Musculoskeletal symptoms in self-employed versus employed therapists: the role of training and social support.

Thesis presented by

Dervla Áine Hogan
(M.Sc. Occupational Health, Safety & Ergonomics, B.Sc. Physiology)

Under the supervision of
Dr Birgit A. Greiner
Dr Leonard W. O'Sullivan

For the degree of Doctor of Philosophy

UCC
University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

Department of Epidemiology and Public Health

Head of Department
Prof. Ivan J. Perry

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Declaration

I declare that this thesis has not been submitted as an exercise for a degree at this or any other University. The work, upon which this thesis is based, was carried out in collaboration with a team of researchers and supervisors who are duly acknowledged in this thesis. The Library may lend or copy this thesis upon request.

Signed: Date:

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(Dervla Áine Hogan)

Acknowledgements

I would like to sincerely thank my PhD supervisors, Birgit and Leonard. I am extremely grateful that both of you agreed to be my supervisors. Birgit, your dedication to and enthusiasm for Occupational Health is an inspiration to me. You are the driving force of Occupational Health in the Department and I hope we continue to work together in the coming years to continue the growth of Occupational Health. I greatly appreciate that no matter how busy you are; you always have time for your students. Thank you for all your support.

Leonard, I am so grateful for your support of me over the last few years within and outside of my PhD. Thank you for welcoming me into the committee of the Irish Ergonomics Society. I have grown and developed so much within my roles, including my current roles of Membership Secretary and Treasurer. I definitely feel like I am an integral part of the functioning of the Society, which I greatly enjoy. I wouldn't have got this opportunity without you and I am forever grateful. I am delighted that our collaboration won't come to an end after my PhD completion.

I wouldn't have had the strength or endurance to complete my PhD without the support of my Department colleagues. Ivan, as Head of Department, you have made me feel so welcome since I started in the Department as a PhD student. You have been a huge supporter of my career development, along with PhD completion, over the past few years. I definitely wouldn't have developed into the professional I am now without you and your invaluable advice. Working full-time and completing the final years of a PhD is not an easy task, however, your support and encouragement, as my manager, has made this much easier for me. I greatly look forward to working with you over the coming years.

To my fellow PhD students in the Department, it is always good to know you are not alone!! I am so lucky to have completed my PhD in a Department with such a strong network of PhD students. Each and every one of you has helped me through this process in a different way and I am eternally grateful. Specifically, words cannot express how grateful I am to my fellow Occupational Health PhD students. Vera and Sara, you have both gone above and beyond in your support of me over the past few years. Seeing you both complete your PhDs definitely gave me the drive to complete and get through the tough times along the way.

I would also like to thank my administrative colleagues, Vicky, Tara, Ber and Michelle. Thank you all for your understanding and support over the last two years since I was appointed as Department Manager. Tony, I am very gratefully for the time and support you gave to me in the completion of my thesis and for your invaluable advice. Sheilah, thank you for giving me the opportunity to work with yourself and Birgit on the Health in Hand-Intensive Tasks and Safety (HITS) study. My PhD wouldn't be what it is without this opportunity. I am so grateful. I could write for pages

to acknowledge individually everyone who has helped me over the past few years, however, I hope you all know who you are and what your support has meant to me.

I am extremely grateful to the Institution of Occupational Safety and Health for the funding they provided for the completion of the HITS study. My PhD would not have been possible without this funding. In addition, they funded my travel to attend and present my research, based on the HITS Study, at the 9th International Scientific Conference on the Prevention of Work-Related Musculoskeletal Disorders (PREMUS 2016) in Toronto, Canada from 20th to 23rd June 2016. This was an invaluable experience as I greatly benefited from presenting my research and receiving feedback from WRMSDs researchers and practitioners across the globe along with the opportunity to talk informally with fellow early-career researchers in my field.

Last but definitely not least, I can't express my appreciation to my Mum and Dad. Mum, you are my rock and I wouldn't be the person I am today without you and your undying support, encouragement and belief in me. You instilled in me a love for learning and an understanding that education is a lifelong process. You are my inspiration. Dad, you have always been a great supporter and champion of me. I am so grateful to both of you.

Glossary

MSD – Musculoskeletal Disorders
WRMSD – Work-related Musculoskeletal Disorders
LBP – Low Back Pain
WRULD – Work-related Upper Limb Disorders
EU – European Union
EU-OSHA – European Agency for Safety and Health at Work
HSA – Health and Safety Authority
IOSH – Institution of Occupational Health and Safety
JD-C – Job Demand-Control
JD-C-S – Job Demand-Control-Support
ERI – Effort-Reward Imbalance
BMI – Body Mass Index
HITS – Health In Hand Intensive Tasks and Safety study
SLÁN – Survey on Lifestyle, Attitudes and Nutrition
COPSOQ – Copenhagen Psychosocial Questionnaire
EODS – European Occupational Diseases Statistics
PTs – Physical Therapists/Physiotherapists
PTAs – Physical Therapists Assistants
CPTs – Chartered Physiotherapists
ATs – Athletic Therapists
IPTAS – Institute of Physical Therapy and Applied Science
I.A.P.T – Irish Association of Physical Therapists
A.R.T.C – Athletic Rehabilitation Therapy Certified
SPSS – Statistical Package for Social Science

Thesis Context

The purpose of this section is to provide context to the thesis as part of the 'Health In Hand Intensive Tasks and Safety' (HITS) study and within the area of Applied Occupational Health and Safety research.

This thesis draws, in part, on the data compiled during the HITS study to develop a scientific evidence base to assist in the prevention of work-related back, neck and upper limb pain/discomfort by investigating the potential risk factors of work-related back, neck and upper limb pain/discomfort in both employed and self-employed Chartered Physiotherapists (CPTs) and Physical Therapists/Athletic Therapists (PTs/ATs) in the Irish context and the effectiveness of current risk reduction strategies. This thesis is one component within the larger context of the HITS study and focuses specifically on employment status, training and social support in relation to work-related musculoskeletal disorders (WRMSDs).

The overall aim of the HITS study was to create a reliable scientific evidence base to inform strategies for effective prevention of work-related upper limb disorders in health care occupations, such as chartered physiotherapists, physical therapists and athletic therapists, with a specific focus on hand-intensive occupations (1). Within the HITS study, two studies were conducted; one cross-sectional study with chartered physiotherapists, physical therapists and athletic therapists and a follow-up study with students in their final month of training in the relevant disciplines and one year into practice. The first study was conducted to provide representative prevalence estimates of work-related upper limb disorders (WRULDs); investigate potential determinants of WRULDs in the workplace; detail self-care behaviour of therapists and determine the role of injury prevention training in the prevention of WRULDs. The evidence base was used to provide recommendations for a comprehensive health and safety guidance document for hand-intensive health care occupations, to compile and test an injury prevention in professional development training and to design a self-care checklist to be used by therapists without prior health and safety risk assessment training. The second study was conducted to determine the prevalence of ULDs in the final month of training and changes in the musculoskeletal health of physiotherapy/physical therapy, sports/manual therapy graduates, approximately, one year after graduation to specifically evaluate early career onset of symptoms.

The candidate was a research assistant on the HITS study. She was directly involved in undertaking the study. This included recruitment of study participants and development of the research questionnaire in close co-operation with the Principal Investigator and the Study Director, issuing of questionnaires to study participants, data processing and management of all returned questionnaires, maintenance and updating of the survey database in SPSS including data entry and cleaning, data analysis for inclusion in the final report through the use of Statistical Package for Social Science (SPSS), report writing for interim and final reports to the funding body and the compilation and development of agendas for and minutes of study team meetings.

This thesis is framed within the area of Applied Occupational Health and Safety research, with a focus on the application of the findings into practice. This thesis uses aspects of the disciplines of occupational health psychology, epidemiology and ergonomics. This thesis uses epidemiologically principles in relation to study design and statistical analysis, whilst reviewing WRMSDs in light of psychosocial work factors, specifically social support, training, specifically manual handling, and employment status.

