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# Musculoskeletal discomfort in veterinarians

A thesis presented in partial fulfilment of the  
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## **Abstract**

This thesis comprises three chapters about musculoskeletal discomfort (MSD) in veterinarians. Two of these chapters have been submitted to peer reviewed journals and one is in preparation for submission. The first chapter describes the prevalence and risk factors associated with MSD in New Zealand veterinarians. The second chapter is a paper on the tasks considered by veterinarians to cause MSD. The third chapter is a review of published literature on musculoskeletal problems (MSP) in veterinarians.

The first chapter in this thesis describes a cross-sectional study of 867 New Zealand veterinarians. We used a modified Nordic musculoskeletal questionnaire to enquire about the presence or absence of MSD, whether this affected normal activities and if MSD necessitated absenteeism from work. Additional questions enquired about work activities, psychosocial factors and workload. The overall period prevalence of MSD was 96%. Normal activities were affected in 67% and 18% of participants reported that they had been absent from work due to MSD. Factors associated with the presence of MSD requiring time off work for clinical veterinarians included 10 year increases in age (odds ratio (OR) 1.26, 95% CI 1.05 - 1.52), work involving awkward grip and hand movements 100% of time (OR 12.91, 95% CI 3.46 – 84.21) and those who were dissatisfied with the level and difficulty of their work (OR 2.72, 95% CI 1.11 - 6.56).

In the second chapter in this thesis, veterinarians were asked to indicate tasks that they considered 'most likely to lead to musculoskeletal aches and pains' and 'why these tasks were likely to be the most risky'. They were also asked to suggest 'any solutions that they applied or knew of' to reduce musculoskeletal aches and pains. They identified the following tasks: lifting, surgery, rectal palpations and animal handling. Their reasons were primarily related to physical risk factors. Few identified psychosocial risk factors. The most common suggested solutions involved training and selection strategies rather than redesign of tasks, activities or facilities. These findings are consistent with a participatory ergonomics approach for reducing the risk of MSD, which aims to enhance personal well-being and improved system performance.

The third chapter in this thesis - a review of the literature - focuses on the prevalence and nature (discomfort, pain, injury and disorders) of MSP amongst veterinarians. Veterinarians are exposed to a range of physical and psychosocial occupational hazards that have been well documented and associated with MSP. The range of reported prevalence estimates in this review was 50% to 96%. This range may reflect real differences among the veterinary populations studied, or more likely be due to differences in MSP definitions, study methodologies, and response rates. The magnitude of the reported prevalence justifies further research to triangulate data and determine other factors associated with MSD. Most of the studies in the review focused on physical risk factors. The lack of studies into psychosocial risk factors for MSP needs to be addressed.

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## List of publications from thesis

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Tasks considered by veterinarians to cause musculoskeletal discomfort and suggested solutions. Scuffham, A. M., Firth, E. C., Stevenson, M. A. and Legg, S. F. (2009). Submitted for publication to the *New Zealand Veterinary Journal*.

Paper presented at the 15<sup>th</sup> New Zealand Ergonomics Society Conference: Ergonomics for the Ageing Population, Martinborough. Scuffham, A., Stevenson, M., Legg, S. & Firth, E. Prevalence of musculoskeletal discomfort in New Zealand small animal veterinarians. In: Proceedings of the 15th New Zealand Ergonomics Society Conference: Ergonomics for the Ageing Population. Eds R. G. Adank & L. Gardner Wood. Martinborough, New Zealand Ergonomics Society. 27-28 May 2009, [CD-ROM].

Paper presented at the Society of Dairy Cattle Veterinarians of the New Zealand Veterinary Association 26th annual conference, Rotorua. Scuffham, A., Firth, E., Stevenson, M. & Legg, S. *Musculoskeletal discomfort in New Zealand large animal veterinarians*. In: Proceedings of the Society of Dairy Cattle Veterinarians of the New Zealand Veterinary Association 26th annual conference. Ed. T. Parkinson. VetLearn, Palmerston North. 24-27 June, 2009, pg 201-204. Scuffham, A., Firth, E., Stevenson, M. & Legg, S.

Paper presented at the New Zealand Equine Veterinary Association Annual Conference, Taupo. Scuffham, A., Firth, E., Stevenson, M. & Legg, S. *Musculoskeletal discomfort in New Zealand equine veterinarians*. In: Proceedings of the New Zealand Equine Veterinary Association of the NZVA Annual Conference. Ed. M Leyland. VetLearn, Palmerston North. 24-27 June 2009, pg 163.

Paper presented at the 17th International Ergonomics Association World Congress on Ergonomics, Beijing. Musculoskeletal discomfort in New Zealand (non-clinical) veterinarians. Scuffham, A., Legg, S., Stevenson, M. & Firth, E. In: Proceedings of the 17<sup>th</sup> World Congress on Ergonomics. 9-14 August, 2009, [CD-ROM].

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# Chapter One: Background

This Chapter presents the background to the research presented in this thesis and frames its context. It specifies the aims and describes the structure of the thesis.

## Overview

Veterinarians play a substantial role in maintaining the health of animals involved in a variety of sectors that greatly impact the New Zealand economy and contribute approximately \$620 million to the New Zealand economy annually (Sanderson & Leung-Wai, 2005). The agriculture sector of New Zealand is worth approximately \$14.5 billion annually (The Treasury, 2009) and in 2004 the racing industry generated an expenditure of \$0.98 billion (New Zealand Racing Board, 2004) .

There is a shortage of veterinarians, especially within rural areas (Jackson et al., 2004). Currently 338 out of a possible 562 (62%) Massey University veterinary graduates from 1994 to 2007 are still practising within New Zealand (VCNZ, 2008). Within Australia, the attrition rate for rural veterinarians ranges between 3% and 13% (Maxwell et al., 2008). Ensuring that veterinarians maintain optimum health is just one component to retain veterinarians. Musculoskeletal discomfort is one facet in the occupational health of veterinarians for which there is a paucity of information concerning prevalence, risk factors and effects.

Musculoskeletal discomfort and disorders are not new phenomena. Ramazzini (1633-1714), who is recognised as the “Father of Occupational Medicine” (Rosen, 1993), described a relationship between occupations and musculoskeletal disorders (Franco & Fusetti, 2004). He noticed that scribes suffered from upper limb fatigue, that was attributed to writing (Melhorn, 1998) and that farmers and soap makers suffered from fatigue due to heavy and sustained work (Franco & Fusetti, 2004).

Internationally, a high proportion of work related injuries are attributed to musculoskeletal disorders and these result in absenteeism from the workplace, reduced productivity and personal costs (Buckle, 2005; MacDonald, 2004). Musculoskeletal disorders are the most common occupational injury claim in New Zealand (ACC, 2008; Pezullo & Crook, 2006).

To date, only partial surveys of workplace musculoskeletal discomfort pain and injury have been undertaken internationally in veterinarians. These indicate a high prevalence of musculoskeletal discomfort (MSD) between 50% (Fritschi et al., 2006) and 82% (Cattell, 2000). Previous studies have focused on physical risk factors such as animal handling (Hafer et al., 1996; Hill et al., 1998), lifting (Gabel & Gerberich, 2002) and manual pregnancy testing (Cattell, 2000; Chambers et al., 2001). It is only very recently that psychosocial risk factors associated with MSD such as stress (Loomans et al., 2008; Smith et al., 2009) and job dissatisfaction (Smith et al., 2009) have been examined. To my knowledge the prevalence of, and risk factors for, MSD in New Zealand veterinarians has not been studied to date.

## **Aims**

The aims of this thesis are to:

- a) determine the period prevalence and risk factors associated with musculoskeletal discomfort in New Zealand veterinarians,
- b) determine the tasks considered by veterinarians to cause musculoskeletal discomfort, and
- c) conduct a literature review of musculoskeletal problems in veterinarians.

## **Organisation of thesis**

The overall structural framework of the thesis is described in the background with structural framework described in chapters two, three and four. The thesis is organised into six chapters and appendices. Chapter One is the background

and explains the organisation of the thesis. The second chapter is a verbatim transcription of a paper that is “in press” with Applied Ergonomics. The third chapter is a verbatim transcription of a paper submitted to New Zealand Veterinary Journal (NZVJ). The fourth chapter has been prepared for submission to a peer reviewed journal for publication. The literature review (chapter four) was placed after chapters two and three as it requires prior awareness of the previous papers. As a result there will be some duplication of material, including references, in this thesis. The styles used in each of these chapters are consistent with the style of the journal to which the paper has been submitted, except for heading formats. Each paper is reproduced in its entirety except for the tables, which have been embedded in the text and the table legends which are located as a list for the whole thesis after the table of contents and list of appendices for the thesis. Emendations and comments from thesis examiners, reviewers and journal editors have been included within the thesis.

Chapter Two “Prevalence and risk factors associated with musculoskeletal discomfort in New Zealand veterinarians” (Scuffham, Legg et al., 2009) describes a cross-sectional study using a modified Nordic musculoskeletal questionnaire which asked 867 New Zealand veterinarians about the presence or absence of musculoskeletal discomfort (MSD). Questions enquired about work activities, psychosocial factors and workload. A binary logistic regression analysis was used to quantify the association between identified risk factors and the presence of MSD.

Chapter Three “Tasks considered by veterinarians to cause musculoskeletal discomfort and suggested solutions” (Scuffham, Firth et al., 2009) presents results from a survey of veterinarians’ perceptions of causes of MSD and introduces practising veterinarians to a unique approach - participatory ergonomics - that can be used to identify the risk of MSD and for ameliorating its consequences. The study also used a novel approach to MSD risk identification, which involved asking members of the veterinary profession to suggest potential solutions for to reducing the MSD risk.

Chapter Four is a literature review of musculoskeletal problems (MSP) amongst veterinarians (Scuffham, Stevenson et al., 2009). The chapter briefly outlines the wide range of occupational hazards to which veterinarians are exposed. The different definitions used to discuss MSP as well as the current concepts of the aetiology of MSP are discussed. The review focuses on the prevalence and nature of MSP amongst veterinarians. It also considers the evidence concerning risk factors for MSP amongst veterinarians and the tasks/procedures that they perform which may be associated with their MSP.

Chapter Five of the thesis is a general discussion. It identifies study limitations, considers the implications of the studies and makes recommendations for further research.

Chapter Six is the conclusions of the thesis.

Lastly, the appendices include letters for approval from Massey University Human Ethics Committee and the Veterinary Council of New Zealand, and a hard copy of the questionnaire used. The appendices also include four papers presented at conferences, resulting from this thesis. Examples of the online questionnaire are included on a compact disc (CD-ROM) that is attached to the inside back cover of the thesis. The raw data in electronic format is also included in the CD-ROM. Some data on the CD-ROM has been modified from the direct entry of respondents to preserve anonymity in line with the Human Ethics Committee approval.

# **Chapter Two: Prevalence and risk factors associated with musculoskeletal discomfort in New Zealand veterinarians**

Scuffham, A. M., Legg, S. F, Firth, E. C. and Stevenson, M. A. (2009).  
Prevalence and risk factors associated with musculoskeletal discomfort in New Zealand veterinarians. *Applied Ergonomics*, in press.

## **Abstract**

A cross-sectional study using a modified Nordic musculoskeletal questionnaire asked 867 New Zealand veterinarians about the presence or absence of musculoskeletal discomfort (MSD). Participants were asked if MSD affected their normal activities and if it required any period(s) of absence from work. Additional questions enquired about work activities, psychosocial factors and workload. A binary logistic regression analysis was used to quantify the association between identified risk factors and the presence of MSD requiring absence from work in the previous 12 months, controlling for the presence of known confounders. The overall period prevalence of MSD was 96%, 67% had normal activities being affected and 18% of participants reported that they had been absent from work due to MSD. The lower back was the body site most commonly reported for MSD (73%). Factors increasing the odds of MSD requiring time off work for clinical veterinarians were 10 year increases in age (OR 1.26, 95% CI 1.05-1.52), work involving awkward grip and hand movements 100% of time (OR 12.91, 95% CI 3.46-4.21) and those who were dissatisfied with the level and difficulty of their work (OR 2.27, 95% CI 1.11-6.56). These findings have implications for health, lifestyle and retention rates for veterinarians.

## **Key Words**

Neck shoulder back pain, psychosocial factors, veterinary procedures, work activities, Nordic musculoskeletal questionnaire.

## Introduction

Musculoskeletal disorders are a major cause of pain, injury, illness, reduced productivity, and work absenteeism (Buckle, 2005; Cherry et al., 2001; Kuorinka et al., 1995), all of which are prevalent in high-risk occupations and industries including the healthcare (Kuorinka et al., 1995) and dental (Palliser et al., 2005) professions, keyboard workers (Punnett and Wegman, 2004) and manually intensive occupations (Kuorinka et al., 1995). It is difficult to compare data from studies of musculoskeletal complaints due to differences in the terminologies used to define the complaints, variety of study designs and in the types of methodologies and questionnaires used to examine the complaints. In the literature, various terms are used to describe musculoskeletal pain, injury, symptoms, trouble, discomfort and diseases/disorders. This creates confusion as diseases and disorders of the musculoskeletal system, usually require medically diagnosis according to a set criterion or definitions (Hagberg et al., 1995). By contrast, musculoskeletal discomfort (MSD) includes musculoskeletal aches and pains which are self-assessed (Burton, 1998; Hamberg-van Reenen et al., 2008), and are a precursor to clinically defined health events (Hamberg-van Reenen et al., 2008; Punnett and Wegman, 2004). Because there are currently no specific definitions used to define the terms above, in this paper we use MSD to mean musculoskeletal aches and pains trouble. In this context 'trouble' is taken to mean any aches, pain, discomfort or numbness affecting an identified body site.

Many physical and psychosocial factors have been established as being associated with MSD, including: prolonged static postures (Bernard, 1997), repetitive tasks (Bernard, 1997; Fredriksson et al., 2000), prolonged periods of exposure to a given task (Bernard, 1997; MacDonald, 2004), stress (Devereux et al., 2004), job satisfaction (Bongers et al., 1993), time and work demands (Bernard, 1997; Bongers et al., 1993), and organisational culture (Ariëns et al., 2001; Bongers et al., 1993; Fredriksson et al., 2000).

The majority of veterinarians in New Zealand work in clinical practice (VCNZ, 2007) and undertake a wide range of tasks which include all the risk factors for

MSD described above. Large animal veterinary practice in New Zealand is predominantly seasonal, which means that the yearly cycle of work is characterised by periods where different physical activities predominate. For instance, rectal palpation of cattle and horses to diagnose pregnancy or reproductive disorders is undertaken during short intense time periods. This task involves lifting, bending, twisting, arm and shoulder extension and torque, forceful pushing, and resisting unpredictable movements of the animal (Darmody et al., 1998). In small animal practice a common procedure is surgery, which involves lifting of animals and/or cages to tables, bending, twisting, crouching, arm extension, and prolonged standing. Regulatory veterinarians, on the other hand, have a role that includes tasks such as administration, animal and public health, animal welfare, ante and post mortem animal inspections, biosecurity, food safety and quality assurance inspections.

There is anecdotal evidence that a large number of veterinarians experience MSD, but this has not been studied in depth. Fritschi et al. (2006) showed that 50% of respondents had chronic musculoskeletal problems, however, Fritschi et al. did not define musculoskeletal problems nor did give information as to the body location where the problem occurred. Hill et al. (1998) in a study of occupational injuries and illness reported by American Zoo veterinarians had some specific questions on musculoskeletal injuries and disorders and found that 60% of respondents reported a musculoskeletal disorder or injury. Hafer et al. (1996) in a study of occupational hazards reported by American swine veterinarians showed that 51% of participants had pain due to repetitive actions. Cattell (2000) and Chambers et al. (2001), showed an association between cattle pregnancy testing and MSD, however both of these studies had low response rates of 11% and 23%, respectively. Recent studies on veterinarians in Ireland (O'Sullivan and Curran, 2008) and Belgium (Meers et al., 2008) demonstrated annual MSD prevalence of 53% and 82%. Although these studies provide useful starting points in terms quantifying the magnitude of the problem among the veterinary profession, they are limited by very low response rates (9.6% and 23%, respectively). In a recent study of Australian vets, Smith et al (2009) found high self-reported musculoskeletal disorders affecting the lower back, neck and shoulders, but they did not determine the overall

prevalence. This study did find an association between musculoskeletal disorders in the population studied and psychosocial factors, but did not investigate the relationship between physical factors or veterinary procedures and reporting of discomfort.

Table 1 summarises findings from research of MSD, pain, disorders and injury amongst veterinarians. They are characterised by being few in number, limited in scope, number of respondents and response rate. Since most studies have used different methodologies, investigated specialised groups or professional association members, and used non-standardised questionnaires, it is not surprising that the reported prevalence of MSD amongst veterinarians varies considerably. The present study sought to address some of these shortcomings in the extant literature through a survey using a standardised questionnaire (a modified Nordic Musculoskeletal Questionnaire (MSQ)) (Kuorinka et al., 1987) to determine the prevalence of MSD among New Zealand veterinarians. Our objectives were to describe the self-reported period prevalence of MSD and identify risk factors associated with MSD amongst registered veterinarians in New Zealand.

**Table 1:** Summary of findings from studies of self reported musculoskeletal discomfort (MSD), pain, disorders and injury amongst veterinarians.

Source Reference (year)	Description Population studied, number of participants (n) and response rate (x%)	Outcome measure	Key findings
Cattell (2000)	Members of American Association of Bovine Practitioners. n = 434 (11%).	Musculoskeletal injury (defined as cumulative traumatic disorder (CTD). Palpation associated acute traumatic injury (ATI). Undefined prevalence time frame. Postal questionnaire. Cross sectional study.	CTD (71%) and ATI (31%) associated with rectal palpation of cattle. CTD reported in shoulder (53%), elbow (32%), wrist (24%) and neck (23%).
Chambers et al. (2001)	Members of Australian Association of Cattle Veterinarians. n = 163 (23%).	Work related injuries to back, shoulder, elbow ankle and/or hand injuries. Undefined prevalence time frame. Cross sectional study. Loose leaf questionnaire in journal and facsimiled.	Back injury (42%), shoulder injuries (40%), elbow injuries (37%) and knee injuries (32%). Mild relationship between pregnancy testing and knee, shoulder, ankle and hand injuries.
Fritschi et al. (2006)	Australian veterinarian graduates. n = 2800 (48%).	Chronic or periodic work related musculoskeletal problems. Undefined time frame. Cross sectional study. Postal questionnaire	Chronic musculoskeletal problems 50%.
Hafer et al. (1996)	Members of American Association of Swine Practitioners. n = 936 (65%).	Physical injuries. Cross sectional study. Undefined prevalence time frame. Postal questionnaire.	Back problems from lifting or moving swine (31%). Pain from repetitive activities (bleeding swine and injections with wrists, elbows and fingers affected) (51%).
Hill et al. (1998)	Members of American Association of Zoo Veterinarians. n = 279 (49%).	Musculoskeletal injuries and disorders. Cross sectional study. Undefined prevalence time frame. Postal questionnaire.	Back problem and/or pain due to repetitive activities (60%). Lifting or moving animals caused back problems (55%), pain from repetitive activities (20%). Time off work due to a back injury (11%).
Loomans et al. (2008)	Equine veterinarians in Holland. n = 120 participants in 36 veterinary practices.	Musculoskeletal problems / diseases or injuries. Undefined prevalence time frame. Cross sectional study. Postal questionnaire.	Musculoskeletal problems / diseases / injuries upper body (54%), lower body (22%). Upper body musculoskeletal problems related to handling horses (72%). Sick leave due to musculoskeletal problems upper body (14%) and lower body (14%).
Meers et al (2008)	Veterinarians in Flanders (Belgium). n = 229 (29%).	Suffer back pain or pain in 9 specific body sites. Cross sectional study. Annual prevalence. Questionnaire handed out at conference, training sessions or personal delivery	Stiffness, pain or discomfort (81%), unable to undertake normal tasks within previous year (41%). MS stiffness, pain or discomfort - lower back (62%), shoulders (38%), neck (37%) and knees (21%). Unable to undertake normal tasks – wrists / hands (32%), knees (29%), lower back (20%) and hips (16%).
O'Sullivan and Curran (2008)	Veterinarians in Ireland. n = 89 (9.6%).	Musculoskeletal ill health. Career and annual prevalence of musculoskeletal symptoms. Cross sectional study. Postal questionnaire.	Annual musculoskeletal symptoms (60%), absent from work over career due to musculoskeletal symptoms (34%). Musculoskeletal symptoms - low back (35%), neck (25%), shoulders (20%), hands / fingers (19%). Perceived risk factors: working with back bent/sustained posture, handling or lifting animals, tuberculosis testing of cattle and equine pregnancy testing.
Reijula et al. (2003)	Members of Finland Veterinarians Association under 65 years. n = 785 (67%)	Tasks and psychosocial working conditions. Undefined time frame. Cross sectional study. Postal questionnaire.	Working in improper postures, bent over or back twisted for >1 h per day (40%). Arms above shoulder height (15%). Back pain (40%) and strain in jury upper limbs (25%).
Smith et al. (2009)	Veterinarians in Queensland, Australia. n = 567 (55%).	Musculoskeletal disorders using adapted Nordic musculoskeletal questionnaire. Annual prevalence of disorders experienced, affecting work and requiring sick leave. Cross sectional study. Postal questionnaire.	Annual musculoskeletal disorders experienced lower back (63%), neck (57%), shoulder (54%). Musculoskeletal disorders affecting work lower back (32%), neck (22%), shoulder (22%), wrist / hands (32%). Musculoskeletal disorders requiring sick leave lower back (6%), neck (3%), shoulder (2%). Risk factors were stress associated with career, time pressure, clients attitude, lack of recognition and insufficient holidays.

