Intermediate	49 (27.1)	1.69 (0.78-3.64)	0.176
Poor	91 (50.2)	3.44 (1.58-7.49)	0.002
Physical load			
No	46 (26.4)	1	
Yes	128 (73.6)	1.30 (0.66-2.54)	0.438
Incentives			

	No	83 (47.2)	1	
	Yes	93 (52.8)	0.97 (0.52-1.82)	0.942
Working under time pressure	No	7 (3.9)	1	
	Yes	174 (96.1)	1.62 (0.44-5.88)	0.463
Lack of control	No	109 (60.9)	1	
	Yes	70 (39.1)	1.20 (0.62-2.33)	0.575
Lack of social support	No	140 (79.5)	1	
	Yes	36 (20.5)	0.99 (0.45-2.15)	0.988
*Job dissatisfaction	No	99 (55.0)	1	
	Yes	81 (45.0)	1.67 (0.87-3.23)	0.122
Job insecurity	No	60 (33.1)	1	
	Yes	121 (66.9)	1.17 (0.60-2.26)	0.634

^a Adjusted for age group and sex; age group and sex adjusted mutually.

* Variables with p-values ≤ 0.2 selected for inclusion in the full model for "any" pain in the past 12 months with adjustment variables included irrespective of the p-value:

Age group, sex, BMI group, past injuries, ethnic group, smoking status, frightening situation, adverse beliefs about low back and arm pain mental health status, number of distressing somatic symptoms, mental health status, job dissatisfaction.