Thesis Abstract

Introduction

Musculoskeletal Disorders (MSDs) are a global health problem and, whilst they are not classified as an occupational disease, they are deemed to be an occupation-related health issue. The health and social care sector appear to be a high risk sector for MSDs. With therapists in health care, including physiotherapists, physical therapists and athletic therapists, been proposed to be a high-risk occupational group for the development of WRMSDs "due to the combination of prolonged stooping, repetitive low-risk and infrequent high-risk lifts" as part of their workday tasks. The overarching aim for this thesis is to develop a scientific evidence base to assist in the prevention of work-related back, neck and upper limb pain/discomfort by investigating the potential risk factors of work-related back, neck and upper limb pain/discomfort in both employed and self-employed Chartered Physiotherapists (CPTs) and Physical Therapists/Athletic Therapists (PTs/ATs) in the Irish context and the effectiveness of current risk reduction strategies.

Objectives

The main objectives of this thesis were to investigate [1] the effectiveness of Manual Handling training, as a current risk reduction strategy for LBP, by systematically reviewing existing scientific literature, [2] the prevalence of LBP among chartered physiotherapists, physical therapists and athletic therapists in Ireland and compare this to the national working population, [3] the association between work-related social support and back, neck and upper limb pain in both employed and self-employed chartered physiotherapists, physical therapists and athletic therapists, and [4] training and preventive work strategies and back, neck and upper limb pain in employed and self-employed chartered physiotherapists, physical therapists and athletic therapists.

Methods

This thesis comprises of one systematic review and three cross-sectional studies. The systematic review investigated the effectiveness of manual handling training on achieving training transfer, leading to a positive change in employees' manual handling behaviours and a reduction of WRMSDs following training. This systematic review used a clear search strategy, explicitly stated inclusion and exclusion criteria along with a validated quality assessment. Each of the three cross-sectional studies used data from the Health In Hand Intensive Tasks and Safety (HITS) study. The HITS study was a cross-sectional study design investigating WRMSDs in practicing chartered physiotherapists, physical therapists and athletic therapists (n=347). Validated questionnaires were used to obtain self-reported data relating to the occurrence of back pain/discomfort (upper, mid and low back pain), neck pain/discomfort and upper limb pain/discomfort (shoulders, elbow, wrist, finger and thumb pain) in the past 12 months along with information on employment status, social support, training and preventive work strategies, among others. The first cross-

sectional study in this thesis (Paper 2) also used the Survey on Lifestyle, Attitudes and Nutrition (SLÁN) 2007. This was a face-to-face interview study of adults aged 18 years, performed at the participant's home address. SLÁN 2007 was a nationally representative survey. To ensure the SLÁN 2007 dataset was an appropriate comparator to the HITS study data, only the working population of SLÁN 2007 was included in this analysis (n=5,862).

Results

The systematic review indicates that whilst employees report understanding and awareness following manual handling training, this does not always lead to the expected behavioural change and, subsequent, reduction of WRMSDs. These results were not reflected in further investigation within this thesis, as, employed therapists with training, reported significantly lower prevalence rates for back and neck pain/discomfort (69.2% and 41.8%, respectively) compared to those who reported no training (88.9% and 61.1%, respectively) (P=0.01 and P=0.04, respectively). This significance disappeared when adjusted for age, gender and employment status. Employed therapists (75.9%) and the entire sample of therapists (employed and self-employed) (71.4%) who had completed training reported a higher use of the preventive work strategy 'modifying the patient / client position' compared to those who reported no training (58.5% and 56.8%, respectively) (P=0.05). When compared with the national working population, therapists were nearly five times more likely to suffer from LBP, after careful adjustment for differences in socio-demographics [adjusted OR 4.8, 95% CI (3.8 – 6.1)] (P<0.001). Self-employed therapists have a higher prevalence of upper limb pain discomfort (86.6%) compared to employed therapists (76.8%) (P=0.04). Conversely, when it comes to incapacitating upper limb symptoms employed therapists have a higher prevalence (32.7%) compared to self-employed therapists (21.5%) (P=0.04). In relation to upper limb pain/discomfort, supervisor support was seen as protective in employed therapists (P=0.05), however, peer support didn't indicate any significant findings. On the other hand, low levels of peer support were identified as a risk factor for the prevalence of incapacitating upper limb pain/discomfort in both employed and self-employed therapists (P=0.03 and P≤0.01, respectively). Interestingly, therapists reporting incapacitating upper limb pain/discomfort reported significantly higher use of the external coping strategy 'changing job because of fear of suffering from long-term MSD' (12.8%) compared to those who did not report incapacitating upper limb pain/discomfort (4.8%) (P=0.02).

Discussion

This thesis indicates that future research needs to focus on both employed and self-employed workers' health and wellbeing to explicitly examine the effects of work on today's changing workforce. In relation to therapists, this thesis indicates that self-employment appears to be predictive of upper limb pain/discomfort, however, not of back pain. This requires further investigation in relation to WRMSD prevalence and

related factors in employed and self-employed therapists through both qualitative and quantitative methods with the use of more objective measures.

Chapter 1 - Introduction and Background

1. Introduction

As we move away from the norm of a permanent full time, for life, job into a world of contingent work and zero-hour contracts, we need to understand the effect of this precarious employment on workers' health and well-being. The lack of security within employed roles has caused an increase in self-employment across a vast range of sectors (2). This includes sectors where self-employment may not have been common previously. As this new working landscape is resulting in more self-employed workers, it is essential that the body of occupational health research moves beyond the employed worker.

Musculoskeletal health has been a major focus in occupational health research along with the relevant physical and, more recently, the psychosocial risk factors. Musculoskeletal Disorders (MSDs) are a foremost cause for concern not only on an individual level, but also because of the economic impact on organisations and on society. Theoretical models of MSDs causation highlight various aspects of the work environment, including organisational culture, physical work demands, mental work demands, psychosocial risk factors and unique factors to the individual employee, to explain the occurrence of Work-related Musculoskeletal Disorders (WRMSDs) (3, 4).

Therapists in health care, including physiotherapists, physical therapists and athletic therapists, have been proposed to be a high-risk occupational group for the development of low back pain (LBP) "due to the combination of prolonged stooping, repetitive low-risk and infrequent high-risk lifts" as part of their workday tasks (5, p309). No investigation has been conducted to date in relation to prevalence rates of WRMSDs and/or symptoms within these occupations, whilst considering employment status, in Ireland. Previous international research has mainly focused on employed

therapists and do not provide data on the large group of self-employed therapists (6-19).

This thesis will focus on the musculoskeletal health of chartered physiotherapists, physical therapists and athletic therapists in Ireland whilst taking account of employment status (employed versus self-employed therapists), training and social support. The main objectives of this thesis were to investigate [1] the effectiveness of Manual Handling training, as a current risk reduction strategy for LBP, by systematically reviewing existing scientific literature, [2] the prevalence of LBP among chartered physiotherapists, physical therapists and athletic therapists in Ireland and compare this to the national working population, [3] the association between work-related social support and back, neck and upper limb pain in both employed and self-employed chartered physiotherapists, physical therapists and athletic therapists, and [4] training and preventive work strategies and back, neck and upper limb pain in employed and self-employed chartered physiotherapists, physical therapists and athletic therapists. These are discussed further in Chapter 2, section 2.6 and the related sub-sections.

The current chapter will focus on defining key terms within this research and provide a conceptual framework for this thesis.

1.1. Epidemiology of Musculoskeletal Disorders

MSDs "include a wide range of inflammatory and degenerative conditions affecting the muscles, tendons, ligaments, joints, peripheral nerves and supporting blood vessels" (20, p13) which mainly affect the upper and lower limbs and the back. MSDs "include clinical syndromes such as tendon inflammations and related conditions (tenosynovitis, epicondylitis, bursitis), nerve compression disorders (carpal tunnel

syndrome, sciatica), and osteoarthrosis, as well as less well standardised conditions such as myalgia, low back pain and other regional pain syndromes not attributable to known pathology" (20, p13). Symptoms can include pain, tenderness, swelling, numbness and loss of function. A literature review, by McBeth and Jones (2007), indicates that musculoskeletal pain is very common with one fifth of adults reporting widespread pain throughout the body, one third shoulder pain and up to 50% reporting low back pain (LBP) within a one month timeframe (21).