## Methods

### Participants

The Veterinary Council of New Zealand database comprised details for 2762 registered veterinarians as of 17 January 2008. The eligible population for this study was 2112 of the 2762 registered veterinarians with a valid email address who had agreed that their contact details could appear in the New Zealand veterinarians' register. Eligible veterinarians were sent an email on 10 May 2008 inviting them to complete a questionnaire using a link to an on-line web page. Three emails were sent 10, 18 and 51 days after the initial invitation, reminding them to complete and return the questionnaire if they had not already done so, as did a notice placed in a veterinary magazine, and announcements at a national veterinary conference. Study participants were those who submitted a completed, valid set of questionnaire responses. Questionnaires that had  $\leq 15$  completed questions or had duplicate responses were excluded from the analysis.

### Questionnaire

The questionnaire was a modified version of the Nordic musculoskeletal questionnaire (MSQ) (Dickinson et al., 1992; Kuorinka et al., 1987) and the Karasek job content questionnaire (JCQ) (1998). The modification was based on an unpublished version of a hybrid MSQ / JCQ developed by the Health and Safety Executive (HSE) to capture both physical and psychosocial factors within a short easily useable questionnaire. The questionnaire was developed and pilot trialled on six veterinarians in January 2008. All six veterinarians who took part in the pilot survey returned completed questionnaires with comments and suggestions as to how the questionnaire could be improved.

The final version of the questionnaire comprised 74 questions, and asked participants about their current job, age, gender, the number of hours worked (within a range), number of nights on call, number of veterinarians and technicians/nurses within the practice/organisation, and the number of breaks of greater than 15 minutes taken per day. Participants were also asked about the

type of practice or work (small animal, mixed animal, large animal, equine, pathology, regulatory, university/research, or other), the type of procedures undertaken during work, and the presence or absence of musculoskeletal aches and pains. The questions related to work activities only. Participants who returned the questionnaire were eligible to win one of five \$100 vouchers. Massey University Human Ethics Committee approved this project.

## Musculoskeletal aches and pains

The questions about musculoskeletal aches and pains assessed the severity of MSD in ten body sites (neck, shoulders, arms, elbows, wrists/hands, upper back, lower back, hips/thighs/buttocks, knees and ankles/feet) during the previous twelve months. Within the previous 12 months, a yes/no response indicated if the participant had trouble (musculoskeletal aches, pains, discomfort or numbness) in any of the 10 body sites, if the trouble prevented them from carrying out their normal activities (such as housework, hobbies or gardening), and if the trouble had necessitated absence from work. The questions regarding musculoskeletal aches and pains differs from a HSE adapted questionnaire (Dickinson et al., 1992), as we used a severity factor of MSD resulting in absence from work in place of a seven day prevalence.

## Work activities

Participants were asked to estimate the fraction of total work activity time (never, quarter of working time, half, three quarters or full-time) that the job involved the following activities: awkward or tiring positions, awkward grip or hand movements, boring work, carrying out repetitive tasks, exposure to loud noise, lifting, standing, sitting, using tools that vibrate, working in cold/damp environments, working at high speed, working in hot/warm environments, working outside or working to tight deadlines.

## Psychosocial factors

Participants were asked to indicate how satisfied they were with their workplace using a 5-point Likert type response scale (very satisfied, satisfied, neutral, dissatisfied, and very dissatisfied) in response to the following 21 questions that allowed computation of six psychosocial factors: 1) *contact and co-operation with management* (contact and co-operation between yourself and your employer, the help and support given to you by your colleagues, the help and support given to you by your manager, co-operation among you and your fellow workers); 2) *level and difficulty of work* (the level of enjoyment of your work, the level of difficulty of work, the level of mental demands of work, the level of physical demands of work); 3) *opportunity to vary pace of work* (the opportunity to vary the pace of work, the opportunity to vary the type of work carried out, and the pace of work); 4) *work organisation* (the total number of hours worked per week, the way work is organised, the times of the day when you are asked to work); 5) *number of rest breaks taken* (the after hours or call system at work, the number of rest breaks taken, the amount of work to do, the total time spent at work); 6) *organisational culture* (details of the way the work organisation is run, the total number of hours overtime expected per week, and work as a whole). In addition, participants were asked to indicate how stressful they found their current job (not at all, mildly, moderately, very or extremely stressful).

## Veterinary procedures

Participants were asked to estimate the number (0, <600, 601-2400, 2401-12,000, 12,001-24,000, 24,001-36,000 and >36,000) of veterinary procedures they performed annually. Procedures included: animal consultations and/or examinations, animal handling / lifting, blood sampling / intravenous injections / intravenous cannulations (including blood sampling), dehorning/velvetting, dental procedures, obstetric procedures, endoscopies, foot trimming, lameness examinations, necropsies, radiography, rectal palpations, surgical procedures lasting <1 hr and > 1 hr, ultrasonographic examinations / scanning and vaccinations / tuberculosis testing. Participants were also asked to estimate the time spent on office / administration work and clinical laboratory work (0, 1-240,

241-480, 481-1200, 1201-1920 and >1920 hours/year). A lookup table showing equivalencies was included in the questionnaire to assist participants determine annual estimates.

## Data management and analysis

Responses were entered directly into a relational database (Microsoft Access 2007, Microsoft Corporation, Redmond, USA) via the questionnaire web page. Survey responses from the database were analysed using the statistical package R version 2.70 (R Development Core Team, 2008).

We reported the frequency of MSD as period prevalence (the number of MSD-positive veterinarians per 100 veterinarians at risk). Here the numerator (cases) equalled the number of participants with MSD present at the start of the 12-month follow-up period as well as MSD-free participants who developed MSD at any time throughout the 12-month follow-up period.

Small animal, large animal, mixed practice and equine were grouped together under the category of clinical veterinarians. University/research, pathology, regulatory and 'other' veterinarians were classified as non-clinical. The five work activity categories (never, quarter, half, three quarters and full-time) were collapsed into three categories (never, half or full-time) for analysis. Similarly, the five psychosocial categories (very satisfied, satisfied, neutral, dissatisfied and very dissatisfied) were collapsed into satisfied, neutral and dissatisfied, whilst the stress categories (not at all, mildly, moderately, very or extremely stressful) were collapsed into not at all, moderately or extremely stressful. The numbers of veterinary procedures (0, <600, 601-2400, 2401-12,000, 12,001-24,000, 24,001-36,000 and >36,000) were collapsed into zero, 1-600 and >600 with the exceptions of blood sampling/intravenous injections/intravenous cannulations, rectal palpations, ultrasonographic examinations/scanning and vaccinations/tuberculosis testing, which were collapsed into categories of 0, 1-600, 601-2400 and >2400.

Descriptive statistics were generated for each of the continuously distributed survey responses (age, years graduated, days on call per week, number of

breaks per day, number of veterinarians and veterinary nurses/technicians in the workplace). Bivariate analyses were undertaken to select, for multivariable modelling, a set of independent variables that best explained the risk of MSD requiring time off work for clinical veterinarians. Procedures were not considered for multivariable modelling, due to the wide variation in the number of procedures undertaken. The frequencies of categorical explanatory variables were compared among MSD present (those participants who reported any MSD) and absent (those participants who did not report any MSD) participants using Fisher's exact test. A backward stepwise approach was used to select those variables that best explained the risk of a participant being MSD "present" (Bernard, 1997; Hosmer and Lemeshow, 1989). All variables associated with the presence of MSD at an alpha value of  $<0.2$  at the bivariate level were entered into a binary logistic regression model. The significance of each explanatory variable was tested using the Wald test. Explanatory variables that were not statistically significant were removed from the model one at a time, beginning with the least significant, until the estimated regression coefficients for all retained variables were significant at an alpha value of  $<0.05$ . The final model is reported in terms of adjusted odds ratios (OR) for each explanatory variable. An adjusted OR (and its 95% confidence interval) of  $>1$  indicates that, after adjusting for other variables in the model, exposure to the explanatory variable increased the odds of a survey participant being MSD present. An adjusted OR (and its 95% confidence interval) of  $<1$  indicates that exposure to the explanatory variable was protective. An OR of 1 indicates that the predictor had no influence on MSD risk. A Receiver Operating Characteristic (ROC) curve was constructed, based on predictions of MSD status by the model. The area under the ROC curve, which ranges from 0-1, provided a measure of the model's ability to discriminate between MSD "present" and MSD "absent" participants.

## Results

### Sample demographics

Of the 961 completed on-line questionnaires 13 sets of responses were duplicates and 81 had less than 15 responses and were removed from the analyses. There were 867 valid questionnaires, representing 41% (867 of 2112) of the eligible population.

Of the 867 participants, 424 (49%) were females. The average age was 41 years (95% CI [confidence interval] 26-62 years). The average length of time since graduation at a veterinarian was 16 years (95% CI 2-38 years). Five hundred and seven (67%) participants worked >40 hours per week and 80% reported that they regularly worked outside of the hours 8 am to 5 pm. Participants spent, on average, 1 night per week on call with 31% spending no time on call. Participants had, on average, two breaks per day lasting >15 minutes, with 72 (8%) reporting that they had no break time. Within veterinary practices or organisations, 113 (13%) veterinarians worked alone, 461 (54%) worked with 2-5 veterinarians, 195 (23%) worked with 6-10, 61 (7%) worked with 11-20, and 25 (3%) work with more than 20 veterinarians. Further demographic information is shown in Table 2.

**Table 2:** Median and interquartile range of each of the continuously distributed variables included in the questionnaire, stratified by presence or absence of three levels of MSD severity.

Variable	MSD severity						Total
	Any trouble		Activities affected		Absent from work		
	Present	Absent	Present	Absent	Present	Absent	
Age (years)	41 (33 - 50)	40 (32 - 53)	42 (34-51)	39 (31-50)	44 (35 - 51)	41 (32 - 50)	867
Years graduated	16 (8-27)	16 (9-29)	18 (9-27)	14 (6-26)	18 (9 - 28)	16 (8 - 26)	867
Days on call per week	1 (0-3)	1 (0-3)	1 (0-3)	1 (0-2)	1 (1 - 3)	1 (0- 3)	867
Work breaks per day	2 (1-2)	2 (1-3)	2 (1-2)	1.5 (1-3)	2 (1 - 2)	1.5 (1 - 2)	867
Number of veterinarians <sup>a</sup>	4 (2-7)	3 (2-5)	4 (2-7)	4 (2-6)	4 (2 - 8)	4 (2 - 7)	867
Number of support staff <sup>b</sup>	3 (1-5)	2 (1-4)	3 (1-5)	3 (1-5)	2 (1 - 4)	3 (2 - 5)	867

<sup>a</sup> Number of veterinarians working in practice or organisation.

<sup>b</sup> Number of technicians or veterinary nurses working in practice or organisation.

## Period prevalence

The self-reported period prevalence of MSD was 96%. Some 67% of participants had normal activities affected, and 18% were absent from work in the previous 12 months due to MSD (Table 3). The greatest period prevalence of MSD was among equine and large animal veterinarians (100% each). Regulatory veterinarians and pathologists had the lowest period prevalence at 90% each. In regards to MSD necessitating absence from work, regulatory veterinarians (27%) had the highest value for, whilst ‘others’ and university / research veterinarians had the lowest period prevalence at 7% and 10% respectively.

**Table 3: Twelve-month period prevalence of three levels of MSD severity** (expressed as the number of cases of MSD per 100 veterinarians at risk and their 95% confidence intervals) stratified by practice-organisation type.

Practice type	MSD severity			Total
	Any trouble	Activities affected	Absent from work	
Equine	100 (91-100)	75 (60-86)	22 (12-38)	40
Large animal	100 (96-100)	75 (60-86)	24 (17-34)	91
Mixed animal	96 (93-97)	66 (1-80)	21 (17-26)	331
Small animal	94 (91-97)	64 (58-70)	12 (9-17)	250
Other	93 (81-97)	61 (46-74)	7 (3-19)	35
Pathology	89 (57-98)	78 (45-94)	22 (6-55)	10
Regulatory	90 (81-96)	70 (58-80)	27 (18-39)	67
University / research	98 (88-100)	67 (52-79)	10 (4-22)	43
Total	96 (94-97)	67 (64-70)	18 (16-21)	867

Three hundred and fifty participants (40%) reported MSD trouble in 1-3 body sites, 435 (50%) reported MSD trouble in 4-7 body sites. Forty-seven (5%) reported MSD trouble in more than 7 body sites. The most commonly affected body site was the lower back, for which 73%, 42% and 9% of participants reported MSD trouble, MSD affecting normal activities, and MSD resulting in being absent from work, respectively (Table 4).

**Table 4: Twelve-month period prevalence of three levels of MSD severity** (expressed as the number of cases of MSD per 100 veterinarians at risk and their 95% confidence intervals) stratified by affected body region.

Variable	MSD severity			Total <sup>a</sup>
	Any trouble	Activities affected	Absent from work	
Neck	58 (54-61)	25 (22-28)	3 (2-5)	831
Shoulders	59 (55-62)	28 (25-31)	3 (2-4)	831
Arm	28 (25-32)	12 (10-15)	1 (1-3)	811
Elbows	29 (26-33)	17 (14-19)	1 (0-2)	816
Wrists-hands	52 (49-55)	28 (25-32)	4 (3-6)	828
Upper back	30 (27-33)	14 (12-17)	2 (1-3)	813
Lower back	73 (70-76)	42 (39-46)	9 (8-12)	842
Hips-thighs-buttocks	24 (21-27)	12 (9-14)	2 (1-3)	812
Knees	38 (34-41)	20 (17-23)	3 (2-5)	829
Ankles-feet	21 (18-24)	12 (10-14)	2 (1-4)	811
Total	96 (94-97)	67 (64-70)	18 (16-21)	867

<sup>a</sup> Not all participants answered all questions

## Work activities

Table 5 shows the number and percentage of participants reporting the presence of MSD that resulted in trouble, activities being affected, or necessitating absence from work, stratified by work activity and qualitative aspects of work activity that were shown to be statistically significant. Differences in the proportions for never, half and full categories within each MSD severity level were tested using Fisher's exact test. Differences in the proportions of participants experiencing awkward and tiring positions, awkward grip or hand movements, boring work, carrying out repetitive tasks, exposure to loud noise, working in a cold/damp environment, working at high speed, working outside and working to tight deadlines. Heavy lifting, sitting, standing, stress, using tools that vibrate were not shown to be statistically significant and have been omitted from the table.

**Table 5:** Number and percentage of participants reporting the presence of MSD that resulted in trouble, activities being affected, or necessitating absence from work in the previous 12 months, stratified by work activity and qualitative aspects of work activity that were shown to be statistically significant. Differences in the proportions for never, half and full categories within each MSD severity level, significant at the alpha level of 0.05, are marked with a superscript (\*).

Procedure	n <sup>a</sup>	MSD severity		
		Any trouble	Activities affected	Absent from work
Awkward and tiring positions:				
never		63 (89%)	36 (51%)	8 (11%)
half		631 (96%)	443 (67%)	117 (18%)
full		125 (98%)	95 (74%)	30 (23%)
total	858	819 (95%) *	574 (67%) *	155 (18%)
Awkward grip and hand movements:				
never		128 (91%)	77 (55%)	15 (11%)
half		595 (96%)	427 (69%)	116 (19%)
full		89 (99%)	64 (71%)	24 (27%)
total	851	812 (95%) *	568 (67%) *	155 (18%) *
Boring work:				
never		224 (96%)	146 (63%)	30 (13%)
half		534 (96%)	382 (68%)	111 (20%)
full		56 (93%)	44 (73%)	14 (23%)*
total	852	814 (95%)	572 (67%)	155 (18%)*
Carrying out repetitive tasks:				
never		64 (93%)	38 (55%)	9 (13%)
half		518 (95%)	365 (67%)	90 (16%)
full		238 (98%)	173 (71%)	56 (23%)
total	859	820 (95%) *	576 (67%) *	155 (18%)
Exposure to loud noise:				
never		368 (93%)	251 (64%)	69 (17%)
half		415 (97%)	302 (71%)	78 (18%)
full		32 (100%)	20 (63%)	7 (22%)
total	854	815 (95%) *	573 (67%)	154 (18%)
Working in a cold or damp environment:				
never		261 (95%)	168 (61%)	37 (13%)
half		507 (95%)	374 (70%)	108 (20%)
full		49 (98%)	32 (64%)	9 (18%)
total	856	817 (95%)	574 (67%) *	154 (18%)
Working at high speed:				
never		100 (92%)	67 (61%)	18 (17%)
half		480 (95%)	331 (66%)	92 (18%)
full		233 (98%)	176 (74%)	45 (19%)
total	850	813 (95%) *	574 (67%) *	155 (18%)
Working in a hot or warm environment:				
never		159 (93%)	111 (65%)	19 (11%)

half	578 (96%)	404 (67%)	120 (20%)
full	71 (97%)	52 (71%)	16 (22%)
total	846	808 (95%)	567 (67%)
Working outside:			
never	298 (95%)	202 (64%)	36 (11%)
half	278 (94%)	199 (67%)	63 (21%)
full	242 (99%)	172 (70%)	57 (23%)
total	857	818 (95%) *	573 (67%)
Working to tight deadlines:			
never	30 (81%)	19 (51%)	3 (8%)
half	413 (96%)	288 (67%)	79 (18%)
full	374 (96%)	268 (69%)	73 (19%)
total	856	817 (95%) *	575 (67%)

## Psychosocial factors

Table 6 shows the number and percentage of participants reporting the presence of MSD that resulted in trouble, activities being affected, or necessitating absence from work, stratified by work activities and qualitative aspects of the psychosocial working environment. Differences in degree of satisfaction of participants with the difficulty of work, their ability to vary the pace of work, and the work organisation and organisational culture were related to significant differences in perception of MSD or absence from work.

**Table 6:** Number and percentage of participants reporting the presence of MSD that resulted in trouble, activities being affected, or necessitating absence from work in the previous 12 months, stratified by psychosocial factors associated with the risk of MSD. Differences in the proportions for dissatisfied, neutral and satisfied categories within each MSD severity level, significant at the alpha level of 0.05, are marked with a superscript (\*).

Factor	MSD severity		
	Any trouble	Activities affected	Absent from work
Level of cooperation at work:			
Dissatisfied	233 (96%)	162 (67%)	54 (22%)
Neutral	349 (96%)	243 (67%)	57 (16%)
Satisfied	203 (95%)	148 (69%)	38 (18%)
Total	785 (100%)	553 (100%)	149 (100%)
Difficulty of work:			
Dissatisfied	36 (92%)	31 (79%)	14 (36%)
Neutral	177 (96%)	132 (72%)	38 (21%)
Satisfied	606 (96%)	413 (65%)	103 (16%)
Total	819 (100%)*	576 (100%)	155 (100%)*
Ability to vary the pace of work:			
Dissatisfied	136 (99%)	104 (75%)	30 (22%)
Neutral	531 (94%)	372 (66%)	98 (17%)
Satisfied	147 (97%)	96 (64%)	28 (19%)
Total	814 (100%)*	572 (100%)	156 (100%)
Work organisation:			
Dissatisfied	395 (94%)	263 (63%)	71 (17%)
Neutral	315 (97%)	234 (72%)	63 (19%)
Satisfied	102 (96%)	75 (71%)	20 (19%)
Total	812 (100%)*	572 (100%)*	154 (100%)
Opportunity to rest:			
Dissatisfied	162 (96%)	120 (71%)	28 (17%)
Neutral	446 (96%)	311 (67%)	92 (20%)
Satisfied	196 (94%)	135 (65%)	31 (15%)
Total	804 (100%)	566 (100%)	151 (100%)
Organisational culture:			
Dissatisfied	73 (96%)	56 (74%)	15 (20%)
Neutral	299 (96%)	215 (69%)	69 (22%)
Satisfied	440 (95%)	300 (65%)	71 (15%)
Total	812 (100%)	571 (100%)	155 (100%)*

## Veterinary procedures

Table 7 shows the number and percentage of participants reporting MSD stratified by numbers of procedures carried out in the previous 12 months that were shown to be statistically significant. Differences in the proportions for 1-600, >601 (or 601-2400 and >2400) within each MSD severity level were tested using Fisher's exact test. Differences in the proportions of participants undertaking dental procedures, foot trimming, necropsies, obstetric procedures, rectal palpations and surgical procedures < 1 hr were significant at the alpha level of 0.05. Animal consultations, animal handling, blood sampling, dehorning / velveting, endoscopies, lameness examinations, radiography, surgical procedures >1hr, ultrasonic examinations / scanning, tuberculosis testing/vaccinations, clinical laboratory work and office/administration work were not shown to be statistically significant and thus omitted from the table.

**Table 7:** Number and percentage of participants reporting the presence of MSD that resulted in trouble, activities being affected or necessitating absence from work in the previous 12 months, stratified by annual number of MSD associated procedures undertaken that were shown to be statistically significant. Differences in the proportions for zero, 1-600, >601 (or 601-2400 and >2400) categories within each MSD severity level, significant at the alpha level of 0.05, are marked with a superscript (\*).

Procedure	n =	MSD severity		
		Any trouble	Activities affected	Absent from work
<b>Dental Procedures</b>				
zero	241 (95%)	170 (67%)	47 (19%)	
1-600	512 (96%)	351 (66%)	94 (18%)	
> 601	59 (67%)	50 (82%)	12 (20%)	
total	849	812 (96%)	571 (67%) *	153 (18%)
<b>Foot trimming</b>				
zero	393 (95%)	269 (65)	59 (14%)	
1-600	378 (96%)	268 (68%)	83 (21%)	
> 601	47 (96%)	37 (76%)	13 (27%)	
total	856	818 (96%)	574 (67%)	155 (18%) *
<b>Necropsies</b>				
zero	200 (93%)	138 (64%)	30 (14%)	
1-600	604 (96%)	426 (68%)	120 (19%)	
> 601	5 (83%)	5 (83%)	3 (50%)	
total	846	809 (96%) *	569 (67%)	153 (18%) *
<b>Obstetric procedures</b>				
zero	347 (95%)	236 (64%)	52 (14%)	
1-600	452 (97%)	325 (70%)	100 (21%)	
> 601	18 (86%)	11 (52%)	3 (14%)	
total	854	817 (96%) *	572 (67%)	155 (18%) *
<b>Rectal palpations</b>				
zero	328 (94%)	221 (64%)	52 (15%)	
1-600	177 (96%)	130 (71%)	36 (20%)	
601 -2400	138 (97%)	93 (65%)	22 (15%)	
>2401	171 (97%)	126 (72%)	44 (25%)	
total	850	814 (96%)	570 (67%)	154 (18%) *
<b>Surgical procedures &lt;1 hr</b>				
zero	113 (92%)	80 (65)	17 (14%)	
1-600	518 (97%)	353 (66%)	99 (19%)	
> 601	185 (95%)	139 (71%)	36 (18%)	
total	852	813 (95%) *	567 (67%)	151 (18%)

\* Differences in the proportions for none, 1-600, >601 (or 601-2400 and >2400) categories for each level of MSD severity significantly different at the alpha level of 0.05.