MSDs have a multifactorial aetiology, therefore, it can be difficult in most cases to point out the exact cause of a case of disease. A frequently cited problem in epidemiological research is the ambiguity of classification systems for occupational musculoskeletal disorders. Some international consensus has been determined in relation to the inclusion of diagnostic criteria related to MSDs. A number of studies have shown that varying conditions can be classified as 'specific' and 'non-specific' conditions (22). Specific conditions are disorders that are medically diagnosed and have a well-defined set of diagnostic criteria established from evidence-based approaches (i.e. carpal tunnel syndrome). Whereas, non-specific conditions are those which are ill defined and characterised by symptoms, such as pain, discomfort, fatigue, limited movement and loss of muscle power, with pain being the primary symptom (22).

Therefore, MSDs are not commonly accepted as occupational diseases in national reporting systems. For example, some disorders of the lower back, neck and shoulder region are only regarded as occupational diseases by a few European Union (EU) Member States and only for specific forms of disease and/or disorders. With this in mind, it is interesting to note that according to Eurostat figures on recognised

Occupational Diseases (EODS), MSDs are the most common occupational disease in the European Union, and as one of the largest causes of long-term sickness absence, they are an ever increasing problem (23). Considering that not all MSDs are recognised as an occupational disease and/or disorder, it can be inferred that the MSD problem is even larger than reported.

1.2. Work-related Musculoskeletal Disorders

Whilst not all MSDs are caused by work, in the work context, they can be caused or aggravated by many physical and psychosocial risk factors and are termed WRMSDs. These risk factors can include rapid work pace, repetitive motion patterns, insufficient recovery time, poor manual handling, excessive static work load, poor work postures and psychosocial hazards (20). As discussed, WRMSDs can mainly affect the upper limb (neck, shoulder, elbow, wrist and fingers), back (upper, middle and lower) or lower limb (leg, ankle, foot and toes).

In 2005, 35.4% of European workers reported that their work affected their health with musculoskeletal diseases as the most prevalent occupational disease at a European level (23). Backache, muscular pains, overall fatigue and stress were the most prevalent health problems. When taking gender into consideration, European males reported a higher incidence rate for MSDs compared to females, however, MSDs account for a higher proportion of all occupational diseases in females. Analysis by age showed that both older (over 55 years of age) and younger (under 25 years of age) European workers reported significant levels of MSD with backache pain at 24.2% and 17.7% respectively. European workers in the health and social work, transport, storage and communication, construction and agriculture sectors displayed the highest rates of MSDs at 1.2 to 1.6 times higher than the average rate. Interestingly,

female workers in the health and social care sector report higher than average levels of MSDs, such as backache (27.7 %) compared to female workers (22.3 %) and both genders (24.7 %) across all sectors. Self-employed and temporary European workers appear to be more at risk of suffering MSDs compared to their permanently employed counterparts (23).

The current literature indicates that low back pain (LBP) remains one of the most prevalent WRMSDs (24). Worldwide, 37% of LBP has been deemed to be attributable to occupational risk factors, such as manual handling and whole body vibration indicating the work-relatedness of the symptoms (25). In 2012, the Health and Safety Authority in Ireland reported that, at 33%, manual handling was the most common trigger for non-fatal injuries. In addition, the most reported injured body part was the back at 22%, followed by the fingers at 10% (26). In 2010, the European Risk Observatory reported that 24.7% of European workers suffered from, what they described as, work-related backache and 22.8% reported muscular pains which they felt were caused by work. Backache was seen as the most prevalent work-related health problem with overall fatigue at 22.5% and stress at 22.3%. Within all age groups, approximately 50% of the absences from work due to WRMSDs in the European Union were related to back disorders (23). As previously discussed, the associated figures within the health and social work sector were higher than the overall figures with 26.3% reporting work-related backache and 24.3% reporting muscular pains associated with work tasks. This indicates the need for further research focusing on occupations within this sector. Even though much research has been completed in relation to the prevention and/or reduction of WRMSDs in health care workers, previous research has primarily related to back injury and discomfort due to patient handling and/or manual handling tasks and focused solely on employed health care

workers especially nurses and nursing assistants (27-31). Future research needs to focus on other health-care occupations, other body parts, specifically upper limbs, and include the self-employed health-care worker.

It is important to note that the methodology used in relation to the measurement of WRMSD prevalence and associated risk factors may influence the outcome of the study. Using LBP as an example of a WRMSD, Ferguson and Marras (1997) described the stages of development of LBP as beginning with "spinal loading, progress to discomfort, which would be identified if asked, then symptoms that would be apparent in active surveillance, and then disorder (injury or illness) followed by the report of an incidence, possibly leading to restricted work activities and may culminate in lost time from work or disability" (32, p212). Each of these stages of LBP development can be measured through different measurement tools, for example, checklists, surveys, medical assessment, and company statistics. From an epidemiological perspective, these different measurement tools, in addition to the statistical methods used and the population under investigation, may influence the outcome of the study (32). These influences need to be taken into account to ensure that study findings are not just reported but also critically reviewed. Therefore, as discussed in the literature, within research investigating WRMSDs, there remains a need for the development of standardised epidemiologic case definitions and the development and validation of practical and consistent methods for measuring physical and psychosocial exposures in the workplace. There is also a demand for completion of further biomechanical studies including human subjects to investigate the relationship between workplace exposures and MSDs outcomes (33-35).

1.3. Costs of WRMSDs

WRMSDs are a major cause for concern not only on an individual level, but also because of the economic impact on organisations and on society. The costs of WRMSDs can be categorised as either direct or indirect. This distinction is important because indirect costs appear to be 10 to 30 times higher than the direct costs (23). These costs will be discussed below with emphasis on the cost to the individual employee, the employer and society as a whole.

WRMSDs can directly result in loss of earnings for the injured employee. They can also result in a negative impact on the employee's quality of life, affecting their physical and mental well-being, with workers in health care being one of the most affected groups (20, 36, 37). It is important to note that the lives of carers, family and friends of the injured employee can also be affected (37). WRMSDs result in both direct and indirect financial costs for the employer. The direct costs can include increases in insurance premiums, compensation and medical and administrative costs. The indirect costs can include sick leave costs including the hiring and training of new employees, decreased productivity levels and the effects on production and quality of work (20, 23, 36). The overall costs of occupational injury and illness in a developed country can be estimated to be 2.5% of national income, equivalent to circa €3.3 billion in Ireland in 2006 (36). This cost includes the significant health-care costs associated with each WRMSD. It is difficult to compare this data across different countries for different services due to the limited comparable statistics (37).

1.4. Theories relating to development of MSDs

1.4.1. Biomechanical Pathway

There are three biomechanical theories put forward by Kumar (2001) (38) which have been described as providing the "in-depth theoretical mechanisms for the relationship between physical factors at work and WRMSDs" (4, p81). These three theories are 'differential fatigue theory', 'cumulative load theory' and 'over-exertion theory' (38). The 'differential fatigue theory' proposed that depending on the activity being completed different joints are differentially loaded and different muscles are affected depending on the motion been performed. This differential loading may not be proportional to the capabilities of the muscles. In the short-term this could lead to fatigue due to different muscles fatiguing at different rates. In the long-term, without a change to the work practices, this could lead to an increased risk of injury (38).

The 'cumulative load theory' discusses the wear and tear mechanism of injury. Biological tissues are capable of self-repair, however, they can suffer from mechanical degradation due to repeated and prolonged use. Overtime, if the loading is not decreased, "permanent deformation of the tissue may result and the stress-bearing capacity may be reduced" (4, p78). This may cause the tissue to be more susceptible to injury (4, 38).

The 'over-exertion theory' suggested that exertion, which was defined by Kumar (2001) as a function of force, duration, posture and motion, can exceed the limits of tissue, which could subsequently result in causing the tissue to fail (4, 38). It is important to note that each of these theories could operate simultaneously within an individual, though the factors leading to the injury could result from any of the theories (4).

1.4.2. Psychosocial Pathway

Several theories (34, 38, 39) have been developed to describe the influence of psychosocial risk factors, such as, rapid work pace, monotonous work, low job satisfaction, job stress and non-work-related stress, high job demands, little control at work and low workplace social support, on WRMSDs. The theory proposed by Carayon et al (1999) stated that physical and psychological exposures could affect the development of WRMSDs and that individual factors might impact the relationships between exposures and outcomes. This theory was initially designed to illustrate the role of job stress mechanisms. The theory proposes that short-term emotional, physiological and behavioural responses to workplace stimuli, such as work organisation, job design, work environment and technology, can impact on longer-term outcomes such as WRMSDs. Feedback loops were present showing that long-term responses, such as WRMSDs, could impact on other short-term responses and the work system exposures (4, 39).

Another model proposed by the National Research Council and Institute of Medicine (2001) postulates that in the workplace external loads, organisational factors and social context could impact directly on biomechanical loading as well as outcomes such as pain/discomfort and impairment/disability. Within the person, biomechanical loading, internal tolerances and outcomes continuously effect each other operating through feedback loops. Individual factors were shown to independently effect biomechanical loading, internal tolerances and outcomes (4, 34). Finally, the 'multi-variate interaction theory of musculoskeletal injury precipitation' developed by Kumar (2001) discusses the interactions between genetic, morphological, psychosocial and biomechanical factors and their impact on the individual's

musculoskeletal system. The impact could result in strain leading to structural, biochemical and/or physiological changes which could eventually cause pain (38).

1.4.3. Integrated Models

Since 2005, integrated theoretical models for WRMSDs have been proposed (3, 4), which include psychosocial risk factors based on the above theories and other similar theories. These theoretical models tie in all aspects of the work environment, which include organisational culture, physical work demands, mental work demands, psychosocial risk factors and unique factors to the individual employee, to explain the occurrence of WRMSDs. The model by Karsh (2006) displays the workplace factors that determine exposures at the top of the model. The social and cultural context of the organisation has been shown to influence the way work is organised. In turn the social and cultural context in the organisation can also have a direct impact on psychological work demands. The model indicates that work organisation, such as nature of work, work/rest cycle, management, supervision and teamwork, may have a direct impact on physical work demands, such as force and posture, and psychological work demands, such as job control, support, ambiguity and uncertainty. It also indicates that the impact of social and cultural context on physical and psychological work demands is mediated by the work organisation. In addition, the environment in the workplace (e.g. noise, lighting and temperature) may also directly affect physical and psychological work demands. Physical and psychological work demands can separately lead to psychological strain, but, they have also been shown to influence each other with physical work demands having shown a direct impact on physical strain. They can be mediated by individual factors such as physical capacity, psychological capacity, genetics, fatigue tolerance, coping, aging and gender (4). The detection of symptoms

or the presence of a WRMSD may impact physical and psychological strain and/or demands because, if affected, a person may modify how he/she works or experience increased psychological stress. Finally, the detection of symptoms or the existence of a WRMSD may lead to the redesign of work which in turn will impact work organisation. Although not included in this model, non-work activities, such as leisure activities, may also impact strain and other physiological responses (4).

The model by Faucett (2005) (Figure 1.1), shows how "social, economic, political, technological and other external conditions influence management decisions and practices, which in turn affect the characteristics of jobs and work processes at the 'micro' level and, subsequently, worker and productivity outcomes" (3, p542). This model is based on sociotechnical systems and macro-ergonomics. "The sociotechnical systems approach takes account of the elements of technology, personnel, work systems and the external environment and considers their influences on managerial decision-making and the goals, structure and processes of the organisation. The aim of macro-ergonomics is the interface of the worker with the organisation; whereas traditional ergonomics targets the interface of the worker with machines, tools, software and individual jobs" (3, p542). This model specifically focuses on the management of the work environment as the key approach to controlling WRMSDs. This model has been used as the underpinning for the theoretical approach for this thesis as some of its components are applicable to both employed and self-employed workers. The linkages between this model and chapters within this thesis are mapped on Figure 1.1 below and also are linked with the theoretical model for the thesis in Chapter 2, subsection 2.6.1.

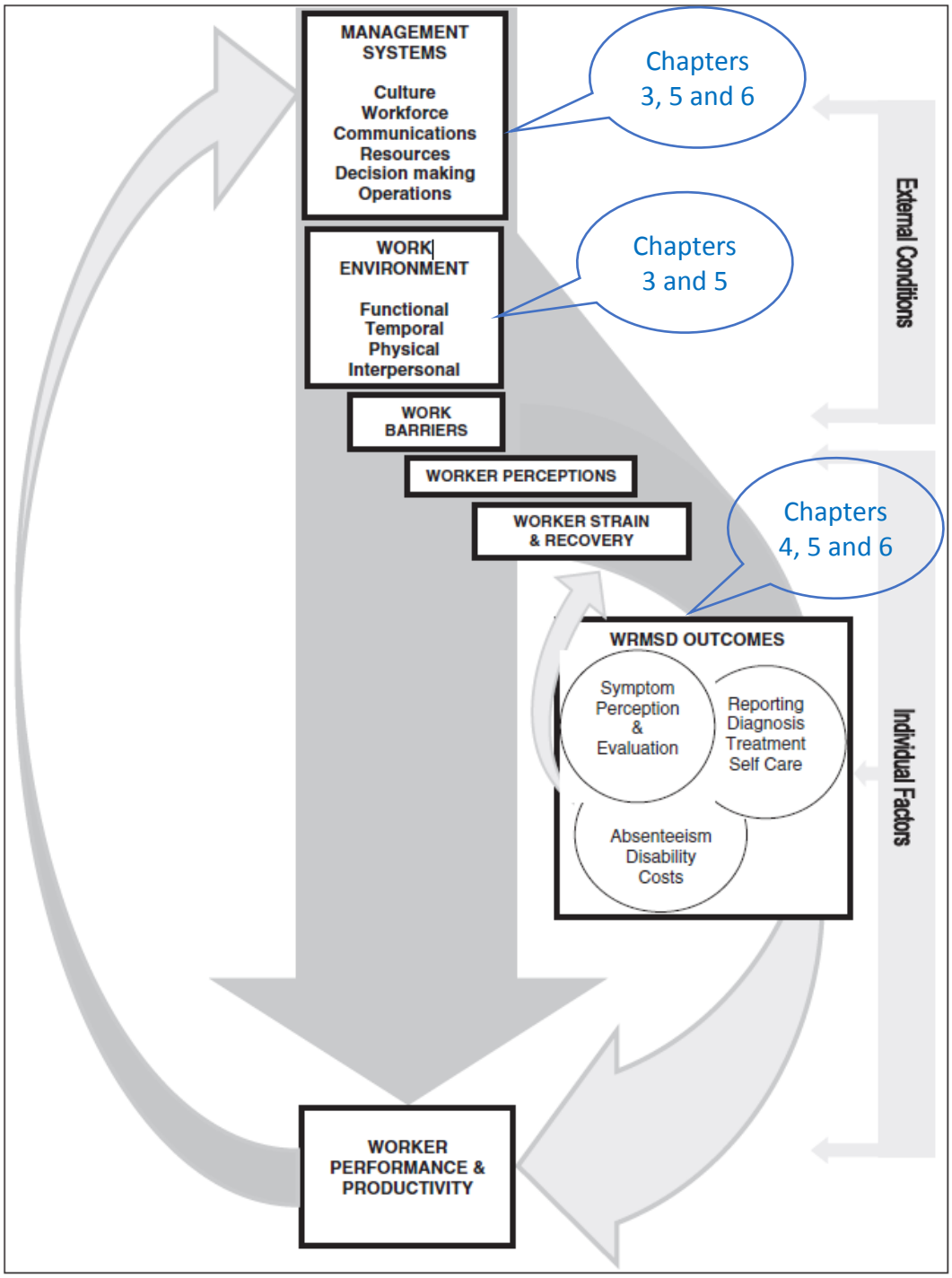

Figure 1.1: An integrated model for the control of work-related musculoskeletal disorders. Faucett (2005)