## Risk of MSD in clinical veterinarians necessitating absence from work

Regression coefficients and their standard errors for the final model of factors influencing the risk of MSD resulting in absence from work in the previous 12 months in clinical veterinarians are shown in Table 8. The risk of MSD was associated with age, the proportion of time spent with work involving awkward grip or hand moments, and dissatisfaction with the amount and difficulty of work. Ten-year increases in age increased the odds of MSD requiring time off work by a factor of 1.26 (95% CI .05-1.52). Veterinarians whose work involved awkward grip or hand movements 100% of the time had 12.91 (95% CI 3.46-84.21) times the odds of MSD requiring time off work, compared with those whose work did not involve such movements. The odds of MSD requiring time off work was 2.72 (95% CI 1.11-6.56) times greater in those veterinarians who were dissatisfied with the level and difficulty of their work, compared with those who were neither satisfied or dissatisfied.

The area under the ROC curve for the model presented in Table 8 was 0.654, indicating that the model had moderate to fair discriminatory ability.

**Table 8:** Regression coefficients and standard errors from a dichotomous logistic regression model of factors influencing the risk of MSD in clinical veterinarians that necessitated absence from work in the previous 12 months.

Variable	Coefficient	SE	Wald z	P value	OR (95% CI) <sup>a</sup>
Age (years) <sup>b</sup>	0.232	0.094	2.457	0.01	1.26 (1.05 - 1.52)
Awkward grip or hand movement:					
0% of the time					1.00
50% of the time	2.191	0.731	2.997	<0.01	8.94 (2.71 - 55.37) <sup>c</sup>
100% of the time	2.558	0.774	3.304	<0.01	12.91 (3.46 - 84.21)
Level and difficulty of work:					
Neither satisfied or dissatisfied					1.00
Satisfied	-0.374	0.235	-1.59	0.11	0.69 (0.44 - 1.10)
Dissatisfied	0.999	0.45	2.219	0.02	2.72 (1.11 - 6.56) <sup>d</sup>

SE: standard error.

<sup>a</sup>Odds ratio (95% confidence interval).

<sup>b</sup>Ten year increments.

<sup>c</sup>Interpretation: compared with participants whose work does not involve awkward grip or hand movements, the odds of MSD in those who stated that they spent 50% of their working time involving awkward grip or hand movements, was increased by a factor of 8.94 (95% CI 2.71 – 55.37).

<sup>d</sup>Interpretation: compared with participants who were neither satisfied or dissatisfied with the difficulty of work), the odds of MSD in those who stated they were dissatisfied with the difficulty of work was increased by a factor of 2.72 (95% CI 1.11 – 6.56).

## Discussion

The 96% period prevalence of MSD trouble was considerably higher than that reported in previous studies of veterinarians (Cattell, 2000; Chambers et al., 2001; Hafer et al., 1996; Hill et al., 1998; Meers et al., 2008; O'Sullivan and Curran, 2008). This may be partially attributed to the differences in the questionnaire between studies, different methodologies or different definitions of musculoskeletal diseases / disorders / discomfort or ill health in other studies.

Also, our study investigated veterinarians on a national register, and although response rates could be different between various veterinary groups or sectors, this feature of experimental design differs from other studies, which have investigated only particular specialised groups, such as small animal (Poole et al., 1998), swine (Hafer et al., 1996), zoo veterinarians (Hill et al., 1998) or veterinarians within professional associations such as dairy cattle practitioners (Cattell, 2000; Chambers et al., 2001).

The 12-month MSD period prevalence in the present study is substantially higher than that previously reported in other occupational groups such as cytotechnologists (58% annual prevalence) (Thompson et al., 2003), dentists (53% annual prevalence) (Palliser et al., 2005), dairy farmers (86% annual prevalence) (Kolstrup et al., 2006), nurses (72% annual prevalence) (Lipscomb et al., 2002), physiotherapists (58% annual prevalence) (Glover et al., 2005), pig farmers (78% annual prevalence) (Kolstrup et al., 2006) and ultrasonographers (91% career prevalence) (Russo et al., 2002), the roles and/or tasks of whom are somewhat comparable to those of veterinarians. The differences may be due to differences in professions, tasks and methodologies used in the various studies.

A high percentage (67%) of participants had their normal activities affected by MSD, which indicates that MSD has an effect on the lifestyle of veterinarians as well as most likely having an effect on their quality of life. In contrast, 41% of Belgian veterinarians reported that they were unable to undertake professional activities as a result of MSD (Meers et al., 2008). Whilst it is impossible to compare directly between the activities affected in the two studies, the difference may be related to the different populations studied, different methodologies including terminology and the low response rate (29%) reported by Meers et al. (2008).

We found that 18% of veterinarians reported absence from work due to MSD. This is an important finding because it has implications for both the employer and the veterinarian through lost time, loss of productivity, loss of earnings and intangible effects on lifestyle. In contrast, O'Sullivan and Curran (2008), reporting on musculoskeletal ill health, found that 34% of veterinarians in Ireland had time off work during their careers due to MSD. This study had a very low response rate (9.6%) so the ability to generalise these findings to the target population of all veterinarians in Ireland must be questioned.

Half of the participants reported MSD in four to seven body sites, with five percent reporting MSD in more than seven body sites. O'Sullivan and Curran (2008) found that 47% of their respondents reported musculoskeletal symptoms in three or more body sites. Loomans et al. (2008) did not describe the number

of sites affected in the equine veterinarians, however, they commented that “most veterinarians had combined problems, e.g. neck and back, shoulder and back, etc”. Haukka et al. (2006) found 35% of female kitchen workers had musculoskeletal pain in three or more body areas. In a study of musculoskeletal pain in the general Dutch populations within the previous 12 months, 29% reported pain in two-three body sites and in four or more sites by 21% (Picavet and Schouten, 2003). Our findings add to the limited reports in the literature regarding musculoskeletal co-morbidity.

The neck was a commonly affected body site with 58% period prevalence for MSD trouble, and with 25% of participants so afflicted having their normal activities affected. The annual period prevalence of MSD for shoulders, elbows and wrists/hands was 59%, 29% and 52%, respectively. This was comparable (with the exception of wrists/hands) when compared to other MSD studies of veterinarians, where the prevalence was 20-53% for shoulders, 11-32% for elbows and 14-32% for wrists/hands (Cattell, 2000; Meers et al., 2008; O'Sullivan and Curran, 2008; Smith et al., 2009).

Reijula et al. (2003), in a study of tasks and psychosocial working conditions in members of the Finish Veterinary Association, showed that 15% of veterinarians worked with arms raised at least at shoulder level for over one hour per day. Palmer et al. (2002) found in the general British population that working with hands raised above shoulder height was associated with neck pain. Other risk factors associated with neck pain include age, job demands, work posture, sedentary work position and repetitive work (Cote et al., 2008), all of which were shown to be associated with MSD in this study. Repetitive use of tools, use of vibrating tools, working with arms above shoulder level, physical work, monotonous work, stress and high job demands have been implicated with pain and MSD for neck and upper extremities (Bongers et al., 2002; Fredriksson et al., 1999; Leclerc et al., 2004).

Seventy-three percent of participants reported MSD trouble in the lower back, with 42% and 9% having normal activities affected and being absent from work, respectively. The result of 9% of participants who were absent from work due to MSD, was slightly lower than the 10% and 11% reported by Smith et al. (2009)

and Hill et al. (1998). This is consistent with observations that body flexion, rotation and weight loading are leading factors in lower back pain (Hagen and Thune, 1998; Hoogendoorn et al., 2002; Palliser et al., 2005).

Those working as clinical veterinarians had the highest period prevalence of MSD. The period prevalence of MSD in regulatory veterinarians was 90% and 27% of this group reported being absent from work due to MSD. According to Fritschi et al. (2006), veterinarians in clinical practice are 10 times more likely than veterinarians from any other sector to have an injury, and to report chronic work related problems. However, the differences between groups in the present study were not substantial. Regulatory veterinarians were more likely to be absent from work than all other veterinary groups. Shouksmith & Hesketh (1986) and Teekayuwat (1998) showed that New Zealand regulatory veterinarians had the lowest level of job satisfaction compared to other New Zealand veterinarians, which may account for the high rate of regulatory veterinarians being absent from work due to MSD. Other potential factors that may explain this conversion from MSD trouble to being absent from work include that the regulatory veterinarians are usually employed by a government department with adequate sick leave and that adequate coverage for absenteeism is provided, unlike self-employed veterinarians.

Our analysis of work activities was in agreement with that of previous studies where awkward or tiring positions (Bernard, 1997; MacDonald, 2004), awkward grip and hand movements (Huang et al., 2002; MacDonald, 2004), boring work (Bongers et al., 1993; Fredriksson et al., 1999), carrying out repetitive movements (Bernard, 1997; Fredriksson et al., 1999; Leclerc et al., 2004; MacDonald, 2004), exposure to loud noise (MacDonald, 2004), working in hot or warm environments (MacDonald, 2004) and working to tight deadlines (Bongers et al., 1993; Smith et al., 2009) were associated with MSD. While all veterinarians experience the above conditions to at least some degree throughout their working life, our multivariate analyses found that clinically active veterinarians who performed awkward grip or hand movements 100% of time had a 12.91 times higher risk (95% CI 3.46-84.21) of MSD compared with those who did not undertake these movements. This may be related to poor

equipment design, holding restraining devices, using instruments, attempting to restrain struggling animals, or engaging in procedures that result in awkward hand movements such as rectal palpations, injections or vaccinations. Awkward grip and hand movements have been associated with arm as well as back pain (Waters et al., 2007) due to overextension of the wrist muscles (Bernard, 1997). Anecdotal reports, personal observations, and direct experience suggest that such loads are sustained by veterinarians in many of the activities discussed above.

Many psychosocial factors are associated with MSD (Bernard, 1997; Bongers et al., 2002; Devereux et al., 2004; Devereux et al., 2002; MacDonald and Evans, 2006). Factors relating to the level and difficulty of work (including the enjoyment of work, mental and physical demands as well as level of difficulty of work), have all been identified in the literature as risk factors for MSD, collectively described as 'job demands' (Bongers et al., 2006; MacDonald, 2003). Clinical veterinarians who were least satisfied with the level and difficulty of work had a 2.72 times higher odds of MSD than those who were satisfied. Due to the cross-sectional design of this study, we were unable to determine if work dissatisfaction was a cause or a consequence of MSD. High job demands or difficulty of work may increase muscle tension and lead to muscle fatigue and reduced performance, thus resulting in MSD. This might explain why there is a protective factor for those who were satisfied with the level and difficulty of work. Our study agreed with the findings of others where inability to vary the pace of work (Bongers et al., 1993; Fredriksson et al., 2000; MacDonald, 2004), dissatisfaction with work organisation (Ariëns et al., 2001; Fredriksson et al., 2000; MacDonald, 2004; Smith et al., 2009; Thorbjornsson et al., 2000) and a poor organisational culture (Ariëns et al., 2001; Bongers et al., 1993; Fredriksson et al., 2000) were all associated with higher severity of MSD.

Rectal palpations and foot trimming are common tasks undertaken by large animal veterinary clinicians. Our findings demonstrated that rectal palpations were associated with MSD, which supports the findings of Cattell (2000) and Chambers et al. (2001). We also showed that foot trimming is associated with MSD, and this is consistent with the findings of Boyle *et al.* (1997), who

demonstrated that foot trimming was associated with a high prevalence of injury.

Our findings corroborate recent findings where Devereux et al. (2002) demonstrated that individuals exposed to both physical (work activities and veterinary procedures) and psychosocial risk factors were more likely to report MSD symptoms than those highly exposed to either of those factors. The findings of our study therefore provide further support for the interaction between physical and psychosocial factors and the prevalence of MSD. The questionnaire, with the exception of the veterinary procedures, did not make a distinction between work and leisure activities from either physical or psychosocial exposures. Similarly, the questionnaire did not include questions about prior medical or MSD history. It is therefore inappropriate to speculate, based on the present data, on the relative role that these factors might play in reported discomfort levels. Future studies of musculoskeletal problems amongst veterinarians should include exploration of the contribution due to non-work activities. Tanaka et al. (2001) estimated that 37% of upper limb musculoskeletal disorders were attributable to work related activities, while Punnett and Wegman (2004) argue that there are many non-work activities such as sporting activities and housework that are related to musculoskeletal disorders. A further limitation of the present study is its cross-sectional and self-reporting nature, which limits its ability to establish meaningful associations with musculoskeletal risk factors. Addressing this issue requires longitudinal studies, for which the present study may serve as a baseline.

There is a shortage of veterinarians, especially within rural areas (Jackson et al., 2004). Within Australia, the attrition rate for rural veterinarians ranges between 3% and 13% (Maxwell et al., 2008). The findings of this study may give an explanation as to why veterinarians are leaving the profession or changing specialities within the profession. A recent study by Heath (2002) in Australian equine veterinarians demonstrated that 25% of males and 8% of females reduced hours within clinical equine practice due to illness, injury or stress. Heath (2007) in a longitudinal study of Australian veterinarians found that 23% veterinarians over a 20-year period were no longer working in the profession.

Further study is required to determine if there is a relationship between MSD and veterinarians either changing speciality or leaving the profession.

The response rate of 41% for the present study is consistent with the average web-based response rate of between 35% and 40% (Cook et al., 2000), and also higher than the average of 38.5% of questionnaires in other studies of MSD in veterinarians (Cattell, 2000; Chambers et al., 2001; Fritschi et al., 2006; Hafer et al., 1996; Hill et al., 1998; Meers et al., 2008; O'Sullivan and Curran, 2008; Reijula et al., 2003). The response rate is likely to be indicative of the concern among veterinarians in regards to MSD, however, the survey potentially could have been subject to selection bias as it could be argued that veterinarians who suffered from MSD had greater motivation to complete the survey.

An additional source of selection bias may have arisen through our exclusion of veterinarians who were no longer registered or working in New Zealand. According to Punnett (1996), who estimated the magnitude of a healthy worker effect on cross-sectional studies, we may have significantly underestimated the effect of MSD in the profession as an unknown number of veterinarians may have left the profession due to MSD. Andersen and Mikkelsen (2008) found that self-reported questionnaires considerably under-report injuries, and thus the results may represent an underestimate. This is perhaps more so in a male-dominated profession (58% (VCNZ, 2007)) in a country which has a high farming and contact sport population in which injury rates are commonplace and accepted (by denial or minimisation), and in which males are known to not visit doctors even when injury or illness is likely or overt. It is also noted that the veterinary profession has a tendency to self-treat (Landercasper et al., 1988).

The measurement of MSD in terms of its effect on absenteeism is thought to have reduced the likely effect of recall bias in this study. According to Baron et al. (1996), the use of a severity scale increases the reliability of a survey. It is noteworthy that results from self-reported musculoskeletal questionnaires are highly correlated with physical musculoskeletal trouble (such as discomfort, aches, pains and disorders) and clinical diagnosis of musculoskeletal disorders

(Baron et al., 1996; Bjorksten et al., 1999; Dane et al., 2002; Punnett and Wegman, 2004).

The participants were asked to estimate time spent on work activities, record satisfaction on workplace as well as estimate the annual number of veterinary procedures undertaken annually. It is noteworthy that the responses were estimations or subjective responses and some participants may have either over or underestimated time or used stronger responses in the subjective comments, which may have affected the results. The collapsing of the categories may have also affected the results.

## **Conclusions**

This study has specifically attempted to address the many deficiencies of previous studies by using a standardised MSQ and proactively facilitating responses to optimise the response rate. We conclude that the prevalence of MSD among New Zealand veterinarians is high and have demonstrated that age, awkward grip and hand movements, level and difficulty of work as well as a range of veterinary procedures are risk factors associated with veterinarians being absent from work due to MSD.

Implications for the veterinary profession with the high prevalence of MSD include pain, discomfort, injury, lost time, loss of productivity, loss of earnings and intangible effects on lifestyle which may result in retention problems for this profession.

The magnitude of the reported prevalence justifies application of further research (e.g. prospective cohort studies, task analysis, verbal protocol analysis, postural analysis or biomechanical analysis) to triangulate data and determine other factors associated with MSD. Further examination of the work that veterinarians undertake is indicated, to make recommendations to reduce the prevalence of MSD within this profession.

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# **Chapter Three: Tasks considered by veterinarians to cause musculoskeletal discomfort and suggested solutions**

Scuffham, A. M., Firth, E. C., Stevenson, M. A. and Legg, S. J. (2009). Tasks considered by veterinarians to cause musculoskeletal discomfort and suggested solutions. Submitted for publication to *New Zealand Veterinary Journal*.

## **Abstract**

**AIMS:** To describe veterinarians' perceptions of the causes of, and reasons for, work-related musculoskeletal discomfort (MSD) and to summarise their suggestions for ways to reduce MSD risk.

**METHODS:** A cross-sectional study administered online asked 2112 veterinarians registered in New Zealand to indicate using free-handed text the three tasks that "will most likely lead to musculoskeletal aches and pains (MSD)", "reasons why are these tasks likely to be the most risky?", and "any solutions that you apply or know of".

**RESULTS:** Complete questionnaires were returned by 828 veterinarians, a response rate of 39%. The tasks considered by veterinarians most likely to lead to MSD were lifting, surgery, rectal palpations, and animal handling. The main reasons why tasks were perceived to be most likely to lead to MSD were awkward posture, repetitive activities, and physical activity. The solutions suggested by veterinarians included provision of appropriate assistance and/or adequate staff, attention to correct manual-handling techniques, provision of facilities to allow work to be carried out a comfortable height, and regular rotation of jobs. Of the 39 solution categories, 16 (43%) were could be categorised as those requiring a change in work environment design and 15 (38%) involved training.

**CONCLUSIONS:** The results of this study indicate that veterinarians perceive the causes of work-related MSD to be related to physical rather than psychosocial factors. We propose that the findings reported in this study provide a useful starting point for the application of a participatory ergonomics approach for addressing the problem of MSD amongst New Zealand veterinarians.

**KEY WORDS:** Animal handling, participatory ergonomics, psychosocial factors, physical factors, veterinary hazards, veterinary procedures

#### Abbreviations

IEA International Ergonomics Association

IQR Interquartile range

MSD Musculoskeletal discomfort

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## Introduction

Musculoskeletal disorders, diseases and discomfort are a major cause of pain, injury, illness, reduced productivity and absenteeism from work (Hagberg *et al.* 1995). Musculoskeletal diseases and disorders are usually medically diagnosed (Hagberg *et al.* 1995), whereas musculoskeletal discomfort (MSD) includes self-assessed musculoskeletal aches and pains (Burton 1998; Hamberg-van Reenen *et al.* 2008) and are a precursor to clinically defined health events (Punnett and Wegman 2004; Hamberg-van Reenen *et al.* 2008).

It is generally acknowledged that MSD is multi-factorial in origin. Both physical and psychosocial factors are generally considered to be risk factors for MSDs. Physical factors include exposure to physical load (weight), awkward postures, prolonged static postures, vibration, repetitive tasks and sedentary tasks (Bernard 1997; Fredriksson *et al.* 2000; Hoogendoorn *et al.* 2000; Thorbjornsson *et al.* 2000; Leclerc *et al.* 2004; MacDonald 2004; Menzel *et al.* 2004; Cote *et al.* 2008). Psychosocial risk factors for MSD include stress, low job satisfaction, hours worked, low job control, time and work demands, and poor organisational culture in the workplace (Waersted and Westgaard 1991; Bongers *et al.* 1993; Fredriksson *et al.* 2000; Ariëns *et al.* 2001; Bongers *et al.* 2002; Hoogendoorn *et al.* 2002; Huang *et al.* 2002; Devereux *et al.* 2004; Leclerc *et al.* 2004; Palliser *et al.* 2005; Cote *et al.* 2008). Sauter and Swanson (1996) described the results of various studies that link psychosocial factors and MSD, with the main pathway identified as stress and increased muscle tension and fatigue. The latter being due to increased muscle contraction resulting in impaired circulation (Grieco *et al.* 1998). Other risk factors for MSD include smoking, gender, non-work activities, obesity, arthritis, gout and muscle strength (Battie *et al.* 1991; Boshuizen *et al.* 1993; Leino-Arjas 1998; Tanaka *et al.* 2001; Punnett and Wegman 2004; Wijnhoven *et al.* 2006; Hooftman *et al.* 2009).

Ergonomics is defined by the International Ergonomics Association (IEA) as “the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the application of appropriate

methods, theory and data to improve human well-being and overall system performance” (Anonymous 2000). Tasks, equipment and machines, personal workspace, the wider workspace, physical environment, work organisation and design as well as financial, legal, technical and social influences all interact with the person who, within the ergonomics paradigm, is at the centre of all work-related interactions (Wilson 2005).

An established approach for reducing the impact of MSD amongst a population of workers is to apply a participatory ergonomics approach. This is defined by Haines *et al.* (2002), as ‘the involvement of people in planning and controlling a significant amount of their own work activities, with sufficient knowledge and power to influence both processes and outcomes in order to achieve desirable goals’. The systematic review by Rivilis *et al.* (2008) found moderate evidence that participatory ergonomic interventions are effective in reducing the incidence of musculoskeletal symptoms, injuries, days lost due to injury and numbers of work-related insurance claims. Key features of a participatory ergonomics approach include the involvement of a team of experts trained in ergonomics principles and the application of those skills and knowledge to the workplace (Rivilis *et al.* 2008). The aim of ergonomics is to achieve the best fit of the task, object, job, system, organisation and environment with the individual. Unfortunately, the most commonly used approaches by non-ergonomists to try to reduce MSD are single interventions such as training or selection, despite evidence that using a design strategy and multi-modal participatory interventions are more effective (Snook 1988; Silverstein and Clark 2004; Rivilis *et al.* 2008). As the ergonomics approach looks at the interaction between people and system elements, the design process needs to take various matters into consideration such as system goals, allocation of tasks, equipment design, people, equipment interactions, tasks interactions, external interactions, work organisation and job design (Buckle 2005; Wilson 2005).

Previous studies have demonstrated a prevalence of musculoskeletal discomfort (MSD) or disorders in veterinarians ranging from 50% to 96% (Hafer *et al.* 1996; Hill *et al.* 1998; Fritschi 2000; Meers *et al.* 2008; O’Sullivan and Curran 2008; Scuffham *et al.* 2009). The wide range of prevalence estimates

cited here is thought to be due to different populations studied, different methodologies used to solicit information from veterinarians and different definitions of what actually constitutes MSD. Reijula *et al.* (2003) showed that inadequate facilities and assistance are major risk factors for injuries and MSD in veterinarians. Manual handling/lifting or moving animals, posture, rectal palpations, feet trimming, repetitive activities, awkward grip or hand movements, exposure to loud noise, obstetric procedures, necropsies, surgical procedures lasting <1 hour, working at high speeds, working outside, or working in a either a cold/damp or hot/warm environment are risk factors that have been demonstrated as being associated with musculoskeletal problems in veterinarians (Boyle *et al.* 1997; Cattell 2000; Chambers *et al.* 2001; Loomans *et al.* 2008; O'Sullivan and Curran 2008; Scuffham *et al.* 2009).

Self-reported psychosocial factors to which veterinarians are exposed and which have been shown to be associated with MSD include boring work, the level and difficulty of work, variation of the pace of work, organisation of work, the requirement to work long hours, high job demands, high levels of job stress, inadequate break periods, lack of holidays, and lack of a clearly defined career structure (Trimpop *et al.* 2000; Gardner and Hini 2006; Hansez *et al.* 2008; Loomans *et al.* 2008; Scuffham *et al.* 2009; Smith *et al.* 2009). Given that all of these factors are established characteristics of veterinary practice it is not surprising that the prevalence of MSD among veterinarians is high.

Although studies such as those listed above have identified various risk factors for MSD, little is known about what veterinarians believe to be factors that cause their MSD. In addition, to the best of our knowledge, no previous work has been done to ask veterinarians what they perceive to be solutions to these problems. The aim of this study was to ask veterinarians what they believed were the causes of work-related MSD, the reasons for their beliefs, and suggestions for ways to reduce MSD risk.

## Materials and methods

### Respondents

The database of the Veterinary Council of New Zealand provided details of 2,585 registered veterinarians on 17 January 2008. The eligible population for this study comprised the 2,112 of the registered veterinarians with a valid email address who had agreed that their contact details could appear in the New Zealand Veterinary Council's register. Veterinarians were sent an email on 10 May 2008, inviting them to complete a questionnaire using a link to an online webpage. Three emails were sent 10, 18 and 51 days after the initial invitation as reminders to complete and return the questionnaire, as did a notice placed in a veterinary magazine and announcements at a national veterinary conference. Respondents included in the study were those who submitted a completed, valid set of responses to the questionnaire. Duplicate responses (i.e. veterinarians completing the questionnaire twice) and questionnaires that had  $\leq 15$  completed questions were excluded from the analyses. Massey University Human Ethics Committee, Palmerston North, New Zealand, provided approval for this study.

### Questionnaire

The questionnaire was developed and trialled on six veterinarians in January 2008. All six veterinarians that took part in the pilot survey returned completed questionnaires with comments and suggestions as to how the questionnaire could be improved.

The questionnaire sought general information on personal attributes (e.g. date of birth, gender) and details of tasks carried out on a regular basis. Respondents were then asked to indicate the three tasks that "will most likely to lead to musculoskeletal aches and pains", reasons "why are these tasks likely to be the most risk?" and "any solutions that you apply or know of". The results in this paper and that presented in Scuffham *et al.* (2009) are from the same cross-sectional study. We acknowledge the subjective nature of responses provided to a survey conducted in this way. Nonetheless we believe this study

provides a useful starting point to addressing an important problem within the veterinary profession and that our findings might be corroborated by further work using alternative data collection methods, such as direct interview and/or direct observation of daily work activities.

## Statistical analysis

Simple frequency calculations were performed on questionnaire responses. A systematic content analysis was carried out on responses to the 'tasks', 'reasons' and 'suggested solutions' sections of the questionnaire. This sought to classify responses that were the same or considered by the analyst to be very similar so as to create a manageable list of key categories for which counts and percentages are reported. 'Suggested solutions' were also categorised into design, training, or selection according to standard ergonomics methodology (Snook 1988). These categories were chosen after collection of the data. We acknowledge that some of the three categories (design, training or selection) could have been classified within multiple categories. Decisions for categorisation were made by the first author by a process of interpreting the meaning of individual survey responses. Classifications were then cross-checked by an independent, suitably qualified individual who was not part of the research team.

Responses were entered directly into a relational database (Microsoft Access 2007, Microsoft Corporation, Redmond, USA) via the questionnaire web page. Survey responses from the database were analysed using the statistical package R version 2.70 (R Development Core Team, 2008) and a spreadsheet (Microsoft Excel 2007, Microsoft Corporation, Redmond, USA).

## Results

Of 961 completed questionnaires in the database, 13 were duplicates and 81 had less than 15 valid responses. A total of 39 respondents did not answer questions regarding tasks that may result in MSD. This left 828 valid responses, equivalent to 39% of the eligible population or 32% of the total number of veterinarians registered in New Zealand in 2008. The mean age of respondents

was 42 (interquartile range [IQR] 33–51) years. A total of 411 (50%) responses were from females. The mean number of years since graduation was 17 (IQR 8–27). Table 1 provides demographic details of those who responded to the survey.

**Table 1.** Practice/organisation type, size of organisation, age and gender counts and percentage comparison between present study, Gardner and Hini (2006) and Veterinary Council of New Zealand (VCNZ) (Anonymous 2008).

	Present study		Gardner and Hini (2006)		VCNZ (2008)	
	n=	%	n=	%	n=	%
Small animal practice	241	29%	254	30%		
Large animal practice <sup>1</sup>	129	16%	82	10%		
Mixed practice	325	39%	280	33%		
Non-clinical	133	16%	203	24%		
Missing			30	3%		
<b>Total</b>	<b>828</b>	<b>100%</b>	<b>849</b>	<b>100%</b>		
<b>Size of organisation</b>						
Work alone	5	1%	71	8%		
1-4	456	55%	336	39%		
5-9	246	30%	264	31%		
>9	111	13%	20.4	2%		
Missing	10	1%	173	20%		
<b>Total</b>	<b>828</b>	<b>100%</b>	<b>849</b>	<b>100%</b>		
<b>Age</b>						
<25	23	3%	19	2%	79	3.0%
25–34	222	27%	215	25%	555	25.0%
35–44	247	29%	277	34%	639	28.0%
45–54	198	24%	223	26%	598	26.0%
55–64	122	15%	84	10%	344	15.0%
≥65	14	2%	20	2%	84	3.0%
Missing	2	0%	11	1%		
<b>Total</b>	<b>828</b>	<b>100%</b>	<b>849</b>	<b>100%</b>	<b>2229</b>	<b>100%</b>
<b>Gender</b>						
Male	414	50%	525	62%	1061	46%
Female	411	50%	319	38%	1238	54%
Missing	3	0%	5	0		
<b>Total</b>	<b>828</b>	<b>100%</b>	<b>849</b>	<b>100%</b>	<b>2299</b>	<b>100%</b>

1: The present study included Equine with Large Animal practice to compare with Gardner and Hini

Respondents identified 2,227 tasks, representing 86% of a possible maximum of 2,484 (828 completed questionnaires × three tasks per questionnaire). Each ‘task’ was categorised into one of 14 classifications, viz animal handling, dehorning/velvetting, dental procedures, footwork/lameness examinations, lifting, use of a motor vehicle, obstetric procedures, office activities, other (including microscopic work, radiography, management, necropsies, research, slips/trips and falls, working outside and non work activities), positioning, rectal palpations, scanning/ultrasounds surgery and tuberculosis testing and/or vaccinations (Table 2).

**Table 2.** Tasks likely to lead to musculoskeletal discomfort among 828 New Zealand veterinarians with the five most frequently cited reasons and the five most frequent cited suggested solutions by veterinarians.

Task, total responses and (%) with top five reasons and solutions	Responses, n= (%)
Animal handling n=208 (9%)	
Responses by practice type	Equine, n=22 (11%); Large animal (LA), n=16 (8%); Mixed, n=54 (26%); Other, n= 8(4%); Regulatory, n=8(4%); Research, n=10 (5%); SA, n=90 (43%).
Top five reasons ( <i>total reasons = 304</i> )	Awkward posture, n=70 (23%); Animal behaviour, n=63 (21%); lifting, n=20 (7%); risk of accidents, n=19 (6%); repetitive activity, n= 14 (5%)
Top five solutions ( <i>total solutions = 240</i> )	Appropriate assistance/adequate staff, n=36 (15%), adequate physical or chemical restraint, n=29 (12%); Adequate working height, n=25 (10%); Risk management, n = 20 (8%); Redesign facilities and/or workspace, n= 18 (7%)
Dehorning/velvetting n=38 (2%)	
Responses by practice type	LA, n=14 (37%); Mixed, n=24(63%)
Top five reasons ( <i>total reasons =61</i> )	Awkward posture, n=16 (26%); repetitive activity, n = 12 (20%); Position and activity of upper limbs, n = 9 (15%); Physical activity, n = 6 (10%); Frequency of procedures, n= 5, (8%); other, n= 5, (8%).
Top five solutions ( <i>total solutions = 40</i> )	Task and job rotation, n = 7 (17%); Refuse/avoid or delegate procedure, n = 6 (15%); Appropriate assistance/adequate staff, n=5 (12%); Use

physical/mechanical devices, n = 5 (12%);

Adequate physical or chemical restraint, n=3 (7%).

Dental n=52 (2%)

Responses by practice type

Equine, n=4(8%); Mixed, n=13(25%); Research, n=1(2%); SA, n=34(65%).

Top five reasons (*total reasons =69*)

Awkward posture, n=29 (42%); Position and activity of upper limbs, n = 9 (13%); Table, n = 8 (12%); repetitive activity, n= 7 (10%); Physical activity, n = 7 (10%).

Top five solutions (*total solutions =59*)

Stool/seating/sitting/standing platform, n = 12 (20%); Adequate working height, n = 8 (14%); Task and job rotation, n = 6 (10%); Redesign or purchase new equipment, n = 5 (8%); Use physical/mechanical devices, n = 4 (7%)

Motor-vehicle use n=29 (1%)

Responses by practice type

Equine, n=2(7%); LA, n=4(14%); Mixed, n=10(35%); Other, n=1(3%); Regulatory, n=11(38%); SA, n=1 (3%).

Top five reasons (*total reasons =33*)

Driving or car seat, n= 23 (70%); Strain or stress on body, n = 5 (15%); Repetitive activity, n= 1 (3%); Other, n = 1 (3%); None, n= 1 (3%).

Top five solutions (*total solutions = 28*)

Drive safely or improve car, n = 8 (29%); Task and job rotation, n = 7 (25%); Maintain fitness and exercise, n = 4 (14%); Stool/seating/sitting/standing platform, n = 2 (7%); other, n= 2 (7%)

Obstetric procedures n=147(7%)

Responses by practice type

Equine, n=5(3%); LA, n=35(24%); Mixed, n=105(71%); Other, n=1(<1%); Regulatory, n=1(<1%).

Top five reasons (*total reasons =216*)

Physical activity, n = 55 (25%); Awkward posture, n=43 (20%); Position and activity of upper limbs, n = 39 (18%); Animal behaviour, n=15 (7%); Other, n= 13 (6%)

Top five solutions (*total solutions = 147*)

Refuse/avoid or delegate procedure, n = 21 (14%); None/do not know, n = 16 (11%); Maintain fitness and exercise, n = 13 (9%); Adequate physical or chemical restraint, n=12 (8%); Improve technique, n=12 (8%).

Footwork/lameness n=136 (6%)

Responses by practice type

Equine, n=18 (13%); LA, n=27 (20%); Mixed, n=81

	(60%); Research, n=5(4%); SA, n=5 (4%).
Top five reasons ( <i>total reasons =210</i> )	Awkward posture, n=70 (33%); lifting, n= 27 (13%); Animal behaviour, n=20 (9%); Position and activity of upper limbs, n = 13 (6%); Repetitive activity, n= 13 (6%).
Top five solutions ( <i>total solutions =142</i> )	Redesign facilities and/or workspace, n= 27 (19%); Use physical/mechanical devices, n = 26 (18%); None/do not know, n = 10 (7%); Appropriate assistance/adequate staff, n=9 (6%); Task and job rotation, n = 8 (6%);
Lifting n=332 (15%)	
Responses by practice type	Equine, n=8(2%); LA, n=5 (1%); Mixed, n=102 (31%); Other, n =12 (4%); Regulatory, n=8(2%); Research, n=10 (3%); SA, n=187(56%).
Top five reasons ( <i>total reasons =402</i> )	Lifting, n= 106 (26%); Animal anthropometrics, n= 62 (15%); Animal behaviour, n=45 (11%); Awkward posture, n=31 (8%); Other, n= 25 (6%).
Top five solutions ( <i>total solutions = 442</i> )	Appropriate assistance/adequate staff, n=145 (33%); Correct manual handling techniques, n= 91 (21%); Lifting device, n= 55 (12%); Adequate working height, n = 37 (8%); Maintain fitness and exercise, n= 20 (12%).
Office activities n=197 (9%)	
Responses by practice type	Equine, n=2 (1%); LA, n=6 (3%); Mixed, n=29 (15%); Other, n =29 (15%); Regulatory, n=55 (28%); Research, n=29 (15%); SA, n=47 (24%).
Top five reasons ( <i>total reasons =226</i> )	Awkward posture, n=54 (24%); Computer work, n = 53 (23%); Frequency of procedures, n= 29, (13%); Repetitive activity, n= 28 (12%); Position and activity of upper limbs, n = 25 (11%).
Top five solutions ( <i>total solutions =231</i> )	Office ergonomics, n= 67 (29%); Task and job rotation, n = 56 (24%); Maintain fitness and exercise, n= 36 (16%); Correct manual handling techniques, n= 11 (9%); Treatment for veterinarian, n= 9 (4%).
Other n=148 (7%)	
Responses by practice type	Equine, n=9 (6%); LA, n=7 (5%); Mixed, n=30 (20%); Other, n =20 (13%); Regulatory, n=36 (24%); Research, n=16 (11%); SA, n=30 (20%).
Top five reasons ( <i>total reasons =165</i> )	Non-work activities, n= 33 (20%); Awkward posture, n=29 (18%); Other, n = 25 (15%); Strain or stress on

	body, n = 13 (8%); Position and activity of upper limbs, n = 12 (7%).
Top five solutions ( <i>total solutions = 160</i> )	Maintain fitness and exercise, n= 24 (15%); Task and job rotation, n = 23 (14%); Risk management, n=19 (12%); Improve clothing and personal protective equipment (PPE), n= 12 (7%); Other, n= 10 (6%).
Positioning n=151 (7 %)	
Responses by practice type	Equine, n=2 (1%); LA, n=6 (4%); Mixed, n=37 (25%); Other, n =13 (9%); Regulatory, n=19 (13%); Research, n=6(4%); SA, n=68(45%).
Top five reasons ( <i>total reasons =142</i> )	Strain or stress on body, n = 57 (40%); Awkward posture, 42 (30%); Other, n= 13 (9%); Time pressure/lack of rest, n= 12 (8%); Poor facilities/slip hazards, n= 5 (3%).
Top five solutions ( <i>total solutions = 161</i> )	Stool/seating/sitting/standing platform, n= 34 (21%); Maintain fitness and exercise, n= 22 (14%); Task and job rotation, n = 22 (14%); Correct manual handling techniques, n= 19 (12%); Improve clothing and personal protective equipment (PPE), n= 13 (8%);
Rectal palpation n=273 (12%)	
Responses by practice type	Equine, n=16(6%); LA, n=71(26%); Mixed, n=178(65%); Other, n=1(<1%); Regulatory, n=4(1%); Research, n=2(<1%); SA, n=1(<1%).
Top five reasons ( <i>total reasons =447</i> )	Repetitive activity, n= 114 (25%); Position and activity of upper limbs, n = 77 (17%); Frequency of procedures, n= 45, (10%); Awkward posture, n=41 (9%); Poor facilities/slip hazards, n = 41 (9%).
Top five solutions ( <i>total solutions =287</i> )	Utilise scanners, n= 44 (15%); Redesign facilities and/or workspace, n= 41 (14%); Task and job rotation, n = 36 (12%); Improve technique, n= 18 (6%); None/do not know, n= 17 (6%).
Scanning / ultrasound n=146 (7%)	
Responses by practice type	Equine, n=5(3%); LA, n=47(32%); Mixed, n=87(60%); Other, n=1(<1%); Research, n=1(<1%); SA, n=5(3%).
Top five reasons ( <i>total reasons =255</i> )	Repetitive activity, n= 84 (33%); Awkward posture, n=50 (20%); Position and activity of upper limbs, n = 31 (12%);

	Frequency of procedures, n= 20, (8%); Poor facilities/slip hazards, n = 16 (6%).
Top five solutions ( <i>total solutions = 168</i> )	Task and job rotation, n = 32 (19%); Redesign facilities and/or workspace, n= 28 (17%); Maintain fitness and exercise, n= 14 (8%); Improve technique, n= 12 (7%); Treatment for veterinarian, n= 12 (7%).
Surgery n= 291 (13%)	
Responses by practice type	Equine, n=8(3%); LA, n=5(2%); Mixed, n=93(32%); Other, n=3(1%); Research, n=6(2%); SA, n=176 (61%).
Top five reasons ( <i>total reasons =371</i> )	Awkward posture, n=191 (52%); Table, n = 34 (9%); Position and activity of upper limbs, n = 30 (8%); Time pressure/lack of rest, n= 26 (7%); Strain or stress on body, n = 24 (6%);
Top five solutions ( <i>total solutions =338</i> )	Adequate working height, n = 102 (30%); Maintain fitness and exercise, n= 59 (17%); Stool / seating / sitting / standing platform, n = 44 (13%); Task and job rotation, n = 29 (9%); Correct manual handling techniques, n = 22 (6%)
Tuberculosis testing/vaccinations n=76 (3%)	
Responses by practice type	LA, n=18(24%); Mixed, n=54(71%); Other, n=3(4%); SA, n=1(1%).
Top five reasons ( <i>total reasons =108</i> )	Repetitive activity, n= 42 (39%); Awkward posture, n=13 (12%); Position and activity of upper limbs, n = 8 (7%); Frequency of procedures, n = 8 (7.4 Physical activity, n = 8 (7%).
Top five solutions ( <i>total solutions = 70</i> )	Improve technique, n= 11 (16%); Redesign facilities and/or workspace, n= 10 (14%); Task and job rotation, n = 10 (14%); Refuse / avoid or delegate procedure, n= 8 (11%); Improve technique, n= 6 (9%).

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Reasons for MSD were categorised into 24 categories; respondents often gave more than one reason, totalling 3,009 responses (Table 3). Suggested solutions were determined to be within one or more of 26 specific categories (Table 4). Categories of suggested solutions were then allocated to design, training, selection or 'other'. Respondents often listed more than one solution. A total of 2,513 responses were recorded. Of the 26 categories of suggested solutions, 11 (42%) were identified as design, 8 (31%) involved training, 3 (12%) selection, and 4 (15%) as identified as 'other' (Table 4).

**Table 3.** Cited reasons for tasks being perceived as being risks for musculoskeletal discomfort among 828 New Zealand veterinarians.

<b>Reasons</b>	<b>Components that made up reasons</b>	<b>Count (%)</b>
Awkward posture	Awkward sustained, poor posture or unaccustomed to work position, sitting or standing.	681 (23%)
Repetitive	Repetitive tasks/actions and activities	356 (12%)
Position and activity of upper limbs	Position of arms/hands/wrists, extended or bent or pressure on arm	278 (9%)
Strain or stress on body	Strain, pain or stress on body, position of body	235 (8%)
Animal behaviour	Uncooperative animal behaviour and handling	183 (6%)
Lifting	Lifting animals, limbs, equipment	168 (6%)
Physical activity	Physical effort, heavy work and fitness, age of veterinarian	162 (5%)
Other	Had other injuries, occurs in the morning, hot equipment, care about animals, one-off risk, not in controlled environment, environmental factors, unavoidable, take the risks, part of the job, too slow to avoid injury, 'yes', self explanatory, problems from previous work, obvious etc	142 (5%)
Frequency of procedures	Frequency and undertaking for long procedures	129 (4%)
Poor facilities / slip hazards	Inadequate or poor facilities, poor workspace, slipper / wet floors or climbing/stepping	120 (4%)
Time pressure / lack of rest	Time pressure, working at high speed, long hours, lack of breaks, fatigue concentrating, delicate or prolonged procedures	107 (4%)
Animal morphometrics	Size, shape, and/or weight of animal	78 (3%)
Table	Table height inadequate, table fixed in position	61 (2%)
Risk of accidents	Risk of accidents (includes bite or kick injuries)	58 (2%)

Computer work	Computer work and set up, constant paperwork	54 (2%)
Non-work activities	Non-work activity cause, sport, age, medical condition	34 (1%)
Equipment	Instrument design, use of blunt instruments, clippers, vaccination guns, scanner probe characteristics, scanner goggles	29 (1.0%)
Motor vehicle use	Driving for prolonged periods	25 (<1%)
Stress or tension	Includes poor working / customer relationships	23 (<1%)
None	'Yes', 'no', none that they know of	23 (<1%)
Position of animal	Position of animal	20 (<1%)
Inadequate assistance	Inadequate/lack of assistance	19 (<1%)
Balance	Difficult to balance, climbing or stepping	17 (<1%)
Surgical access	Difficult surgical access, surgical technique or poor surgical light	7 (<1%)
Total		<b>3,009</b>

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**Table 4.** Suggested ways to reduce the risk of musculoskeletal discomfort among 828 New Zealand veterinarians.