1.5. Workplace Risk Factors

1.5.1. Physical Risk Factors

Existing theories of WRMSD development recognise that there are many factors that contribute to its causation. It has been agreed that there are pertinent physical risk factors implicated in their occurrence in the workplace such as "high forces, deviated postures, high repetition, and insufficient rest" (40). Physical risk factors relating to WRMSDs include posture-related risks (heavy manual work, frequent lifting or carrying, frequent bending and/or twisting, static and/or awkward work postures, dynamic factors, compression and vibration) (41, 42). The reported levels of exposure to physical risk factors in the workplace by employees in the EU have not diminished greatly from 1991 to 2010. The most prevalent physical risk factor was exposure to repetitive hand or arm movements followed by tiring or painful positions. Males showed much higher levels of exposure to all physical risk factors compared to females (42). As one of the most prevalent WRMSDs, the main physical risk factors which have been identified as attributing to the development of LBP are heavy physical work, awkward static and dynamic working postures and lifting (43). There is substantial evidence within the literature that exposure to work related physical risk factors is associated with the development of WRMSD (35). However, the effect of exposure to psychosocial risk factors and possible interactions between physical and psychosocial risk factors should not be overlooked.

1.5.2. Psychosocial Risk Factors

The European Agency for Safety and Health at Work, (EU-OSHA), describes psychosocial risk factors as those "which are related to the way work is designed organised and managed, as well as the economic and social contexts of work." (44).

There are many more detailed definitions of psychosocial risk factors, including the two definitions detailed below:

1) *"External aspects of the psychological and social work environment that cause the worker to experience "stress", a condition of chronic (prolonged) arousal of the human "flight or fight" mechanisms that has been linked to a wide variety of negative health outcomes, including MSDs."*
2) *"Internal characteristics of a worker's psychological makeup that affect how he/she experiences pain, discomfort and other symptoms and thus affect the worker's reporting of disease, experience of disability, and return to work."* (41, p223)

Two of the main job stress models, which are used within occupational research on psychosocial risk factors, are Karasek's job demand-control (JD-C) model (45) and Siegrist's effort-reward imbalance model (ERI) (46). Karasek's job demand-control (JD-C) model has been used repeatedly in occupational health research since its introduction in the late nineteen seventies (47). This model focuses on two job characteristics - psychological job demands and job control, whilst the ERI model focuses on intrinsic and extrinsic efforts and rewards (47). The dimensions, demand and control, within the JD-C model include high strain (high demands and low control), low strain (low demands and high control), passive (low demands and low control) and active (high demands and high control) (45). The JD-C model hypothesises that when the workplace demands are high and workplace control is low, high employee strain occurs. It is theorised that this can lead to poor health outcomes and this has been supported by the literature for outcomes such as cardiovascular disease (48, 49). Johnson and Hall (1988) expanded the JD-C model beyond the

demand-control formulation to include social support. This is called the job-demand-control-support model (50). This moved the emphasis from the individual workers' interaction with their work environment and allowed the inclusion of working relationships with peers and supervisors. A sense of belonging and a connection with the organisation and fellow workers can compensate for the pressures workers have to contend with in the workplace. Therefore, a lack of social support, including peer and supervisor support, can have a negative impact on the individual worker (42, 51, 52). It is important to note that social support is made up of several components including, the above, emotional aspect along with instrumental and informational aspects which relate to the set-up of the work environment (53, 54). Existing literature has shown that groups of workers with high physical and high psychosocial demands may have an increased risk of self-reported back and upper limb disorders (52, 55, 56). The main psychosocial risk factors which have been identified as attributing to the development of WRMSDs are low social support, negative affectivity, low level of job control, low decision authority, high job strain, high psychological demands and high work dissatisfaction (43, 51, 52). From a protective perspective, good social support, high job satisfaction and good mental health have been shown to be protective for preventing persistent low back pain 12 weeks after an acute/subacute episode of low back pain (57). Within the literature, the Copenhagen Psychosocial Questionnaire (COPSOQ) is used as a measurement of psychosocial factors (58). This questionnaire was developed as a reliable tool to measure psychosocial factors in the workplace. It has drawn on previous job stress questionnaires incorporating measurements dictated by relevant theories on psychosocial work characteristics.

1.5.3. Individual Risk Factors

Specific individual risk factors have been detailed as contributing to the development of WRMSDs. These risk factors include age, female gender, smoking, high body mass index (BMI) and presence of co-morbidities (43). The risk factors differ dependent on affected body part. For example, the main risk factors for LBP have been shown to be heavy physical work, awkward postures, lifting, psychosocial factors, increased BMI and younger age. Whereas the main risk factors for neck pain/discomfort have been shown to be psychosocial factors, smoking, female gender, awkward postures, and co-morbidities (43). Individual and workplace psychosocial risk factors are strongly and independently associated with work-related musculoskeletal pain (21). Therefore, it is clear that WRMSDs have a multi-factorial origin i.e. physical, psychosocial and individual origin (59).

1.6. Training and WRMSDs

Training has been discussed as an important aspect of WRMSD reduction and/or prevention both in research and in practice. Training can be described as ‘a planned purposeful event that aims to improve performance in a specific job or task’ (60, p283). In relation to work-related back pain and upper limb pain, Cochrane systematic reviews have been undertaken which show that there is very little quality evidence to indicate that manual handling training and/or ergonomic interventions are effective in reducing or preventing back pain and upper limb pain, respectively (61, 62). However, based on the above definition of training, it can be expected that manual handling/ergonomic training methods results in an improvement in the completion of the task from a musculoskeletal perspective. The Verbeek et al (2011) systematic review studied the hypothesised intermediate variables, such as ‘change in knowledge,

behaviour or attitudes related to manual handling (adherence to the training or advice), or reduction in the exposure to physical workload', in a limited capacity as a secondary outcome of interest (61, p5). There is a clear gap in the literature in relation to focused investigation of these hypothesised intermediate variables. A review of these variables may assist in determining why the above training programmes do not indicate effectiveness at the reduction or prevention of back and upper limb pain. Such a review would also allow an investigation of the current literature on training and WRMSDs to determine the occupations studied to date, specifically their employment status. The work environment of organisationally employed workers differs from that of self-employed workers and this needs to be investigated in greater detail.

1.7. Employment Status

1.7.1. Types of Employment

Employment status has been subject to changes in recent times which have seen the emergence of new and diverse working arrangements. This has caused a growth of "atypical" forms of employment and the decline of the "standard" full time permanent job. The working population are made up of less full time organisational employed workers with benefits and more contingency, part time contract and self-employed workers (2). It is important to note that this varies across European countries. In 2000, full time permanent employees in Germany, Luxembourg, Norway, Sweden, Iceland, Finland and Denmark made up 60 to 70% of the working population. Whereas Greece and Spain showed a high percentage of small employers and sole traders (63). Across Europe 15% of workers are classified as self-employed (42). Self-employment is difficult to define, however, five basic categories have been outlined:

1. Entrepreneurs, who run their business with the help of employees;

2. Traditional ‘free professionals’, who, in order to work in their occupation, must meet specific requirements, abide by regulations and duty-bound codes and often pass examinations to be listed in public registers. They can hire workers, but, with some exceptions, they generally carry out their activities alone or in association with other professionals and with the help of a limited number of employees, if any;
3. Craft-workers, traders and farmers, who represent the traditional forms of self-employment. These self-employed workers often work with their family members and possibly a small number of employees;
4. Self-employed workers in skilled but unregulated occupations, sometimes referred to as ‘new professionals’;
5. Self-employed workers in unskilled occupations, who run their business without the help of employees, but can sometimes be assisted by family members (64, p2).