<b>Suggested solutions</b>	<b>Counts (%)</b>	<b>Solution type strategy</b>
<b>(components that made up solutions)</b>		
Task and job rotation (take breaks, task rotation, share/schedule workload, reduce workload)	262 (10%)	Design
Adequate working height (adequate working height, adjustable height or higher table )	191 (8%)	Design
Redesign facilities and/or workspace (improve/redesign facilities and/or workspace, improve flooring, improve cage design/undertake procedures in alternative facilities)	173 (7%)	Design
Stool/seating/sitting/standing platform	127 (5%)	Design
Office ergonomics (set up office equipment, workplace assessment, touch typing or dictate )	84 (3%)	Design
Adequate chemical or physical restraint (appropriate sedation/ anaesthesia/analgesia drug protocols, restrain animal)	82 (3%)	Design
Use physical/mechanical devices (use crush, calving aids, recovery boxes for horses, winches for horses, hip lifter)	67 (3%)	Design
Lifting device (Stretcher/lifting trolley)	63 (2%)	Design
Utilise scanners (purchase or use more scanners, use lighter scanner / probe, adjust level of screen)	54 (2%)	Design
Improve clothing and personal protective equipment (PPE) (improve clothing design or wear better clothing or PPE/knee pads/kneeling or improved or good footwear)	49 (2%)	Design
Re-design or purchase new equipment (improve or maintain equipment; grips on handles or re-design grip, sharpen equipment, improved x-ray machines, automatic vaccination guns)	47 (2%)	Design
Maintain fitness and exercise	235 (9%)	Training

(improve/maintain veterinarians fitness, stretching, moving and exercise)		
Correct manual-handling techniques (good lifting technique, posture, working height, training, don't lift)	203 (8%)	Training
Refuse/avoid or delegate procedure (refuse or avoid procedure, delegate task to others)	104 (4%)	Training
Improve technique (trained or use alternative technique, alternate arms / hands or change grip )	83 (3%)	Training
Risk management (accept risk, emergency preparedness, be careful or unavoidable)	79 (3%)	Training
Educate farmers/owners	18 (<1%)	Training
Reposition animal	16 (<1%)	Training
Drive safely or improve car	9 (<1%)	Training
Appropriate assistance/adequate staff (trained/adequate assistance/adequate staff)	230 (9%)	Selection
Leave speciality/profession (change occupations, specialities or retire)	35 (1%)	Selection
Farmer or owners to assist	30 (1%)	Selection
Treatment for veterinarian (Analgesia, medical treatment, physiotherapy, chiropractor, yoga, support stockings, braces)	67 (3%)	Other
None / don't know	93 (4%)	Other
Other	66 (3%)	Other
Unusable (unusable - contact regulatory authority, animals are difficult, explanation for reasons, no suitable solution, 'turn back the clock' )	46 (2%)	Other
<b>Total</b>	<b>2513</b>	

## Discussion

A unique approach was used in this study to obtain the opinions of registered veterinarians about the causes of and the reasons for MSD and to identify solutions that might help reduce the prevalence of work-related MSD.

Respondents were able to give open-ended responses representing their opinions. This encouraged original thought, rather than using a pre-selected list of potential answers which might have led or biased individual responses.

Despite pilot-testing the questionnaire, 17% of respondents misunderstood the question concerning reasons why they considered each task was most likely to be the most risky to lead to musculoskeletal aches and pains. Allowing open-ended text for responses, rather than pre-written answers, is a shortcoming of this type of questionnaire as respondents may misinterpret the question being asked.

The tasks perceived by veterinarians as being most likely to cause MSD included lifting, surgery, rectal palpations, and animal handling. Lifting has previously been shown to be associated with musculoskeletal pain or injury in veterinarians (Hafer *et al.* 1996; Hill *et al.* 1998; Gabel and Gerberich 2002). The commonly cited reasons for regarding lifting as a risk factor for MSD included variation in the size of animals being handled, animal behaviour, and the awkward postures it often requires. According to D'Souza *et al.* (2009), small animal veterinarians frequently adopt awkward postures or angles to lift animals from floor level. Gabel and Gerberich (2002) found that veterinarians who lifted weights >18.5 kg were at increased risk of injury than those who did not lift at all or used mechanical aids. Hafer *et al.* (1996) and Hill *et al.* (1998) suggested that veterinarians should receive training in lifting heavy objects in order to reduce the incidence of MSD. We would argue that single intervention approaches such as training alone are unlikely to have a substantial impact on MSD prevalence. Experience from other professions is that multi-modal interventions, such as the use of training in combination with other strategies (e.g. the use of mechanical lifting aids) are likely to be more effective as long preventive strategies (Silverstein and Clark 2004; Karsh 2006).

Surgery was of particular concern to respondents as it is a procedure undertaken by most, if not all, involved in clinical practise. The perceived reasons for the association between MSD and surgery included the observation that surgeons frequently work in awkward physical postures. Scuffham *et al.* (2009) identified an association between surgery and self-reported MSD,

consistent with reports associating MSD and surgery in the medical profession (Kant *et al.* 1992; Mirbod *et al.* 1995; Bos *et al.* 2007). Human surgeons work in fixed postures, lean forward with the neck flexed and forward, work with abducted arms and neglect posture as they concentrate during surgery, and thus are at risk of MSD (Mirbod *et al.* 1995). Kant *et al.* (1992) and Bos *et al.* (2007) reported that prolonged standing and awkward postures were associated with an increased prevalence of MSD in operating theatre staff. A commonly cited suggestion for reducing the risk of MSD attributed to surgery was to provide operating tables of a height that matched the stature of the individual surgeon. Specific attention to operating table height would therefore comprise an important component of a multi-modal intervention strategy to reduce MSD risk.

As previous studies have demonstrated an association between rectal palpation of cattle and horses and MSD (Cattell 2000; Chambers *et al.* 2001; Scuffham *et al.* 2009) it was surprising that only 12% of the respondents in the present study regarded rectal palpations as a cause of MSD. Miller (1994) and Ailsby (1996) identified the act of arm extension, the number of palpations carried out on single occasions, as well as short stature of the operator as risk factors for pain resulting from rectal palpation work. Increased use of ultrasonography was commonly cited by respondents as a means to reduce the incidence of MSD arising from rectal palpation work. While this may, at first sight, seem a reasonable strategy it should be noted that Fourie and Hoffman (2004) found that 75% of veterinary ultrasonographers reported work-related MSD arising from scanning, with awkward posture and poor scanning techniques cited as the main contributory factors. Ailsby (1996) recommended that veterinarians modify the rectal palpation procedure by flexing the examining arm 20-25°, with the neck and shoulder flexed forward. Other recommendations include that the use of a stool or platform (Ailsby 1996), having adequate rest between palpations (Cattell 2000) and ensuring that animals are trained in the use of stocks (Miller 1994).

Another unexpected response was that only 3% of respondents identified tuberculosis testing and vaccinations as tasks likely to result in MSD. These

findings are in contrast to those of Hafer *et al.* (1996) who reported an association between musculoskeletal pain and undertaking repetitive tasks such as venipuncture, vaccinations and tuberculosis testing.

Only 4.2% of the reasons for MSD were identified as psychosocial factors, which included stress or tension, lack of breaks and rest, mental demands, and long hours/fatigue. Psychosocial factors are well supported in the literature as being associated with MSD (Bongers *et al.* 1993; Bernard 1997; MacDonald 2004; Waters *et al.* 2007) and it was therefore a surprise that the majority of reasons for MSD cited by respondents included physical rather than psychosocial factors. This may reflected a tendency for the veterinary profession to think of a problem in terms of physical, i.e. tangible issues as opposed to subjective, psychosocial issues. In addition, we note that psychosocial issues can be either a cause or a consequence of MSD, a subtlety in the data that we were unable to detect given the cross-sectional design that was used for this study.

Rotation of tasks and jobs as suggested by respondents has generally been recommended as a control measure to reduce musculoskeletal injury, as this allows different muscles to be used for different tasks (Kuijer *et al.* 1999) and has also been demonstrated to improve job satisfaction (Semmer 2006; Dawal *et al.* 2009). We recommend that rotation of jobs must be considered as a means for reducing MSD among veterinarians. However, care must be taken when transferring from a job of minimal use of muscles to a physically demanding role (Frazer *et al.* 2003; Kuijer *et al.* 2005).

A range of interventions need to be applied to reduce the social, health, economic, and other consequences arising from work-related MSD in veterinarians. Solutions for the reduction of the prevalence of MSD are likely to be complex, due to the large number of procedures undertaken by veterinarians, different facilities they work in, as well the variation between and within animal species. One way forward is to use a participatory ergonomics approach. A participatory ergonomics approach would empower veterinarians to be involved in developing solutions, address multiple risk factors, and utilise experts from several fields. As veterinarians drive the change process, they

should, as a result, have greater commitment to change. For this to succeed, veterinarians from a range of small and large practices, academics, and professional associations should be involved, as well as other stakeholders such as farmers, pet owners, enforcement agencies and abattoir personnel. Commitment to change by all stakeholders, effective leadership, open communication, clear responsibilities, benefits described in tangible (financial) and non-tangible effects (such as reduced sick leave and turnover of staff etc.) are all key components to ensure that a participatory ergonomics approach is effective (Wilson *et al.* 2005; Vink *et al.* 2006).

The response rate of 39% for the present study is consistent with the average web-based response rate of between 35% and 40% (Cook *et al.* 2000). The response rate is likely to be indicative of the concern among veterinarians in regards to MSD. However, the survey potentially could have been subject to selection bias as it could be argued that veterinarians who suffered from MSD had greater motivation to complete the survey, inflating our estimates of MSD prevalence. Potential selection bias to the study may have also occurred due to the use of email to recruit participants. However, as there were very small numbers of veterinarians without an email address we believe that the effect of any selection bias, if it was present, would have been small. Data on type of work and size of organisation for registered veterinarians in New Zealand were not available for comparison and to ensure representation among the various practice/organisation types. However, when we compared the responses to that of Gardner and Hini (2006) (Table 1), we had similar results for the practice type but not for the size of the organisation – partially due to missing data in the Gardner and Hini (2006) study.

The questionnaire did not enquire regarding the effects of non-work activities. Tanaka *et al.* (2001) estimated that 37% of upper limb musculoskeletal disorders in US workers were attributable to work related activities, while Punnett and Wegman (2004) argue that there are many non-work activities such as sporting activities and housework cause MSD. Future studies of musculoskeletal problems amongst veterinarians should include exploration of the contribution due to non-work activities.

In conclusion, lifting, undertaking surgery, rectal palpations and animal handling were the tasks considered by veterinarians that were most likely to result in MSD. The main reasons for MSD were awkward postures, repetitive actions, factors related to animal behaviour, physical activity, lifting, and frequency of procedures undertaken. The most commonly cited solutions by veterinarians to reduce MSD were ensuring that appropriate assistance is available during the conduct of daily work activities, the use of correct manual handling techniques, ensuring that work (particularly surgery) is carried out at a suitable height, and regular rotation of tasks and jobs. We propose that the findings reported in this study provide a useful starting point for the application of a participatory ergonomics approach for addressing the problem of MSD amongst New Zealand veterinarians.

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# Chapter Four: Musculoskeletal problems amongst veterinarians

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## Abstract

This paper reviews the scientific literature on musculoskeletal problems (MSP) amongst veterinarians. It outlines the different definitions that have been used to discuss musculoskeletal discomfort and focuses on the prevalence and nature (discomfort, pain, injury and disorders) of musculoskeletal problems.

Comparison between studies is difficult as most studies used different methodologies, investigated specialised groups or professional association members, used non-standardised questionnaires and had a range of response rates. As a consequence it is not unexpected that the reported prevalence of MSD amongst veterinarians varies considerably.

The physical risk factors for MSP shown are awkward grip and hand movements, awkward postures, dental procedures, foot trimming, manual handling, necropsies, obstetric procedures, rectal palpations, repetitive activities, undertaking surgical procedures. Few studies examined psychosocial risk factors associated with MSD and they found that stress, time pressure, job dissatisfaction and dissatisfaction with the level and difficulty of work.

Further research into veterinary MSP is required using standardised questionnaires and definitions of MSP, prospective cohort studies and studying the psychosocial risk factors.

## **Introduction**

Manual handling and exposure to physical hazards are commonplace in the veterinary profession. Although there is a considerable body of knowledge about occupational hazards amongst veterinarians, very little is known about the consequences of exposure to physical hazards associated with common procedures undertaken in clinical practice. Most readers would intuitively agree with the anecdotal view that the physical hazards associated with handling animals are likely to be high and therefore the prevalence of musculoskeletal problems (MSP) in veterinarians is also likely to be high. The purpose of this paper is to review the literature on musculoskeletal problems amongst veterinarians.

The paper briefly outlines the wide range of occupational hazards to which veterinarians are exposed, and the importance of distinguishing between discomfort, pain, injury and disorders when discussing MSP. It includes a brief discussion of current concepts of the aetiology of MSP, including physical and psychosocial risk factors, in order to help explain the wide range of reported prevalences amongst veterinarians. The review of the literature focuses on the prevalence and nature (discomfort, pain, injury and disorders) of MSP amongst veterinarians as well as prevalence for different body sites. It also considers the evidence concerning risk factors for MSP amongst veterinarians and the tasks/procedures that they perform which may be associated with MSP.

## **Literature search and review methods**

A search of literature was undertaken using the following keywords: "vet\* hazard"; "vet\* musculoskeletal dis\*"; "vet\* msd"; "vet\* wmsd"; "vet\* wrmsd"; "vet\* pain"; "vet\* scan\*", "vet\* manual handling"; "vet\* lifting"; "musculoskeletal dis\*"; "msd"; "wmsd"; "wrmsd" and "work related musculoskeletal dis\*". The following data sources were searched: Web of Science; Ergonomics Abstracts; Google Scholar and Business Source Premier. All referred articles, non refereed articles, abstracts and thesis were considered for inclusion in the review. Four main literature searches were conducted between May 2007 and May 2009.

## **Occupational hazards in the veterinary profession**

The nature of the activities undertaken by veterinarians in clinical practice exposes them to many occupational hazards. These include: animal bites / kicks / scratches, animal allergens, chemicals, fatigue, needle-stick injuries, radiation, biological agents, traffic, stress and zoonotic diseases (Brody 1993; Chambers and others 2001; D'Souza and others 2009; Elbers and others 1996a; Elbers and others 1996b; Faucett and Werner 1999; Fritschi and others 2008; Gaardboe and Andersen 1991; Gabel and Gerberich 2002; Gardner and Hini 2006; Hafer and others 1996; Hansez and others 2008; Hill and others 1998; Jeyaretnam and Jones 2000; Jeyaretnam and others 2000; Landercasper and others 1988; Langley and others 1995; Loomans and others 2008; Lucas and others 2009; Meers and others 2008; Moore and others 1993; Nienhaus and others 2005; Poole and others 1998; Poole and others 1999; Reijula and others 2003; Sebastian 1998; Shirangi and others 2007; Thigpen and Dorn 1973; Trimpop and others 2000; Whitten 1989).

Physical activities such as manually handling and lifting animals (D'Souza and others 2009; Fretz 1989; Gabel and Gerberich 2002; Jeyaretnam and Jones 2000; O'Sullivan and Curran 2008; Thigpen and Dorn 1973) such as horses (Loomans and others 2008; Lucas and others 2009), swine (Hafer and others 1996), and animals in zoos (Hill and others 1998) have all been reported as occupational hazards for veterinarians.

Since stress is implicated as a psychosocial risk factor for MSP (see below), it is worth noting that several studies have reported moderate to high stress levels amongst veterinarians. High job demands, poor interpersonal relationships, requirements to keep up to date with current veterinary knowledge, financial pressure, career prospects, staffing issues, lack of job clarity, as well as the pressure of living in isolated communities have all been associated with stress (Chambers and others 2001; Gardner and Hini 2006; Hansez and others 2008; Reijula and others 2003).

## **The importance of distinguishing between discomfort, pain, injury and disorders when discussing musculoskeletal problems**

The literature concerning MSP is often confusing. One reason is that different authors use the 'D' in the term 'MSD' to variously mean either musculoskeletal 'discomfort' or 'disorders'. Thus, MSD is commonly used to include diseases and disorders of the musculoskeletal system, both of which need to be medically diagnosed using a set criterion or definition (Hagberg and others 1995). Kumar (2001) uses musculoskeletal disorder to describe dysfunction of the musculoskeletal system and defines disorders as a gradual process.

According to the National Institute of Occupational Safety and Health (NIOSH) the initial symptoms of musculoskeletal disorders and impairment are pain and discomfort (Bernard 1997). In contrast, Kuorinka and others (1995) describe MSD as "a physical distress and ... a synonym for inconvenience". 'MSD', in this context, is used to describe musculoskeletal aches and pains which are self-assessed and subjective symptoms (Burton 1998; Hamberg-van Reenen and others 2008), and are a precursor to clinically defined health events (Descatha and others 2008; Hamberg-van Reenen and others 2008; Punnett and Wegman 2004). Descatha and others (2007) demonstrated an association between musculoskeletal discomfort and musculoskeletal disorders as individuals with musculoskeletal symptoms subsequently developed musculoskeletal disorders three years later. In order to avoid this confusion, in the present paper we have used the term musculoskeletal problems (MSP) to encompass musculoskeletal discomfort, pain, injury and disorders.

### **Aetiology of musculoskeletal problems**

It is generally acknowledged that MSP is multi-factorial in origin. Physical and psychosocial factors are generally considered to be risk factors for MSPs. Physical factors include exposure to physical load (weight) (Hoogendoorn and others 2000; Menzel and others 2004), awkward postures (Cote and others 2008; Hoogendoorn and others 2000), prolonged static postures (Bernard

1997), vibration (Thorbjornsson and others 2000), repetitive tasks (Bernard 1997; Cote and others 2008; Fredriksson and others 2000; Leclerc and others 2004), sedentary tasks (Cote and others 2008; Thorbjornsson and others 2000) and prolonged periods of conducting a given task (Bernard 1997; MacDonald 2004).

Psychosocial risk factors include stress (Bongers and others 1993; Bongers and others 2002; Devereux and others 2004; Huang and others 2002; Palliser and others 2005), low job satisfaction (Bongers and others 1993; Hoogendoorn and others 2002), hours worked (Waersted and Westgaard 1991), low job control (Leclerc and others 2004), time and work demands (Bernard 1997; Bongers and others 1993; Cote and others 2008), and poor organisational culture (Ariëns and others 2001; Bongers and others 1993; Fredriksson and others 2000). Sauter & Swanson (1996) describe the results of various studies that link psychosocial factors and MSP, with the main pathway being stress and increased muscle tension and fatigue. The latter being due to increased muscle contraction resulting in impaired circulation (Grieco and others 1998). Work related stress may increase with high work demands, lack of job control and an inability to cope (Bongers and others 1993). Psychosocial factors are influenced by an individual's motivation and coping strategies (Bongers and others 1993; Bongers and others 2002; MacDonald 2004).

Other risk factors for MSP include smoking (Battie and others 1991; Boshuizen and others 1993; Leino-Arjas 1998), gender (Hooftman and others 2009; Wijnhoven and others 2006), obesity, arthritis, gout and muscle strength (Punnett and Wegman 2004). Tanaka and others (2001) estimated that 37% of upper limb musculoskeletal disorders were attributable to work related activities. Punnett and Wegman (2004) argue that there are many non-work activities such as sporting activities and housework that are related to musculoskeletal disorders.

## Prevalence and nature of musculoskeletal problems in veterinarians

Table one summarises the main findings from 16 studies of MSP amongst veterinarians. The table provides details of the methodology and response rates. It also shows the prevalence and the nature (discomfort, pain, injury, disorder) of the MSP and includes, where possible, information about the body region(s) affected.

**Table 1:** Summary of findings from studies of MSP amongst veterinarians.

Source Reference (year)	Description Population studied, number of participants (n) and response rate (x%)	Outcome measure	Key findings
Thigpen and Dorn (1973)	Members of American Veterinary Medical Association Group Insurance Trust.	Analysis of insurance data (1967-1969). Males only. Work related only.	Most common claims involving musculoskeletal problems – sprains (12%), spine/neck injuries, (6.6%) and disk syndrome (3.6%).
Hafer and others (1996)	Members of American Association of Swine Practitioners. n = 936 (65%)	Physical injuries. Cross sectional study. Undefined prevalence time frame. Postal questionnaire.	Back problems from lifting or moving swine (31%). Pain from repetitive activities (bleeding swine and injections with wrists, elbows and fingers affected) (51%).
Hill and others (1998)	Members of American Association of Zoo Veterinarians. n = 279 (49%)	Musculoskeletal injuries and disorders. Cross sectional study. Undefined prevalence time frame. Postal questionnaire.	Back problem and/or pain due to repetitive activities (60%). Lifting or moving animals caused back problems (55%), pain from repetitive activities (20%). Time off work due to a back injury (11%).
Cattell (2000)	Members of American Association of Bovine Practitioners. n = 434 (11%)	Musculoskeletal injury (defined as cumulative traumatic disorder (CTD). Palpation associated acute traumatic injury (ATI). Undefined prevalence time frame. Cross sectional study. Postal questionnaire.	82% had at least one MS symptom. CTD (71%) and ATI (31%) associated with rectal palpation of cattle. CTD reported in shoulder (53%), elbow (32%), wrist (24%) and neck (23%).
Chambers and others (2001)	Members of Australian Association of Cattle Veterinarians. n = 163 (23%)	Work related injuries to back, shoulder, elbow ankle and/or hand injuries. Undefined prevalence time frame. Cross sectional study. Loose leaf questionnaire in journal and facsimiled.	Back injury (42%), hands (45%), shoulder injuries (40%), elbow injuries (40%) and knee injuries (32%). Mild relationship between pregnancy testing and knee, shoulder, ankle and hand injuries.
Reijula and others (2003)	Members of Finland Veterinarians Association under 65 years. n = 785 (67%)	Tasks and psychosocial working conditions. Undefined time frame. Cross sectional study. Postal questionnaire.	Working in improper postures, bent over or back twisted for >1hr per day (40%). Arms above shoulder height (15%). Back pain (40%) and strain in jury upper limbs (25%).
Fourie and Hoffman (2004)	Delegates at International Veterinary Radiology Association conference n = 48 (32%) Abstract only	Work-related musculoskeletal disorders to veterinary sonologists. Cross sectional study. Questionnaire distributed to delegates at conference.	Work-related musculoskeletal disorders – incidence 75%. Normal activities (work, home work and leisure activities) affected – 25%. 83% respondents scanning with discomfort. Poor posture, poor scanning technique, and awkward postures maintained while scanning main contributory factors.

Nienhaus and others (2005)	Veterinarians in Germany insured by BGW.	Analysis of work related insurance data for occupational diseases in 2002. BGW covered 35% of German veterinarians.	Most common claims involving musculoskeletal problems – disc related diseases (7.3%), tendosynovitis (0.2%) and meniscus (0.2%).
Fritschi and others (2006)	Australian veterinarian graduates. n = 2800 (48%)	Chronic or periodic work related musculoskeletal problems. Undefined time frame. Cross sectional study. Postal questionnaire.	Chronic musculoskeletal problems 50%.
Haverkamp (2006)	Veterinarians in Holland n = 260 (45%)	Veterinarians suffering occupational disability for more than three months. Cross sectional study. Postal questionnaire to veterinarians insured by two specific insurance companies.	Musculoskeletal problems (55%) of occupational disability. Average duration of disability 5 ½ years. Mixed practice and large animal veterinarians at higher risk of MSP.
Loomans and others (2008)	Equine veterinarians in Holland. n = 120 selected participants in 36 veterinary practices	Musculoskeletal problems / diseases or injuries. Undefined prevalence time frame. Cross sectional study. Postal questionnaire.	Musculoskeletal problems / diseases / injuries upper body (54%), lower body (22%). Upper body musculoskeletal problems related to handling horses (72%). Sick leave due to musculoskeletal problems upper body (14%) and lower body (14%).
Meers and others (2008)	Veterinarians in Flanders (Belgium) n = 229 (29%)	Suffer back pain or pain in 9 specific body sites. Cross sectional study. Annual prevalence. Questionnaire handed out at conference, training sessions or personal delivery (via personal correspondence).	Stiffness, pain or discomfort (81%), unable to undertake normal tasks within previous year (41%). MS stiffness, pain or discomfort - lower back (62%), shoulders (38%), neck (37%) and knees (21%). Unable to undertake normal tasks – wrists/hands (32%), knees (29%), lower back (20%) and hips (16%).
O'Sullivan and Curran (2008)	Veterinarians in Ireland. n = 89 (9.6%)	Musculoskeletal ill health. Career and annual prevalence of musculoskeletal symptoms. Cross sectional study. Postal questionnaire.	Annual MS symptoms (60%), absent from work over career due to MS symptoms (34%). MS symptoms - low back (35%), neck (25%), shoulders (20%), hands/fingers (19%). Perceived risk factors were working with back bent/sustained posture, handling or lifting animals, tuberculosis testing of cattle and equine pregnancy testing.
Scuffham and others (2009a)	Registered veterinarians in New Zealand n= 828 (39%)	Tasks considered by veterinarians to cause musculoskeletal discomfort and suggested solutions. Cross sectional survey. Web-based survey.	Main tasks considered to be associated with MS discomfort were lifting, surgery, rectal palpations, animal handling, and office activities. The main reasons why 'tasks were considered most likely to lead to MSD' were: awkward posture, repetitive activities, and physical activity. The common 'suggested solutions' were: appropriate assistance / adequate staff, correct manual handling techniques, adequate working height, task and job rotation.
Scuffham and others (2009b)	Registered veterinarians in New Zealand n= 867 (41%)	Musculoskeletal discomfort. previous twelve months Modified Nordic musculoskeletal questionnaire Modified job content questionnaire Cross sectional survey Web-based survey.	Prevalence of musculoskeletal discomfort (96%), normal activities affected (67%) and absenteeism (18%). MSD discomfort - lower back (73%), shoulders (59%), neck (58%) and wrists/hands (52%). Age, awkward grip and hand movements, dissatisfaction with the level and difficulty of their work were associated with musculoskeletal discomfort necessitating absenteeism from work. Procedures associated with MS discomfort were dentals foot trimming, necropsies, obstetrics rectal palpations and short surgeries

According to Cattell (2000), 82% of cattle veterinarians had MSP with the shoulder (53%), elbow (32%), neck (23%), knee (18%) and hip (10%) being the body sites most commonly affected. The response rate in this study was very low (11%), making it hard to determine how representative the findings were of the cattle veterinarian population studied.

Chambers and others (2001) found that 42.3% of cattle veterinarians had a back, neck or head injury. They also found that between 36.8% and 44.8% of respondents had a hand, elbow or shoulder injury. They noted that some of the injuries were the results of head injuries, motor vehicle accidents or sport.

Reijula and others (2003) studied the occupational health of 783 Finnish veterinarians. Their study included questions on musculoskeletal discomfort, physical strain and the work environment. Forty percent of the respondents reported a back injury, while 25% had an upper limb injury and 34% had neck or shoulder pain.

Fritschi and others (2006) found that 50% of Australian veterinarian graduates had chronic musculoskeletal problems, with those more affected working in mixed animal practices. They did not define musculoskeletal problems, the length of time that the problems may have occurred, nor give any information about the body regional location of the problem.

Haverkamp (2006) found in a study of 260 veterinarians in the Netherlands that the majority (55%) of occupational disabilities were due to musculoskeletal problems but did not define "occupational disability". The back (23%), shoulder (15%), neck (14%) and knee (13%) were the body sites most affected.

O'Sullivan and Curran (2008) studied musculoskeletal ill health among veterinarians in Ireland. The annual prevalence of musculoskeletal symptoms was 60%, with 34% being absent from work at some time over their career due to musculoskeletal symptoms. The lower back (35%), neck (25%), shoulders (20%), hands/fingers (19%) were the body sites that were most affected with musculoskeletal symptoms. The response rate in this study was very low

(9.6%), making it hard to determine how representative the findings were of the general veterinarian population in Ireland.

Meers and others (2008) studied Belgian veterinarians and used various methods as described in Table 1 to distribute a questionnaire (C. Meers, personal communication 21 March 2009). Respondents were asked if they suffered pain in nine body sites and if it influenced their professional practice (C. Meers, personal communication 21 March 2009). Of 229 respondents, 81% had stiffness, pain or discomfort and 41% were unable to undertake normal tasks within the previous year. The body sites affected for stiffness, pain or discomfort and inability to undertake normal tasks respectively were lower back (62%, 20%), shoulders (38%, 9%), neck (37%, 5%) and knees (21%, 29%), wrists/hands (14%, 32%), and hips (16%, 16%).

Smith and others (2009) studied registered veterinarians in Queensland, Australia. In a postal questionnaire, they used a modified Nordic musculoskeletal questionnaire and asked veterinarians to report perceived stress levels with respect to career structure, peer support, time pressures and clients attitude. They reported that 66% of veterinarians had musculoskeletal disorders in the lower back, neck (57%), shoulder (52%) and upper back 52%. They did not give an overall prevalence of MSD, nor did they use a standardised psychosocial questionnaire.

Loomans and others (2008) studied 120 selected Dutch equine veterinarians and found respondents reported MSP to the upper body 54% and lower body 22%. The majority of musculoskeletal problems related to work and handling horses. They also reported that sick leave was due to musculoskeletal problems in the upper body (14%) and lower body (14%).

The recent study by Scuffham and others (2009b) found the period prevalence of MSD was 96% (95% CI 94%-97%), 67% (95% CI 64%-70%) for normal activities affected and MSD necessitated 18% (95% CI 16%-21%) of veterinarians being absent from work. They found the lower back the most commonly affected body site with 73% reporting MSD trouble, 42% (95% CI 39%-46%) and 9% (95% CI 8%-12%) having normal activities affected and

being absent from work, respectively. The shoulders, neck and the wrists/hands were the body sites next affected. Undertaking dental procedures, foot trimming, necropsies, obstetrical procedures, rectal palpations and surgical procedures less than one hour were the procedures associated with MSD. The multivariate analysis for MSD necessitating clinicians being absent from work found that increases in age (OR 1.26), the proportion of time spent with work involving awkward grip or hand moments (OR 12.91) and dissatisfaction with the amount and difficulty of work (OR 2.27).

Three publications (Haverkamp 2006; Nienhaus and others 2005; Thigpen and Dorn 1973) analysed insurance data or surveyed those who have made workers insurance claims to determine MSP or injuries to veterinarians. Using the insurance data is biased, as not all veterinarians will claim insurance. However, those who claim insurance will generally be those who are most severely affected. Haverkamp (2006) found musculoskeletal disability resulted in 55% of occupational disability in veterinarians. The study by Nienhaus and others (2005) did not undertake study prevalence, but found that seven percent of their insurance claims were disc related problems. Thigpen and Dorn (1973) found that sprains and strains and spine/neck problems were the most common insurance claims. It is notable that 55% (Gabel 2000) and 77% (Landercaasper and others 1988) of veterinarians engaged in self-treatment of injuries and thus may affect veterinarians insurance data.

Overall, the prevalence of MSP among veterinarians ranges from 50% (Fritschi and others 2006) to 96% (Scuffham and others 2009b). The body sites most affected were: lower back, with a mean prevalence of 51% (range 45% to 67%, 8 studies); followed by the shoulder, 44% (range 20% to 59%, 6 studies); neck, 40% (range 23% to 58%, 5 studies); hands / wrists / fingers, 31% (range 14% to 52%, 5 studies) and elbows at 28% (range 12% to 40%, 4 studies). This is in line with other industries (Battie and others 2007; Hagberg and others 1995; MacDonald and Evans 2006). The studies by Cattell (2000) and Chambers and others (2001) were the only studies to demonstrate a task with particular body sites and MSP. The body site and tasks should be examined to determine any specific associations between them.

There is potentially a substantial response bias in self reported studies. The average response rates of the studies included in Table one was 35% (range 10% to 67%). It is possible that response rates may have a marked influence on the reported findings as they may not be representative of the population studied because of the potential for only those respondents with a strong opinion replying. According to Templeton and others (1997) low response rates do not necessarily affect the validity of the data. It is noteworthy that none of the 13 cross-sectional studies examined had included non-respondents. Research involving non-respondents needs to be conducted so the populations of respondents and non respondents can be compared with appropriate corrections made to the data. To validate self-reported MSP, a clinician could medically examine a sample of veterinarians. A study could be restricted to those who have sought medical treatment, but this may also result in self selection.

Of the 16 studies examined, 13 were cross-sectional studies. The cross sectional studies are a snap shot of the population at a particular point in time. It is possible that bias may occur with cross-sectional studies due to self selection into or out of the study. Cross-sectional studies also make it difficult to determine cause and effect. A longitudinal study such as a prospective cohort study would be beneficial to undertake in a veterinary population as variables within the veterinarians and their environment should be able to control over time. Gabel and Gerberich (2002) used a nested case-control study design to investigate injuries and risk factors to veterinarians and not MSP.

## Summary

MSP prevalence's range from 50% (Fritschi and others 2006) to 96% (Scuffham and others 2009b) (Table 1). The range of MSP prevalence for body sites also varies considerably. Prevalence's for the lower back range from 31% (Hafer and others 1996) to 73% (Scuffham and others 2009b), the neck 23% (Cattell 2000) to 58% (Scuffham and others 2009b) and shoulders 20% (O'Sullivan and Curran 2008) to 59% (Scuffham and others 2009b). Most of the studies of the prevalence and nature of MSP amongst veterinarians have used different

methodologies, investigated specialised groups or professional association members, and used different and non-standardised questionnaires. It is therefore not surprising that the reported prevalence varies considerably. A gap in the literature is that the most of reported studies were cross-sectional. No study to date has used a powerful study design such as a prospective cohort study to control any variables over time and reduce self selection biases.

## **Risk factors for MSP amongst veterinarians**

The risk factors for MSP amongst veterinarians are similar to those identified for MSP in general. They include physical (manual handling) and psychosocial factors. This section summarises the literature about both of these factors.

### **Manual handling risk factors**

Gabel & Gerberich (2002) in a retrospective cohort study of Minnesota veterinarians demonstrated that those who lifted weights greater than 18.5 kg had an increased incidence of injury compared with those who did not lift at all or used mechanical aids. Hafer and others (1996) reported 31% of swine veterinarians had back pain due to manual handling or movement of pigs. Hill and others (1998) found that 55% of zoo veterinarians, had back pain from manually handling animals. O'Sullivan and Curran (2008) found that handling or lifting animals were tasks that veterinarians considered were associated with MSP. Lifting and animal handling were tasks considered by veterinarians to be most likely to result in MSP (Scuffham and others 2009a). Interestingly, Scuffham and others (2009b) did not find an association with MSP and the aforementioned tasks.

Within small animal veterinary clinics in the United Kingdom, 40% of practices used a trolley and 68% used a stretcher to transport animals (D'Souza and others 2009). D'Souza and others also found that it was routine in 95% of practices to treat heavy dogs on the floor. Treating heavy dogs on the floor may reduce the risk of injury due to lifting, however, the veterinarians will place themselves at risk of MSP by assuming awkward postures (D'Souza and others 2009).

According to Reijula and others (2003), over 33% of veterinarians worked in awkward postures and 15% worked with arms raised over shoulder level for over one hour per day. Working with arms raised is a risk factor for neck and shoulder MSP (Palmer and others 2001). Scuffham (2009b) found that awkward and tiring postures as well as carrying out repetitive tasks were associated with MSD. Loomans and others (2008), O'Sullivan and Curran (2008) and Scuffham and others (2009a) found that veterinarians perceived working with awkward postures is associated with MSP.

Hafer and others (1996) in a study of occupational hazards reported by members of American Association of Swine Practitioners showed 51% of participants had pain due to repetitive actions due to the equipment used whilst undertaking venepuncture or injections. Hill and others (1998) studied zoo veterinarians and found that 20% had pain as a result of repetitive actions. It is notable that this study is specific to zoo veterinarians and the results may not be valid for other occupational groups.

Miller (1994) after informal discussions with equine veterinarian colleagues found that shoulder problems were common among his colleagues. Miller considered that these problems were due to horses jerking on the lead rope, rectal palpations and dental procedures. Miller (2005) also found that female colleagues did not have shoulder pain – as he summarised that they let the lead rope go on the horse and did not fight the horse. He also considered that height was a protective factor to prevent shoulder injuries as the veterinarians do not have to reach. However, he commented that tall veterinarians have lower back problems. It is notable that no further study has used Miller's work to examine his hypothesis further.

## Psychosocial risk factors

There have only been three studies where any association between psychosocial risk factors and MSP has been examined. Scuffham and others (2009b) found difficulty of work, varying pace, work organisation, organisational culture as well as dissatisfaction with the level were associated with musculoskeletal discomfort. They found that those veterinarians who were

satisfied with the level and difficulty of work had reduced odds of having MSD was a protective factor. Smith and others (2009) found stress, career structure, time pressures, clients attitude, lack of public and colleague recognition, lack of understanding and lack of holidays were all associated with MSP within specific body sites. Loomans and others (2008) found that equine veterinarians considered that some MSP were caused by work-related stress. Scuffham and others did not find an association with stress and MSP and therefore disagreed with the findings from Smith and others and Loomans and others. Neither of the aforementioned studies defined stress, how they measured stress and if they used a standardised psychosocial questionnaire such as Karasek and others (1998) job content questionnaire.

It is notable that Scuffham and others (2009a) asked veterinarians the reasons why 'tasks likely to be the most risky' result in MSP, and few (4%) veterinarians considered psychosocial risk factors to be associated with MSP. A possible explanation for these results is that there is a tendency for the veterinary profession to think of a problem in terms of physical (i.e. tangible) issues as opposed to subjective (psychosocial) issues.

## Summary

Manual handling and lifting are the most commonly reported risk factor associated with MSP for veterinarians (Gabel and Gerberich 2002; Hafer and others 1996; Hill and others 1998; O'Sullivan and Curran 2008; Scuffham and others 2009a). Posture has been implicated as a risk factor with arms raised over shoulder level (Reijula and others 2003), working at the floor level (D'Souza and others 2009) and awkward postures (Scuffham and others 2009b). Difficulty of work, varying pace, work organisation, organisational culture (Scuffham and others 2009b), stress (Loomans and others 2008; Smith and others 2009), time pressure (Smith and others 2009) and job dissatisfaction (Smith and others 2009) have all also been implicated as psychosocial factors associated with MSP.

## **Veterinary tasks related to MSP**

Various tasks or commonly performed procedures have been shown to be associated with MSP in veterinarians. For example, Scuffham (2009b) have shown that necropsy, dental, obstetric and surgical procedures are associated with MSP. However the procedures most commonly shown to be associated with MSP are: rectal palpations (undertaken during the course of manual pregnancy testing); ultrasonographic examinations and foot trimming.

### **Rectal palpations**

Ailsby (1996), a human orthopaedic surgeon, was the first to report an association between rectal palpations and MSP in veterinarians. He found that veterinarians reported a syndrome of arm, shoulder and neck pain as well as neurological damage, and that the pain worsened during periods of undertaking rectal palpations and improved during resting in the off season (i.e. when no rectal palpations were performed). Ailsby (1996) commented that veterinarians of shorter stature were at higher risk of this syndrome. Cattell (2000) in a low response study (11%) demonstrated an association between cumulative trauma disorder (CTD) with for a limb used and undertaking pregnancy testing of cattle. However, Catell's study did not show an association between the number of hours worked per day or the number of cows palpated per day and CTD. In contrast, Chambers and others (2001) in a low response study of 23% found an association between the number of pregnancy testing undertaken and risk of injury. Scuffham and others (2009b) demonstrated that rectal palpation was associated with musculoskeletal discomfort. O'Sullivan and Curran (2008) and Scuffham and others (2009a) found that palpation was a risk factor considered by veterinarians to be associated with MSP. Singleton (2005) in a letter to "The Veterinary Record" commented that within one practice, there were three shoulder injuries within 12 months to large animal veterinarians and had attributed their problems to working with cattle. Singleton believed that the large numbers of rectal palpations undertaken daily and the height of cows are causative factors for the shoulder problems. It is noteworthy that no study to

date has investigated whether the height of cows is associated with MSP in veterinarians.

## Ultrasonographic examinations

According to an abstract by Fourie and Hoffman (2004), 75% of veterinary ultrasonographers reported MSP and 83% reported discomfort resulting from scanning. Awkward posture and poor scanning techniques were identified as the main contributory factors. In human ultrasonographers twisting, reaching, arm abduction and forceful gripping are associated with musculoskeletal dysfunction (Brown and Baker 2004). These risks may also apply to veterinary ultrasonographers. Human and veterinary ultrasonographers use similar equipment; however the differences between the various species and procedures must be taken into account though. According to Scuffham and others (2009a), veterinarians considered scanning was associated with MSP, however, statistical analysis did not confirm this (Scuffham and others 2009b).

## Foot trimming

Boyle and others (1997) found an association with foot trimming of cattle and injury, while Scuffham and others (2009b) demonstrated that foot trimming was associated with musculoskeletal discomfort.

## Tasks considered by veterinarians to cause musculoskeletal aches and pains

Scuffham and others (2009a) asked veterinarians a) to determine tasks that 'will most likely to lead to musculoskeletal aches and pains, b) reasons: 'why are these tasks likely to be the most risky' and c) 'any solutions that you apply or know of'. The tasks considered most likely to lead to musculoskeletal aches and pains (MSAP) were: lifting, surgery, rectal palpations, animal handling, and office activities. Awkward posture, repetitive activities, and physical activity were the main reasons why veterinarians considered tasks to be associated with MSAP. The common 'suggested solutions' were: appropriate assistance / adequate staff, correct manual handling techniques, adequate working height,

task and job rotation. This paper by Scuffham and others was the first study to solicit opinions of veterinarians of the causes of MSP and to try to proactively address identification of solutions.

## Summary

There is considerable evidence that performing rectal palpations as part of pregnancy testing is associated with MSP. The studies by Cattell (2000), Chambers and others (2001) and O'Sullivan and Curran (2008) all had low response rates, which must be taken into account with their results. There is only one paper (Fourie and Hoffman 2004) that showed an association between MSD and ultrasonographic examinations, which is surprising as it has been associated with MSP in human ultrasonographers. Awkward posture, repetitive activities, and physical activity were the main reasons why veterinarians considered tasks to be associated with MSAP, whilst the common 'suggested solutions' to MSAP were: appropriate assistance / adequate staff, correct manual handling techniques, adequate working height, task and job rotation.