In light of the need for further research relating to WRMSDs in occupations within the health and social care sector, the focus of this thesis will be on chartered physiotherapists, physical therapists and athletic therapists. This thesis will investigate both employed and self-employed therapists. The self-employed therapists within the population under investigation in this thesis would be best described as traditional “free professionals”.

1.7.2. Self-employment

Self-employed workers appear to be older on average than their employed counterparts. Around 87% of self-employed workers in Europe are over 35 years old and a third are over 50 years old, whereas more than three-quarters of employed

workers are less than 49 years old. Self-employed workers in Europe work primarily in the private sector with less than 5% working in the public sector (42). Self-employment has many positive aspects. The current literature indicates that self-employed workers have "an internal locus of control, a greater willingness to take risks, high self-assertiveness, high self-efficacy and a heightened need for success, achievement, autonomy and control" (65, p164). Individuals employed by organisations suffer from "reduced autonomy and skill requirements because of the characteristics of industrial bureaucracy" (65, p164). On the other hand, self-employed workers are reported to work longer hours, have more work–life conflict and higher levels of work stress compared to their employed counterparts (66-69).

1.7.3. Health, Wellbeing and Self-Employment

The wellbeing of self-employed workers can be measured against six common indicators of wellbeing: job satisfaction, life satisfaction, whether the job is stressful, whether the job is mentally straining, mental health and general health. In relation to job satisfaction, there appears to be conflicting findings in the literature. Andersson et al (2008) indicated that self-employed workers were more likely to report an increase in job satisfaction and in addition appear to be more satisfied with their lives compared to their employed counterparts (70). On the contrary, Benavides et al (2000) stated that sole traders were more likely to report job dissatisfaction than full-time permanent workers when controlled for age and gender (63). These conflicting findings could relate to the fact that Andersson et al (2008) was focused on the Swedish population and Benavides et al (2000) used data from 15 European countries indicating the diversity within self-employed workers as a group. The importance of "doing what

one likes" has been put forward as explaining a large part of the greater job satisfaction reported by self-employed workers (71).

Further conflicts in the literature are found when investigating whether the job is stressful. Andersson et al (2008) reported that self-employed workers do not appear to perceive their job as any more stressful or experience a greater deterioration of general health compared to their employed counterparts. However on the other hand, self-employment does appear to have an effect on mental health problems (70). Benavides et al (2000) stated that small employers reported high percentages of stress compared to permanent full-time employees (63). These findings indicate the main limitation of cross-sectional data which is the difficulty in determining causation and temporal sequence. For example, it cannot be established if the stress came before the self-employment or was caused by the self-employment status of the worker. In addition, fatigue levels have been shown to be significantly higher for small employers (OR: 1.55, 95% CI 1.32 – 1.81) and full-time sole traders (OR: 1.67, 95% CI 1.47 – 1.89) compared to full-time permanent workers, when controlled for age and gender (63). The literature indicates that self-employed workers report higher levels of smoking, obesity and more psychosomatic health problems than organisationally employed workers. However, counterintuitively, they visit doctors and miss work less frequently (68). This finding is supported by a previous systematic review which has shown tentative evidence that workers in temporary or insecure employment have a higher risk of occupational injuries along with lower absenteeism due to ill health or injury when compared to those in permanent employment (72).

European Union reports have indicated that there is very little or no data available on work-related health problems and occupational illness for self-employed workers

without employees across many European countries including Ireland. The data that does exist indicates that 45% of self-employed workers without employees and 36% of self-employed workers with employees feel that their work affects their health, this compares to 33% for the employed workers (64). Self-employed workers report more exposure to specific physical risk factors compared to their employed counterparts. These specific risk factors are repetitive movements, carrying/moving heavy loads, prolonged standing or walking, painful and tiring positions and exposure to vibrations (73). The most frequently reported symptoms were "musculoskeletal disorders such as backache and muscular pains, followed by fatigue, stress, headaches and irritability." Full-time sole traders were more likely to report backache and muscular pain than permanent full-time workers (63). In 2013, statistics in the United Kingdom showed that the prevalence rates for MSDs were higher among self-employed workers, at 3%, compared to employed workers at 1.9% (64).

1.8. Key Themes emerging from this chapter

This review of the international literature indicates that MSDs are a global health problem and, whilst they are not classified as an occupational disease, they are deemed to be an occupation-related health issue. The health and social care sector appear to be a high risk sector for MSDs. The literature to date on MSDs in the health and social care sector has focused specifically on employed nurses and LBP (27-31). There is a dearth of empirical evidence in relation to self-employed workers and their MSD health, with no specific information on employment status in the health and social care sector. Therapists in health care, including physiotherapists, physical therapists and athletic therapists, have been proposed to be a high-risk occupational group for the development of WRMSDs "due to the combination of prolonged stooping, repetitive

low-risk and infrequent high-risk lifts" as part of their workday tasks (5, p309). This indicates the need to investigate the musculoskeletal health of both employed and self-employed therapists, whilst taking their different working arrangements, training accessibility and social support into account. This investigation will initially require a review of the current literature in relation to therapists and MSD prevalence.

Chapter 2 – Prevalence of Work-related Musculoskeletal Disorders in Physiotherapists/Physical Therapists – Narrative Literature Review

Chapter 2: Prevalence of Work-related Musculoskeletal Disorders in Physiotherapists / Physical Therapists – Narrative Literature Review

2. Introduction

International studies and reports have suggested that musculoskeletal symptoms and disorders among health care workers are common. Previous research on the prevention and/or reduction of work-related musculoskeletal symptoms and disorders in health care workers has focused predominantly on nurses, nursing assistants and nursing students (27-31). In this review, physiotherapists as a health care occupational group are proposed to have a high rate of work-related musculoskeletal symptoms and disorders "due to the combination of prolonged stooping, repetitive low-risk and infrequent high-risk lifts" as part of their workday tasks were chosen for investigation (5, p309). Throughout the international literature, the terms 'physiotherapist' and 'physical therapist' are used interchangeably. Within this review, physiotherapists and physical therapists will be described as PTs. Through a review of the literature, it emerged that up until late 2015, there was no published systematic reviews or meta-analysis investigating prevalence and prevention of work-related musculoskeletal symptoms and disorders in PTs. This systematic review was written by Vieira et al (2015) (74). Prior to this, two narrative literature reviews have been published in 2002 and 2012 (75, 76). These reviews were completed at different time points, however, they show very worrying and similar findings.

Glover (2002) discussed that the lifetime prevalence of work-related musculoskeletal symptoms and disorders for PTs may be as high as 90% with younger PTs (i.e. those below the age of 30) more at risk of developing work-related musculoskeletal symptoms and disorders, particularly during their first four or five

years of practice (75). Sharan and Ajeesh (2012) indicated that worldwide more than 60% of PTs experience work-related musculoskeletal symptoms and disorders with a higher prevalence, of approximately 80%, for younger PTs (76). Vieira et al (2015) reported that up to 90% of PTs have WRMSD during their working life and 50% experience WRMSD within the first five years of practice (74). One in six PTs may change speciality or leave the occupation completely as a result of musculoskeletal injury. Across the three reviews, the findings also showed injury or strain to the low back as the injury with the highest prevalence (74-76). PTs suffering from work-related musculoskeletal symptoms and disorders are reported as generally either self-treating or going to a colleague for treatment rather than from a doctor or the occupational health department (75, 76). Lifting or transferring patients was discussed as the task most likely to lead to injury (74-76). The risk factors which have been discussed as contributing to the development of the work-related musculoskeletal symptoms and disorders are performing manual therapy, failure to take rest breaks, inadequate staffing levels and heavy caseload (74-76). Surprisingly, whilst reporting a possible 90% lifetime prevalence of work-related musculoskeletal symptoms and disorders for PTs, the review by Glover (2002) indicates that work-related musculoskeletal symptoms and disorders although widespread may be under-reported. One of the main recommendations of both reviews was the need to develop targeted awareness training around work-related musculoskeletal symptoms and disorders for PTs (75, 76).

Within the review by Glover (2002), there was no clear search strategy or inclusion/exclusion criteria to detail the selection procedure for the included studies (75). The Sharan and Ajeesh (2012) review indicated a broad search strategy and inclusion/exclusion criteria (76). The systematic review by Vieira et al (2015) included

a clear inclusion and exclusion criteria and a comprehensive search strategy. This review includes very clear and explicit inclusion/exclusion criteria and a detailed search strategy completed in a systematic manner. None of the published narrative reviews or the published systematic review indicated whether the studies included in the review investigated only employed PTs or both employed and self-employed PTs. Therefore, it still remains unclear what research currently exists around work-related musculoskeletal symptoms and disorders in self-employed PTs.

2.1. Research Questions

Through the existing literature, this review aims to investigate the following questions:

a) What is the prevalence rate of work-related musculoskeletal symptoms and disorders in PTs across different countries?
b) Which body part has the highest prevalence rate for injury?
c) What are the determinants/risk factors for the development of work-related musculoskeletal symptoms and disorders in PTs?
d) What are the main preventive work strategies used by PTs suffering from work-related musculoskeletal symptoms and disorders?
e) What research exists around work-related musculoskeletal symptoms and disorders in self-employed PTs?

2.2. Search Strategy

2.2.1. Criteria for considering articles for this review

The criteria for this review centred on the study design, the types of participants in the study, and the key outcomes investigated. Each of these was included in the inclusion/exclusion criteria for this review. These criteria are part of the Population,

Intervention, Comparison, Outcome (PICO) framework, which can be used to develop a highly structured search strategy (77).

2.2.2. Inclusion and Exclusion Criteria

The included studies had to use a quantitative study design, either cross-sectional study design or cohort study design. Therefore, all qualitative studies were excluded from the review. The study participants had to be PTs or Physical Therapist assistants (PTAs). Therefore, all studies investigating work-related musculoskeletal symptoms and disorders in other occupations, including similar occupations such as massage therapists and occupational therapists, were excluded. The main outcome of interest in this review was prevalence of work-related musculoskeletal symptoms and disorders in both the back and upper limbs. Therefore, included studies had to investigate this outcome. Studies which only investigated prevalence of injury in a specific body part were excluded from the review. Only articles published in peer-reviewed journals in the English language were included. Book chapters, conference papers, government documents and other grey literature were excluded.

2.2.3. Literature Search

The following three electronic databases were searched: PubMed, Embase and Science Direct. These searches were completed from December 2013 to June 2016 with no date restrictions on articles retrieved. This literature search also involved manually hand searching the references of all potentially eligible articles found to check for further relevant articles. Finally, a review of the author's own holdings added to the eligible articles.

Prior to completion of the literature search, the following keywords were decided upon as the search words for this review: 'physiotherapist', 'physical therapist',

‘work-related musculoskeletal disorders’, ‘work-related musculoskeletal injuries’, ‘low back pain’ and ‘back pain’. Different formats of these keywords were used to search each database with the separation of the Boolean Logic terms (AND, OR, AND NOT) when applicable.

The databases returned a total of 260 articles. Following a review of the titles and abstracts, 14 potentially eligible articles were found. Following a review of the full text of these articles, all 14 articles were determined as eligible to be included in the review. Three additional articles were deemed as eligible following hand searching of the references of the included articles and review of the author’s own holdings. In conclusion, 17 eligible articles were included in this review (6-19, 78-80). The main findings of interest from each article were extracted, summarised and included in Table 2.1. This was completed by a sole reviewer (D.H.).

2.3. Summary of Findings of the Included Studies

2.3.1. Methodology

Of the 17 included articles, 16 articles had a cross-sectional study design and one of them had a cohort study design. Cross-sectional study designs are a good method of determining a representative sample of the population to examine the association between the exposure and outcome of interest. However, it is important to note that due to the study design causality cannot always be determined, unless a clear temporal sequence of the exposure preceding the onset of MSD can be established. The exposure of interest in this review was workplace determinants/risk factors for work-related musculoskeletal symptoms and disorders with the outcome of interest as work-related musculoskeletal symptoms and disorders. Cohort studies have the ability to demonstrate the temporal relationship between exposure and disease and are,

therefore, suitable for establishing causation. None of the 17 included articles divided the PTs who participated in the studies by employment status (i.e. employed or self-employed). The findings within each of the 17 included articles were based on self-reported data. These 17 studies had varying response rates, although some not reported, and sample sizes.

2.3.2. Work-Related Musculoskeletal Symptoms and Disorders

Of the 17 included articles, 16 had PTs as the study population with one focusing on female PTs who had more than 15 years' work experience as PTs (12). The final article included PTs and PTAs (19). Whilst most of the included articles discussed investigating WRMSDs, a closer analysis of each of the articles methodology indicated that it was mainly musculoskeletal symptoms which were under investigation. Across the 17 included articles, 12 of these based their questionnaire on the standardised Nordic Musculoskeletal Questionnaire (6-14, 18, 79, 80). This questionnaire has been widely used to assess the nature and severity of self-reported musculoskeletal symptoms. These musculoskeletal symptoms can be described as ache, pain or discomfort to a specific body part over a certain time period (i.e. last 12 months or last 7 days) (81). Of these 12 articles, nine specifically stated work-related or job-related ache, pain and/or discomfort (6, 8-14, 18). The other three articles investigated musculoskeletal symptoms which could also include non-work-related injuries (7, 79, 80). Three of the 16 articles, did not specifically state if the questionnaire was based on a validated questionnaire. One of these three articles described an operational definition of work-related injury as "pain lasting more than three days that you feel was caused by your work as a physiotherapist" (17, p180). Another article investigated lifetime prevalence of LBP, sick leave, treatment and

other musculoskeletal problems which the participants felt were related to work (15). The third article defined WRMSDs "as an unpleasant sensation or pain in musculoskeletal system of the body developed after joining the PT profession" (78, p460). The final two included articles investigated the type of injury incurred and the body part affected, the activity being performed at the time of the injury, the work setting in which the injury occurred, whether the injury was reported and if a physician was consulted (16, 19). Therefore, within this review the phrase "work-related musculoskeletal symptoms" will be used in place of WRMSDs.

The 17 included articles had been completed worldwide i.e. across Europe, America, Asia, Africa and Australia. Within Europe, the 12-month prevalence of musculoskeletal symptoms in PTs ranged from 85.8% in Greece to 53.5% in Sweden (12, 79). Lifetime prevalence of work-related musculoskeletal symptoms in PTs in Europe ranged from 95% in Greece to 73.7% in Slovenia (15). The one study completed in Africa showed a 91.3% 12-month prevalence of work-related musculoskeletal symptoms in PTs (6, 79). In Australia the 12 month prevalence of work-related musculoskeletal symptoms in PTs was 55% (17) with lifetime prevalence at 91% (10). In Asia the 12-month prevalence of work-related musculoskeletal symptoms in PTs ranged from 92.4% in Korea to 47.6% in Kuwait (7, 13, 18). It is important to note that the study completed by Alrowayeh et al (2010), in Kuwait, requested self-report data on MSDs from respondents, however, they did not specifically request data on work-related MSDs (7). In America, Holder et al (1999), found that PTs reported a 32% prevalence rate for work-related musculoskeletal symptoms with PTAs at 35% (19). These findings are in addition to the findings displayed in Table 2.1. The cohort study by Campo et al (2008) showed a 20.7% one-year incidence rate. In addition, these authors reported a 12-month prevalence of work-

related musculoskeletal symptoms in PTs at baseline of 60.8% and in the follow up year of 57.5% which were similar to the 12-month prevalence rates reported within the cross-sectional studies included in this review (9). Table 2.1 shows that the low back was consistently the most affected body part across all 17 included articles. It is important to note that next to the lower back the most prevalent affected body parts were within the upper limbs, specifically, the neck, shoulders and hands/wrists. This indicates that upper limbs make up an integral part of the existing literature and warrant further investigation.