## Conclusions

Veterinarians are exposed to a range of physical and psychosocial occupational hazards that are associated with MSP.

This review has shown that there is a range of reported prevalence 50% of MSP from (Fritschi and others 2006) to 96% (Scuffham and others 2009b) within veterinarians. This may be due to different definitions, methodologies used, a wide range of response rates as well as the research studying different populations such as Belgian (Meers and others 2008) or New Zealand veterinarians (Scuffham and others 2009b), zoological (Hill and others 1998), swine (Hafer and others 1996), cattle veterinarians (Cattell 2000; Chambers and others 2001) or selected populations such as members of professional associations. The lower back is the body site most affected in veterinarians followed by the shoulders and neck.

Although there is a plethora of evidence which demonstrates that physical and psychosocial risk factors are associated with MSP in the general population and in many occupational groups, research into MSP in veterinarians has predominately been focused on the physical risk factors, such as animal/manual handling (D'Souza and others 2009; Gabel and Gerberich 2002; Hafer and others 1996; Hill and others 1998), rectal palpations (Cattell 2000; Chambers and others 2001) or tasks (Hill and others 1998; O'Sullivan and Curran 2008).

Tasks considered most likely to lead to MSAP were: lifting, surgery, rectal palpations, animal handling, and office activities. Awkward posture, repetitive activities, and physical activity were the main reasons why veterinarians considered tasks to be associated with MSAP. The common 'suggested solutions' were: appropriate assistance / adequate staff, correct manual handling techniques, adequate working height, task and job rotation.

The variation and magnitude of the reported prevalence justifies the need for further research (e.g. prospective cohort studies, task analysis, verbal protocol analysis, postural analysis or biomechanical analysis); this research should be undertaken to triangulate data and determine other factors associated with MSD. It is essential that any further studies on MSP in veterinarians use a standardised musculoskeletal questionnaire with clear definitions of MSP to enable comparison between studies. The lack of studies into psychosocial risk factors and MSP is also an area that needs to be addressed, by using a standardised questionnaire, such as a job content questionnaire (Karasek and others 1998). Future study should also include a proactive participative approach to identification of ways for veterinarians to avoid or minimise their risks of MSP.

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## Chapter Five: Discussion

The aims of the research were to determine the period prevalence and risk factors associated with musculoskeletal discomfort in New Zealand veterinarians, determine the tasks considered by veterinarians to cause musculoskeletal discomfort and to conduct a literature review of musculoskeletal problems in veterinarians. The results of each study have already been discussed within each chapter. The purpose of this Chapter is to discuss the overall findings from the three chapters, to outline limitations of the research, and make recommendations on directions and scope of future research.

Chapter Two “The prevalence and risk factors associated with musculoskeletal discomfort in New Zealand veterinarians (Scuffham, Legg et al., 2009)” demonstrated that the period prevalence of MSD in New Zealand veterinarians is very high in all three severity factors (MSD trouble, MSD affecting normal activities, and MSD necessitating absence from work). The 96% period prevalence of MSD was considerably higher than that reported in previous studies of veterinarians (Cattell, 2000; Chambers et al., 2001; Hafer et al., 1996; Hill et al., 1998; Meers et al., 2008; O’Sullivan & Curran, 2008). A high percentage (67%) of participants had their normal activities affected by MSD, which indicates that MSD has an effect on the lifestyle of veterinarians as well as most likely having an effect on their quality of life. The reported 18% absence of veterinarians from work due to MSD is considered to be a very important finding as it has implications for both the employer and the veterinarian through lost time, loss of productivity, loss of earnings and intangible effects on lifestyle. Overall, the high prevalence of MSD and its effect on quality of life could potentially have an impact on the loss of veterinarians from the profession or workforce. For example, a veterinary practice will need to find a replacement veterinarian for those absent due to MSD. The veterinarian may have a reduced income during the absence and there will be additional locum costs for the practice. These findings therefore have an important economic impact on veterinarians and the respective organisational stakeholders.

The findings of the present study showed multiple risk factors associated with MSD in veterinarians which have not been identified in previous research. This may be due to the thorough methodology of the present study where the numbers of risk factors considered were more numerous than in previous studies.

Chapter Three examined veterinarians' perceptions of causes and reasons of MSD as well as their suggested solutions (Scuffham, Firth et al., 2009). Within this chapter, open ended questions were used and this enabled veterinarians to answer questions in their own specific way, rather than having predetermined answers, such as tick boxes, which may limit the answers given.

The veterinarians considered that the tasks most likely to lead to MSD were lifting, surgery, rectal palpations, animal handling, and office activities.

Most of the reasons veterinarians 'considered most likely to lead to MSD' were physical factors, rather than psychosocial risk factors such as fatigue, stress or job dissatisfaction etc. This finding possibly reflects a tendency for the veterinary profession to think of a problem in terms of physical (i.e. tangible) issues as opposed to subjective (psychosocial) issues.

The most commonly 'suggested solutions' were provision of appropriate assistance and/or adequate staff, correct manual handling techniques, adequate working height, task, and job rotation. Solutions most commonly suggested were training and education or selection strategies (e.g. ensuring appropriate staff present, employing strong fit males). By contrast, it has been shown that design strategies (such as using mechanical devices) to prevent injuries and MSD are most effective (Snook, 1988).

An example of task redesign could be the use of hormonal testing of milk or faecal samples to determine pregnancy rather than using rectal palpations or ultrasonography. There may however be some resistance to this kind of task redesign, as veterinarians do use pregnancy testing as part of a herd health programme and this technique may result in the veterinarians having less contact time with livestock and farmers.

Solutions for the reduction of the prevalence of MSD are likely to be complex, due to the large number of procedures undertaken by veterinarians, different facilities they work in, as well the variation between and within animal species. One way forward is to use participatory ergonomics, which is defined by Haines et al. (2002) as “the involvement of people in planning and controlling a significant amount of their own work activities, with sufficient knowledge and power to influence both processes and outcomes in order to achieve desirable goals”. A participatory ergonomics approach may be seen as a partnership with all stakeholders, being consultative in decision making and empowering the users to control the problem.

A systematic review on 10 participatory ergonomics interventions found partial evidence that musculoskeletal symptoms, injuries, workers compensation claims and sick days were reduced (Cole et al., 2005). Participatory ergonomics is effective in reducing MSD in various industries (Rivilis et al., 2008) such as construction (Vink et al., 1997), food (Moore & Garg, 1997), healthcare (Lee et al., 2006) and manufacturing (Laing et al., 2005). There are limited studies reporting on the use of a participatory ergonomics approach across an entire industry (Tappin, 2008). Having a suitable structure, financial implications, ensuring appropriate representation, conflicting interests, confidentiality issues, as well as the logistics of organising meetings are all potential obstacles to having industry wide participatory ergonomics approaches (Tappin, 2008).

A participatory ergonomics approach empowers veterinarians to be involved in developing solutions, addresses multiple risk factors, and utilises experts from several fields. As the veterinarians are driving the change process, they should have greater commitment to change.

There are various organisational and seasonal factors conspiring against genuine change. Lack of time and resources, unrealistic expectations, lack of enthusiasm, securing commitment from management and stakeholders (including farmers) are all possible impediments to using a participatory ergonomics approach (Kuorinka, 1997; Wilson et al., 2005).

The keys to an effective participatory programme include: commitment to change by all stakeholders, all stakeholders should be involved, ensure senior management commitment, effective leadership, have appropriate resources, have a suitable facilitator, open communication and consultation between all parties, clear responsibilities, have a clearly defined process and goals, train all personnel in the participatory ergonomics process, benefits described in tangible (financial) and non-tangible effects (such as reduced sick leave and turnover of staff etc.) (Van Eerd et al., 2008, Vink et al., 2006, Wilson, 2005). For the participatory ergonomics approach to succeed, veterinarians from a range of small and large practices, academics, and professional associations should be involved, as well as other stakeholders such as farmers, pet owners, enforcement agencies and abattoirs.

Chapter Four of the thesis “Musculoskeletal Problems in Veterinarians (Scuffham, Stevenson et al., 2009)” reviewed the academic literature on musculoskeletal problems amongst veterinarians and likely contributing factors. It focused on the prevalence and nature (discomfort, pain, injury and disorders) of MSP amongst veterinarians. It also considered the evidence concerning risk factors for MSP amongst veterinarians.

The variations of terminology used to define musculoskeletal problems can and does cause confusion within the scientific literature. Various terms are used to describe musculoskeletal pain, injury, symptoms, trouble, diseases/disorders and discomfort. The latter term includes self-assessed musculoskeletal aches and pains (Burton, 1998; Hamberg-van Reenen et al., 2008), which can be a precursor to clinically defined health events (Hamberg-van Reenen et al., 2008; Punnett & Wegman, 2004). Unfortunately, the term is commonly used to include diseases and disorders of the musculoskeletal system, both of which usually can be medically diagnosed according to set criteria or definitions (Hagberg et al., 1995).

The prevalence of musculoskeletal problems for veterinarians ranges from 50% (Fritschi et al., 2006) to 82% (Cattell, 2000). Comparison between studies is difficult as most studies used different methodologies, investigated specialised groups or professional association members and used non-standardised

questionnaires. Consequently it is not surprising that the reported prevalence of MSD amongst veterinarians varies considerably, but is always high.

Awkward postures (Loomans et al., 2008; O'Sullivan & Curran, 2008), foot trimming (Boyle et al., 1997), manual handling (Gabel & Gerberich, 2002; Hill et al., 1998; Loomans et al., 2008), rectal palpations (Cattell, 2000; Chambers et al., 2001), repetitive activities (Hafer et al., 1996; Hill et al., 1998) and ultrasonography (Fourie & Hoffman, 2004) were the most commonly reported physical risk factors associated with MSP in veterinarians. Only two recent studies on veterinarians (Loomans et al., 2008; Smith et al., 2009) implicated psychosocial risk factors with MSP. The lack of research into psychosocial risk factors associated with MSP is surprising, considering the large number of publications showing the relationship between psychosocial factors and MSP in other occupational groups (Bongers et al., 1993; Bongers et al., 2002; Devereux et al., 2004; Hoogendoorn, 2002; MacDonald, 2003; MacDonald, 2004).

With such a high prevalence of MSD amongst veterinarians, there are significant implications within the veterinary profession. According to Hamberg-van Reenen et al. (2008), musculoskeletal pain will develop in 33% of those people who have reported musculoskeletal discomfort within a two year time period. Since this study has shown such a high prevalence of MSD amongst New Zealand Veterinarians, it is likely that nearly one third of New Zealand veterinarians will have musculoskeletal pain. This will clearly have an important impact on their lifestyle and long term career options.

As various physical tasks have been associated with MSD, these tasks will have to be redesigned to reduce the MSD impact on the veterinarian. Without such interventions, veterinarians will continue to be placed at risk of MSD.

## **Limitations of the present research**

Various limitations to the research are discussed and outlined in Chapter Two and Three.

A 41% response rate may be considered a limitation of the study. However, as discussed in Chapter Two, this response rate is higher than the average response rate of 38.5% of questionnaires in other studies of MSD in veterinarians. Thus the response rate in the present study is somewhat better (and certainly no worse than most other similar studies).

Potential selection bias to the study may have occurred due to the use of email to recruit participants. However, as there were very small numbers of veterinarians without an email address, any selection bias will have been small.

According to Punnett (1996), who estimated the magnitude of a healthy worker effect on cross-sectional studies, we may have significantly underestimated the effect of MSD in the profession as an unknown number of veterinarians may have left the profession due to MSD. Andersen and Mikkelsen (2008) found that self-reported questionnaires considerably under-report injuries, and thus the results may represent an underestimate.

The measurement of MSD in terms of its effect on absenteeism is thought to have reduced the likely effect of recall bias in this study. According to Baron *et al.*(1996), the use of a severity scale increases the reliability of a survey. As discussed in Chapter Two, self-reported musculoskeletal questionnaires are highly correlated with physical musculoskeletal trouble (such as discomfort, aches, pains and disorders) and clinical diagnosis of musculoskeletal disorders (Baron *et al.*, 1996; Bjorksten *et al.*, 1999; Dane *et al.*, 2002; Punnett & Wegman, 2004).

Within Chapter Three, it is acknowledged that respondents were able to give open-ended responses representing their opinions. This allowed them to make their own choices, thus encouraging original thought, rather than using a pre-selected list of potential answers which might have led or biased the responses. The responses were very subjective based on the veterinarians perceptions and appreciation of MSD. Age, experience, location, type of practice, facilities, equipment, type of animals treated and clients served will affect the veterinarians perceptions of MSD risks, “reasons” and “suggested solutions”.

It is recognised that the classification of the responses used for Chapter Three, “tasks”, “reasons” and “suggested solutions” maybe considered by some as subjective and that some bias may have occurred with the classifications. A systematic process was used to determine the most likely and appropriate categories to reduce any bias.

## **Future research**

The present study examined only MSD in currently registered veterinarians. It did not include veterinarians who have left the profession, veterinary students or support workers (such as veterinary nurses or technicians). The investigation of MSD in these populations is recommended. As discussed in Chapter Four, this study needs to be repeated in a sample of the non-respondent veterinarians to compare results between non respondents and the present study.

Future research should include analysis of tasks and risk factors identified in Chapter Two of this study as associated with MSD. Once tasks have been analysed, then interventions are required to reduce the MSD but the effectiveness of the interventions will need to be evaluated.

The participatory ergonomics approach should also be evaluated for the effectiveness of interventions.

## Chapter Six: Conclusion

This thesis has specifically attempted to address the many deficiencies of previous studies by using a standardised musculoskeletal questionnaire and proactively facilitating responses to optimise the response rate. It is concluded that the prevalence of MSD among New Zealand veterinarians is very high. This study has shown that the period prevalence of MSD is 96% (95% CI 94%-97%), 67% (95% CI 64%-70%) for normal activities affected and MSD necessitated 18% (95% CI 16%-21%) of veterinarians being absent from work.

Seventy three percent (95% CI 70%-76%) of participants reported MSD trouble in the lower back, with 42% (95% CI 39%-46%) and 9% (95% CI 8%-12%) having normal activities affected and being absent from work, respectively. The shoulders, neck and the wrists/hands were the body sites next affected.

The bivariate analysis demonstrated that awkward grip or hand movements, boring work, carrying out repetitive tasks, exposure to loud noise, working in a cold/damp environment, working at high speed, working outside and working to tight deadlines, experiencing difficulty of work, vary pace, work organisation and organisational culture were the work activities and psychosocial risk factors associated with MSD. Undertaking dental procedures, foot trimming, necropsies, obstetrical procedures, rectal palpations and surgical procedures less than one hour were the procedures associated with MSD.

Regression coefficients and their standard errors for the final model of factors influencing the risk of MSD resulting in absence from work in the previous 12 months in clinical veterinarians are associated with age, the proportion of time spent with work involving awkward grip or hand moments, and dissatisfaction with the amount and difficulty of work. Ten year increases in age increased the odds of MSD requiring time off work by a factor of 1.26 (95% CI 1.05-1.52). Veterinarians whose work involved awkward grip or hand movements 50% and 100% of the time had 8.94 (95% CI 2.71-55.37) and 12.91 (95% CI 3.46-84.21) times the odds of MSD requiring time off work respectively, compared with those who whose work did not involve such movements. The odds of MSD

requiring time off work was 2.72 times greater in those veterinarians who were dissatisfied with the level and difficulty of their work, compared with those who were satisfied. Contrastingly, it was demonstrated that there was a protective factor with the odds of 0.69 (95% CI 0.44-1.10) for those who were satisfied in the level and difficulty of work. Therefore, veterinarians who enjoyed work and adequate mental and physical demands had substantially less odds of having MSD than those who did not enjoy work and did not have adequate mental or physical demands.

This study showed that veterinarians considered lifting, undertaking surgery, rectal palpations and animal handling were the tasks most likely to cause their MSD. The main reasons for this were considered (by the veterinarians themselves) to be related to physical activities such as awkward postures (23%), repetitive activities (12%), position and activity of upper limbs (9%), strain and stress on body (8%), animal behaviour (6%) and lifting (6%). Few respondents considered that psychosocial risk factors were causes for their MSD.

The most common solutions identified by veterinarians to reduce MSD were in the physical domain through maintain physical fitness and exercise (9%) and the use of correct manual handling techniques (8%), working at a suitable height (8%) and in the organisational domain with task and job rotation (10%) and ensuring appropriate assistance is available (9%). These solutions generally involved training (38%) and selection (9%) strategies rather than task redesign (43%), even though it has been shown to be a more effective strategy to reduce the prevalence of MSD. In order to facilitate the adoption of redesign strategized to help reduce MSD, it is recommended that a participatory ergonomics approach be adopted.

There is a range of reported prevalence of MSP from 50% (Fritschi et al., 2006) to 96% (Scuffham, Legg et al., 2009) within veterinarians. This may be due to different definitions, methodologies used, as well as the research studying different populations. The lower back is the body site most affected in veterinarians followed by the shoulders and neck.

Although there is a plethora of evidence that demonstrates that physical and psychosocial risk factors are associated with MSP in the general population and in many occupational groups, research into MSP in veterinarians has generally only focused on the physical risk factors, such as animal/manual handling, rectal palpations or tasks.

The magnitude of the reported prevalence justifies further examination of the work that veterinarians undertake in order to find ways to reduce the prevalence of MSD within this profession.

The veterinary profession as well as interested parties – such as Government regulatory authorities should investigate the risk factors associated with MSD and take urgent action to reduce the high prevalence of MSD.

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# Appendices

(Reformatting of some of the original documents was required to meet Massey University page layout requirements when writing this thesis; however the content of all the appendices remains unchanged).

Appendix 1: Massey University Human Ethics Committee approval letter



**Massey University**

16 January 2008

Mr Andrew Scuffham  
1109A Heretaunga Street  
HASTINGS

OFFICE OF THE ASSISTANT  
TO THE VICE-CHANCELLOR  
(Research Ethics)  
Private Bag 11 222  
Palmerston North 4442  
New Zealand  
T 64 6 350 5573/350 5575  
F 64 6 350 5622  
humanethics@massey.ac.nz  
animalethics@massey.ac.nz  
gtc@massey.ac.nz  
www.massey.ac.nz

Dear Andrew

**Re: HEC: Southern B Application – 07/63  
Prevalence and risk factors associated with work related musculoskeletal discomfort  
in New Zealand veterinarians**

Thank you for your letter dated 15 January 2008.

On behalf of the Massey University Human Ethics Committee: Southern B I am pleased to advise you that the ethics of your application are now approved. Approval is for three years. If this project has not been completed within three years from the date of this letter, reapproval must be requested.

If the nature, content, location, procedures or personnel of your approved application change, please advise the Secretary of the Committee.

Yours sincerely

Dr Karl Pajo, Chair  
Massey University Human Ethics Committee: Southern B

cc Prof Stephen Legg  
Dept of Management  
PN214

Prof Claire Massey, HoD  
Dept of Management  
PN214

Prof Elwyn Firth  
IVABS  
PN411

Prof Grant Guilford, HoI  
IVABS  
PN412

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Massey University Human Ethics Committee  
Accredited by the Health Research Council



Appendix 2: Veterinary Council of New Zealand letter



24 December 2007

Andrew Scuffham  
1109A Heretaunga St  
HASTINGS

Dear Andrew

Thank you for your letter of 19 December regarding access to the Council's database for the contact addresses for veterinarians.

We are delighted to be able to assist you with this important project.

I would therefore ask that you read and sign the attached agreement regarding access, return both copies to me and advise me when you need the information by. We will provide this in an excel spreadsheet format.

Good luck with this work.

Yours sincerely

A handwritten signature in black ink, appearing to read "Janet Eden".

Janet Eden  
REGISTRAR

**Mission**

To protect the public interest by regulating the veterinary profession and by promoting and encouraging high professional standards through prudent implementation of the Veterinarians Act 2005.

## Appendix 3: Information sheet



### Information Sheet

## **Prevalence and risk factors associated with work related musculoskeletal discomfort in New Zealand veterinarians**

### **Researcher(s) Introduction**

We are conducting a survey to investigate the muscle and joint aches and pains that New Zealand veterinarians may have.

We are also interested in your attitudes and perceptions about work, your general working conditions and any tasks that you consider may be linked to any musculoskeletal discomfort.

This project is partial fulfilment of the degree of Masters of Ergonomics (MErg) from Massey University for Andrew Scuffham.

This is an invitation to participate in this survey.

The research team is

Andrew Scuffham<sup>1</sup>, Professor Stephen Legg<sup>2</sup>, Professor Elwyn Firth<sup>3</sup> and Associate Professor Mark Stevenson<sup>3</sup>.

<sup>1</sup> 1109A Heretaunga Street East, Hastings.

<sup>2</sup> Centre of Ergonomics and Occupational Safety and Health, Massey University, Private Bag 11222, Palmerston North

<sup>3</sup> Institute of Veterinary, Animal and Biomedical Sciences, Massey University, Private Bag 11222, Palmerston North.

### **Participant Recruitment**

The entire registered veterinary population is invited to participate in this study.

Its aim is to determine whether there are any types of veterinary practice in which musculoskeletal discomfort is more prevalent than others and to determine if there are any specific risk factors associated with musculoskeletal discomfort.

Your contact details were accessed from the registered veterinarians database with permission from the Veterinary Council of New Zealand.

If you complete the web based questionnaire by 03/06/2008 you will go into a draw to win one of five \$100 bonus bonds – but you must use the link at the end of the survey if you wish to be in the draw.

Currently there are no known perceived risks to participants as a result of participating in this research.

## **Project Procedures**

The data will be used to determine the prevalence and risk factors associated with musculoskeletal discomfort in veterinarians. The data, once obtained will be entered into a data base and analysed by the researchers. This is an anonymous questionnaire and all information is confidential. The data will be stored separately in secured locations at Massey University and destroyed after 5 years.

The findings will be submitted to an international peer reviewed journal. Summary findings will be published in "Vetscript" and presented at a relevant NZ veterinary conference. The funding agency of the project (the Department of Labour) will receive a copy of the report but will not get access to data that will identify any individual or veterinary practice. Information from the Department of Labour will be used for education and accident prevention purposes.

If employees are completing the questionnaire during "work time" or using employers computers, the employee should follow their employers relevant information technology policy.

## **Participant involvement**

Participants are invited to complete the questionnaire at an online web address. It is expected that this will take 20 minutes to complete.

## **Anonymity**

For the electronic online web based survey, there should be no information that can track individual responses. A link at the end of the questionnaire can be used for participants to make comments to the research team directly and/or to enter the draw for the 5 x \$100 bonus bonds. This link will not be related to the individual response. Email addresses or names of participants will not be distributed to a third party.

## **Participant's Rights**

Completion of the questionnaire implies consent. You have the right to decline to answer any particular question.

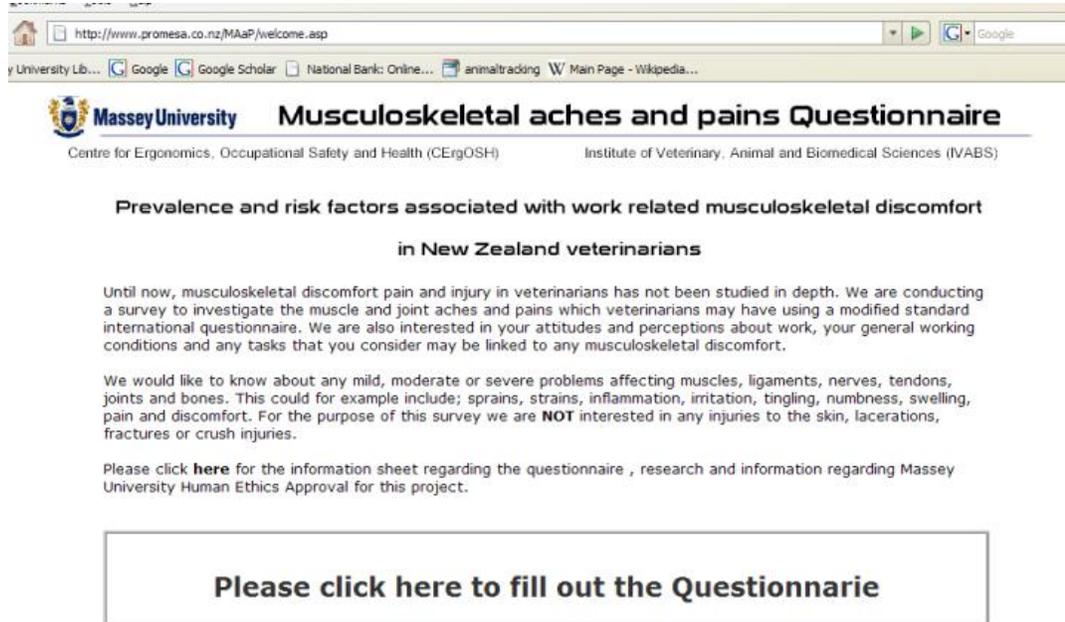
## **Project Contacts**

Please contact any of the following researchers for any questions regarding the project.

Andrew Scuffham 021 0312980  
Professor Stephen Legg 0800 627 739  
Professor Elwyn Firth 0800 627 739

*This project has been reviewed and approved by the Massey University Human Ethics Committee: Southern B, Application 07/63. If you have any concerns about the conduct of this research, please contact Dr Karl Pajo, Chair, Massey University Human Ethics Committee: Southern B, telephone 04 801 5799 x 6929, email humanethicsouthb@massey.ac.nz".*

**Appendix 4:** Example of online questionnaire  
*Please note as there is a requirement to replicate the questionnaire used on hard copy, some information from the online questionnaire is missing (e.g. information from drop down boxes). The complete questionnaire, from which the online questionnaire was generated from, is in Appendix 5.*



The screenshot shows a web browser window with the URL <http://www.promesa.co.nz/MAaP/welcome.asp>. The browser's address bar and search bar are visible. Below the browser window, the Massey University logo is on the left, and the text "Massey University" and "Musculoskeletal aches and pains Questionnaire" are displayed. Below this, the text "Centre for Ergonomics, Occupational Safety and Health (CErgOSH)" and "Institute of Veterinary, Animal and Biomedical Sciences (IVABS)" is shown. The main heading of the page is "Prevalence and risk factors associated with work related musculoskeletal discomfort in New Zealand veterinarians". The text below the heading describes the survey and provides a link to the questionnaire.

**Prevalence and risk factors associated with work related musculoskeletal discomfort  
in New Zealand veterinarians**

Until now, musculoskeletal discomfort pain and injury in veterinarians has not been studied in depth. We are conducting a survey to investigate the muscle and joint aches and pains which veterinarians may have using a modified standard international questionnaire. We are also interested in your attitudes and perceptions about work, your general working conditions and any tasks that you consider may be linked to any musculoskeletal discomfort.

We would like to know about any mild, moderate or severe problems affecting muscles, ligaments, nerves, tendons, joints and bones. This could for example include; sprains, strains, inflammation, irritation, tingling, numbness, swelling, pain and discomfort. For the purpose of this survey we are **NOT** interested in any injuries to the skin, lacerations, fractures or crush injuries.

Please click **here** for the information sheet regarding the questionnaire , research and information regarding Massey University Human Ethics Approval for this project.

**Please click here to fill out the Questionnaire**

**Massey University Musculoskeletal aches and pains Questionnaire**

We would like a few background details first:

1. What is today's date ? (dd/mm/yyyy)
  2. Are you :  Male  Female
  3. How old are you in years ?
  4. What ethnic group do you belong to ?
  5. Year graduated as a veterinarian ? (year)
  6. Are you right or left handed?  Right  Left  Ambidextrous
- Next we are going to ask you some questions about your current job:
7. On average, approximately how many hours per week do you work in this job ?
  8. How many days per week are you on call in this job? (on average)
  9. How often do you take a break (over 15 mins) from work during a normal day ?
  10. Do you regularly work outside 8 - 5 o'clock for this job ?  Yes  No
  11. Number of veterinarians at your place of work ?
  12. Number of veterinary nurses \ technicians at your place of work?

**Massey University Musculoskeletal aches and pains Questionnaire**

13. What is your job title ?
  14. What best describes your position in your organisation ?  Partner/owner  Employee  Self employed
  15. Type of veterinary practice or work that you currently work in ?
- | 16. How often does your work involve ? | All the time          | 3/4 of the time       | 1/2 of the time       | 1/4 of the time       | Never                 |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Awkward or tiring positions            | <input type="radio"/> |
| Awkward grip or hand movements         | <input type="radio"/> |
| Lifting                                | <input type="radio"/> |
| Carrying out repetitive tasks          | <input type="radio"/> |
| Working at high speed                  | <input type="radio"/> |
| Working to tight deadlines             | <input type="radio"/> |
| Boring work                            | <input type="radio"/> |
| Working in cold / damp environment     | <input type="radio"/> |
| Working in hot / warm environment      | <input type="radio"/> |
| Standing                               | <input type="radio"/> |
| Sitting                                | <input type="radio"/> |
| Tools that vibrate                     | <input type="radio"/> |
| Working outside                        | <input type="radio"/> |
| Loud noise                             | <input type="radio"/> |

Job demands

17. In general, how do you find your current job ?



## Musculoskeletal aches and pains Questionnaire

How satisfied are you with your current work?

Q18

	Very satisfied	Satisfied	Neutral	Dissatisfied	Very dissatisfied
The total number of working hours per week?	<input type="radio"/>				
Contact & co-operation between yourself & your employer?	<input type="radio"/>				
The level of enjoyment of your work?	<input type="radio"/>				
The level of difficulty of your work?	<input type="radio"/>				
The opportunity to vary the pace of your work?	<input type="radio"/>				
The after hours or call system at your work?	<input type="radio"/>				
The help & support given to you by colleagues?	<input type="radio"/>				
The way your work is organised?	<input type="radio"/>				
The level of mental demands of your work?	<input type="radio"/>				
The number of rest breaks?	<input type="radio"/>				
The times of the day you are asked to work?	<input type="radio"/>				
The help & support given to you by your manager?	<input type="radio"/>				
The way your organisation is run?	<input type="radio"/>				
The amount of work to do?	<input type="radio"/>				
The opportunity to vary the type of work that you do?	<input type="radio"/>				
The total number of hours overtime expected per week?	<input type="radio"/>				
Co-operation among you and your fellow workers?	<input type="radio"/>				
Work as a whole?	<input type="radio"/>				
The level of physical demands of your work?	<input type="radio"/>				
The pace of your work?	<input type="radio"/>				
The total time you spend working?	<input type="radio"/>				

Back Next



## Musculoskeletal aches and pains Questionnaire

We would now like to ask you about your musculoskeletal aches and pains in general:

- 1) Have you at any time during the past 12 months had any trouble (such as aches, pains, discomfort or numbness) in your?
- 2) During the last 12 months had you been prevented from carrying out normal activities (such as housework, hobbies, gardening) because of this trouble?
- 3) During the last 12 months, have you been absent from work because of this trouble?
- 4) How often do you get, or have had this trouble in the last 12 months?

	1) Had any trouble	2) Normal activities affected	3) Absent from work	4) Trouble in the last 12 months
Neck	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No	please select
Shoulders	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No	please select
Arms	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No	please select
Elbows	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No	please select
Wrists/ Hands	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No	please select
Upper back	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No	please select
Lower back	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No	please select
Hips / Thighs / Buttocks	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No	please select
Knees	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No	please select
Ankles / Feet	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No	please select



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**Massey University Musculoskeletal aches and pains Questionnaire**

We would now like to ask you about annual workload:

How many cases or procedures do you do each year?  
 Please tick the appropriate radio button for each of the 16 procedures listed.

( 10 a day, 50 a wk, 200 a mth = 2400 annually )

Procedure	Procedures undertaken annually						
	0	1 - 600	601 - 2400	2401 - 12000	12001 - 24000	24001 - 36000	36000+
Animal consultations / examinations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Animal handling / lifting	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Birthing / Calving / Foaling etc	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Blood sampling / Intravenous injections or intravenous cannulations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dehorning / Velveting	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dental procedures	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Endoscopies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Foot trimming	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lameness examinations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Rectal palpations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Necropsies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Radiography	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Surgical procedures <1 hr	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Surgical procedures >1 hr	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ultrasounds	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vaccinations / TB testing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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**Massey University Musculoskeletal aches and pains Questionnaire**

How many hours do you spend each year on clinical laboratory or office work ?

( 2 a day, 10 a wk, 40 a mth = 480 annually )

Procedure	Approximate annual hours					
	0	1 - 240	241 - 480	481 - 1200	1201 - 1920	1920 +
Q39 Clinical laboratory work	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q40 Office / administration work	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

What tasks are most likely to lead to Musculoskeletal aches and pains ?

<b>Tasks</b> Please list, in order, your 3 tasks that will most likely to lead to musculoskeletal aches and pains .	<b>Why ?</b> are these tasks likely to be the most risky?	<b>Practicable solutions</b> please list any you apply or know of
--	--	--

1 <input type="text"/>	<input type="text"/>	<input type="text"/>
2 <input type="text"/>	<input type="text"/>	<input type="text"/>
3 <input type="text"/>	<input type="text"/>	<input type="text"/>

Back Finished



**You are finished. Thank you for your help**

If you wish to enter the draw for one of **five \$100 bonus bonds** or wish to make comment to the research team, please click here to a web page. A new window will open and the information will not be linked to your response for this questionnaire.

[Home Page](#)

[Questionnaire Page](#)



Name

Email address

Phone number

Any comments regarding musculoskeletal aches, pains discomfort or injury in veterinarians?

[Home Page](#)

[Questionnaire Page](#)

## Appendix 5: Questionnaire



Centre for Ergonomics, Occupational Safety and Health (CErgOSH)

Institute of Veterinary, Animal and Biomedical Sciences (IVABS)

# Musculoskeletal aches and pains Questionnaire

*Prevalence and risk factors associated with work related musculoskeletal discomfort in New Zealand veterinarians*

*Discomfort, pain and injury to muscles, joints and bones in New Zealand Veterinarians*

Until now, musculoskeletal discomfort pain and injury (MSD) in veterinarians has not been studied. This survey investigates this problem. We are using a modified, standard questionnaire that has been developed for this purpose and used in many countries. We are also interested in your attitudes and perceptions about work, your general working conditions and any tasks that you consider are linked to MSD

We would like to know about any problems affecting your muscles, ligaments, nerves, tendons, joints and bones, for example: sprains, strains, inflammation, irritation, tingling, numbness, swelling, pain and discomfort. We are **NOT** interested in injuries to the skin, lacerations, fractures or crush injuries.



### Musculoskeletal aches and pains questionnaire

Background details:

1. Today's date?     
Day Month Year

2. Are you:  Male  Female

3. How old are you?   
Years

4. What ethnic group do you belong to (tick as many as necessary)?  
 NZ Maori  Samoan  Tongan  
 NZ European  Cook Is Maori  Niuean  
 Chinese  Other European  
 Other (please specify)

5. Year graduated as a veterinarian?

6. Are you right or left handed?  
 Right  Left  Ambidextrous

Your current job:

7. On average, approximately how many hours per week do you work in this job?

8. How many days per week are you on call in this job? (on average)  
 0  1  2  
 3  4  ≥5

9. How often do you take a break (over 15 minutes) from work during a normal working day?  
 0  1  2  
 3  4  ≥5

10. Do you regularly work outside 8 – 5 o'clock for this job?  
 Yes  No

11. Number of veterinarians at your place of work?

12. Number of veterinary nurses or technicians at your place of work?

13. What is your job title?

14. What best describes your position in your organisation?  
 Partner/owner     Employee     Self employed

15. Type of veterinary practice or work that you currently work in?

Please tick one response

<input type="checkbox"/> Small animal practice	<input type="checkbox"/> Large animal practice
<input type="checkbox"/> Mixed practice	<input type="checkbox"/> Equine
<input type="checkbox"/> Pathology	<input type="checkbox"/> Regulatory
<input type="checkbox"/> University / Research	
<input type="checkbox"/> Other (please specify)	<input type="text"/>

16. How often does your work involve	All the time	3/4 of the time	1/2 of the time	1/4 of the time	Never
Awkward or tiring positions	<input type="checkbox"/>				
Awkward grip or hand movements	<input type="checkbox"/>				
Lifting	<input type="checkbox"/>				
Carrying out repetitive tasks	<input type="checkbox"/>				
Working at high speed	<input type="checkbox"/>				
Working to tight deadlines	<input type="checkbox"/>				
Boring work	<input type="checkbox"/>				
Working in cold /damp environment	<input type="checkbox"/>				
Working in hot / warm environment	<input type="checkbox"/>				
Standing	<input type="checkbox"/>				
Sitting	<input type="checkbox"/>				
Tools that vibrate	<input type="checkbox"/>				
Working outside	<input type="checkbox"/>				
Loud noise	<input type="checkbox"/>				

**Job demands**

17. In general, how do you find your current job?

<input type="checkbox"/>	Not at all stressful
<input type="checkbox"/>	Mildly stressful
<input type="checkbox"/>	Moderately stressful
<input type="checkbox"/>	Very stressful
<input type="checkbox"/>	Extremely stressful

18. How satisfied you are with your workplace?

	Very satisfied		Neutral		Very dissatisfied
					
The total number of working hours per week?	<input type="checkbox"/>				
Contact & co-operation between yourself & your employer?	<input type="checkbox"/>				
The level of enjoyment of your work?	<input type="checkbox"/>				
The level of difficulty of your work?	<input type="checkbox"/>				
The opportunity to vary the pace of your work?	<input type="checkbox"/>				
The after hours or call system at your work?	<input type="checkbox"/>				
The help & support given to you by colleagues?	<input type="checkbox"/>				
The way your work is organised?	<input type="checkbox"/>				
The level of mental demands of your work?	<input type="checkbox"/>				
The number of rest breaks?	<input type="checkbox"/>				
The times of the day you are asked to work?	<input type="checkbox"/>				
The help & support given to you by your manager?	<input type="checkbox"/>				
The way your organisation is run?	<input type="checkbox"/>				
The amount of work to do?	<input type="checkbox"/>				
The opportunity to vary the type of work that you do?	<input type="checkbox"/>				
The total number of hours overtime expected per week?	<input type="checkbox"/>				
Co-operation among you and your fellow workers?	<input type="checkbox"/>				
Work as a whole?	<input type="checkbox"/>				
The level of physical demands of your work?	<input type="checkbox"/>				
The pace of your work?	<input type="checkbox"/>				
The total time you spend working?	<input type="checkbox"/>				

**We would now like to ask you about your musculoskeletal aches and pains in general:**

Please complete this question by starting with the list of body parts (Q19). If any is 'yes', complete all other questions (Q20 – Q22) for this body part, then continue with the list of body parts (Q19)

	Q 19. Have you at any time during the past 12 months had any trouble (such as aches, pains, discomfort or numbness) in your?		Q 20. During the last 12 months had you been prevented from carrying out normal because of this trouble?		Q 21. During the last 12 months, have you been absent from work because of this trouble in your?		Q 22. Have often do you get, or have had this trouble in the last 12 months?		
	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> Daily A year	<input type="checkbox"/> One or more times a week One episode of trouble only	<input type="checkbox"/> a month never
Neck	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Shoulders	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Arms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Elbows	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wrists / Hands	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Upper back	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lower back	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hips / Thighs / Buttocks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Knees	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ankles / Feet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



**Annual workload:**

How many cases or procedures do you do each year?  
Please tick the appropriate box for each of the 16 procedures listed.  
The table coming next lets you find yearly equivalents for procedures per day, week or month.

Procedures per day	Procedures per week	Procedures per month	Procedures Annually
2.5	12.5	50	600
10	50	200	2400
25	125	500	6000
50	250	1000	12000
100	500	2000	24000
150	750	3000	36000

Q	Procedure	Procedures undertaken annually						
		0	< 600	600 - 2400	2401 - 12000	12001 - 24000	24001 - 36000	>36000
23	Animal consultations / examinations							
24	Animal handling / lifting							
25	Birthing / Calving / Foaling etc							
26	Blood sampling / Intravenous injections or intravenous cannulations							
27	Dehorning / Velveting							
28	Dental procedures							
29	Endoscopies							
30	Foot trimming							
31	Lameness examinations							
32	Rectal palpations							
33	Necropsies							
34	Radiography							
35	Surgical procedures <1 hr							
36	Surgical procedures >1 hr							
37	Ultrasounds							
38	Vaccinations / TB testing							

How many hours do you spend each year on clinical laboratory or office work?  
The table lets you find yearly equivalents for hours per day, week or month.

Hours Per day	Hours per week	Hours per month	Hours annually
1	5	20	240
2	10	20	480
5	25	100	1200
8	40	160	1920

	Procedure	Approximate annual hours					
		0	<240 hrs	241 – 480 hrs	481 – 1200 hrs	1201 – 1920 hrs	>1920 hrs
39	Clinical laboratory work						
40	Office / administration work						

What tasks are most likely to lead to musculoskeletal aches and pains?

41. Part A – Task Please list, in order, your three tasks that will most likely to lead to musculoskeletal aches and pains. Part B – Why are these tasks likely to be the most risky? Part C – Solutions – please list any you apply or know of.			
List in order	Task	Why?	Practicable solutions
1.			
2.			
3.			

If you wish to enter the draw for one of five \$100 bonus bonds or wish to make comment to the research team please click here to go to a web page. A new window will open and the information will not be linked to your response for this questionnaire.  
You are finished. Thank you for your help

Please use this web page to enter into the draw for one of five \$100 bonus bonds. Please note that your name and details will not be linked or associated with your response from the questionnaire.

Name	
Email address	
Phone number	

Any comments regarding musculoskeletal aches, pains discomfort or injury in veterinarians?

Appendices 6-9 removed due to copyright restrictions

**Appendix 6:** Paper presented at the 15th New Zealand Ergonomics Society Conference: Ergonomics for the Ageing Population, Martinborough. Scuffham, A., Stevenson, M., Legg, S. & Firth, E. Prevalence of musculoskeletal discomfort in New Zealand small animal veterinarians. In: 15th New Zealand Ergonomics Society Conference: Ergonomics for the Ageing Population. Eds R. G. Adank & L. Gardner Wood. Martinborough, New Zealand Ergonomics Society. 27-28 May, 2009, [CD-ROM].

**Appendix 7:** Paper presented at the Society of Dairy Cattle Veterinarians of the New Zealand Veterinary Association 26th annual conference, Rotorua. Scuffham, A., Firth, E., Stevenson, M., & Legg, S. Musculoskeletal discomfort in New Zealand large animal veterinarians. In: Proceedings of the Society of Dairy Cattle Veterinarians of the New Zealand Veterinary Association 26th annual conference. Ed. T. Parkinson. VetLearn, Palmerston North. 24-27 June 2009, pg 201-204.

**Appendix 8:** Paper presented at the New Zealand Equine Veterinary Association Annual Conference, Taupo. Scuffham, A., Firth, E., Stevenson, M. & Legg, S. Musculoskeletal discomfort in New Zealand equine veterinarians. In: Proceedings of the New Zealand Equine Veterinary Association of the NZVA Annual Conference. Ed. M Leyland. VetLearn, Palmerston North. 24-27 June 2009, pg 163.

**Appendix 9:** Paper presented at the 17th International Ergonomics Association World Congress on Ergonomics, Beijing. Musculoskeletal discomfort in New Zealand (non-clinical) veterinarians. Scuffham, A., Legg, S., Stevenson, M. & Firth, E. (9-14 August, 2009). [CD-ROM]

**Appendix 10:** Raw data (refer to CD-ROM in back cover)