2.3.3. Workplace Determinants / Risk Factors

Of the 17 included articles, 13 articles investigated the reported workplace determinants/risk factors of work-related musculoskeletal symptoms for PTs. Of these 13 articles, 10 investigated which risk factors the respondents perceived to be the most pertinent determinants/risk factors of work-related musculoskeletal symptoms with the use of descriptive statistics to develop percentages. The most pertinent determinants/risk factors of work-related musculoskeletal symptoms perceived by PTs were lifting/transferring patients, repetitive tasks, awkward or static postures and completing manual therapy (6, 8, 11, 13-19).

Of the final three articles, two used statistical modelling which allowed adjustment for confounders to investigate the most pertinent determinants/risk factors of work-related musculoskeletal symptoms (9, 12). The final article calculated the relative risk of cited determinants/risk factors of work-related musculoskeletal symptoms (10). The cohort study by Campo et al (2008) (9) indicated that patient transfers, patient repositioning, bent or twisted postures and job strain increased the risk for low back disorders. Grooten et al (2011) (12) indicated that working in a

kneeling or squatting position and working in awkward or cramped positions were associated with low back pain or discomfort in female PTs. However, in comparison to Campo et al (2008), there was no evidence of increased risk of work-related musculoskeletal symptoms for transfers and repositioning of patients. Cromie et al (2000) (10) indicated that the following determinants/risk factors were associated with an increased risk of work-related musculoskeletal symptoms: performing manual orthopaedic techniques (upper limbs), lifting or transferring dependent patients (low back), working in awkward or cramped positions (low back), working in the same position for long periods (upper back, low back and neck), bending or twisting in an awkward way (low back), performing the same task over and over (upper limbs), treating a large number of patients in one day (upper limbs), working schedule (elbows and shoulders), not enough rest breaks during the day (upper limbs and upper back), working at or near your physical limits (wrists/hands) and continuing to work when injured or hurt (upper limbs).

2.3.4. Preventive work strategies

Nine of the 17 included articles reported on preventive work strategies employed by PTs suffering from work-related musculoskeletal symptoms. Eight of these nine articles investigated which preventive work strategies were mainly employed by PTs with the use of descriptive statistics to develop percentages. The final article only reported on two specific preventive work strategies with the use of percentages (79). The main preventive work strategies reported were adjust plinth/bed height before treating a patient and modify their position and/or the patient's position (6, 8, 10, 11, 16-19, 79).

Table 2.1: Description of Included Studies and Key Findings

Study	Study Design	Participants	Data Analysis used	Most affected body part(s)	Reported or attributed determinants/risk factors of work-related musculoskeletal symptoms	Preventive work strategies employed by PTs
Adegoke et al, 2008	Cross-sectional	126 PTs in Nigeria (Response Rate: 58.1%)	Descriptive Statistics, Frequency and Chi-square Test	Low Back (69.8%) Neck (31.1%) Shoulders (22.2%) ***(12-month prevalence)***	Treating large number of patients in a day Working in same position for long periods Lifting or transferring dependent patients	Modify their position and/or the patient's position Select techniques that will not aggravate or provoke their discomfort Adjust plinth/bed height before treating a patient
Alrowayeh et al, 2010	Cross-sectional	222 PTs in the State of Kuwait (Response Rate: 63%)	Descriptive Statistics, Frequency and Chi-square Test	Lower Back (32.0%) Neck (21.0%) Upper Back (19.0%) ***(12-month prevalence)***	-	-
Bork et al, 1996	Cross-sectional	928 PTs in America (Response Rate: 80%)	Descriptive Statistics, Frequency and Chi-square Test	Low Back (45.0%) Wrist/Hand (29.6%) Upper Back (28.7%) ***(12-month prevalence)***	Lifting or transferring dependent patients Treating an excessive number of patients in one day Working in awkward and cramped positions	Altering the frequency or technique of manual therapy Avoiding stressful positions Improving body mechanics

Table 2.1 (contd): Description of Included Studies and Key Findings

Study	Study Design	Participants	Data Analysis used	Most affected body part(s)	Reported determinants/risk factors of work-related musculoskeletal symptoms	Preventive work strategies employed by PTs
Campo et al, 2008	Prospective Cohort Study	882 PTs in America involved in the baseline questionnaire (Response Rate: 67%) 93% response rate to follow-up questionnaire	Descriptive Statistics, Independent-sample t-tests for continuous variables, Chi-square Test for categorical variables and Unconditional Logistic Regression	Low Back (6.6%) Hand and Wrist (5.3%) Neck (4.9%) ***(One-year incidence rate)***	Patient Transfers Patient repositioning Bent or Twisted Postures	-
Chung et al, 2013	Cross-sectional	180 PTs in Korea (Response Rate: 76.9%)	Descriptive Statistics, Frequency and Chi-square Test	Low Back (53.5%) Shoulders (45.2%) Wrist/Hand (33.8%) ***(12-month prevalence)***	Treating an excessive number of patients in one day Lack of rest breaks during the day Repetition of the same tasks	Modify their position and/or the patient's position Use other body part in order to apply manual treatment Adjust plinth/bed height before treating a patient

Table 2.1 (contd): Description of Included Studies and Key Findings

Study	Study Design	Participants	Data Analysis used	Most affected body part(s)	Reported determinants/risk factors of work-related musculoskeletal symptoms	Preventive work strategies employed by PTs
Cromie et al, 2000	Cross-sectional	541 PTs in Australia (Response Rate: 67.9%)	Descriptive Statistics, Frequency, Chi-square Test and Mantel-Hanzel odds ratios and 95% Confidence Intervals (Relative Risk)	Low Back (62.5%) Neck (47.6%) Upper Back (41.0%) ***(12-month prevalence)***	Performing manual orthopaedic techniques Lifting or transferring dependent patients Working in awkward or cramped positions Working in the same position for long periods Bending or twisting in an awkward way Performing the same task over and over Treating a large number of patients in one day Working schedule Not enough rest breaks during the day Working at or near your physical limits Continuing to work when injured or hurt.	Adjust plinth/bed height before treating a patient Modify their position and/or the patient's position Get someone else to help them handle a heavy patient

Table 2.1 (contd): Description of Included Studies and Key Findings

Study	Study Design	Participants	Data Analysis used	Most affected body part(s)	Reported determinants/risk factors of work-related musculoskeletal symptoms	Preventive work strategies employed by PTs
Glover et al, 2005	Cross-sectional	2688 PTs in the United Kingdom (Response Rate: 73.4%)	Descriptive Statistics, Chi-square Test and Kruskal-Wallis with 95% Confidence Intervals	Low Back (37.2%) Neck (25.7%) Upper Back (18.4%) ***(12-month prevalence)***	Performing the same task over and over Working in same position for long periods Treating a large number of patients in one day	Adjust plinth/bed height before treating a patient Modify their position and/or the patient's position Obtain assistance when handling a heavy patient
Grooten et al, 2011	Cross-sectional	131 Female experienced PTs in Sweden (Response Rate: 64.5%)	Descriptive Statistics, Univariate (crude) logistic regression analysis	Lower Back (30.0%) Shoulder (23.0%) Neck (21.0%) ***(12-month prevalence)***	Passive muscle stretching on patients Massage or soft tissue mobilization Joint mobilization, manual traction and/or orthopaedic manual therapy techniques	-
Holder et al, 1999	Cross-sectional	370 PTs & 253 PTAs in America (Response Rate: 67%)	Descriptive Statistics, Chi-square Test and Fisher exact 2-tail test, continuity correction and likelihood ratio	**PTs** Low Back (62.0%) Upper Back (23.0%) Wrist and Hand (23.0%) **PTAs** Low Back (56.0%) Upper Back (28.0%) **(2-year injury prevalence)**	Transferring a patient Lifting Responding to an unanticipated or sudden movement by a patient	Use improved body mechanics Increase use of other personnel Change working position frequently

Table 2.1 (contd): Description of Included Studies and Key Findings

Study	Study Design	Participants	Data Analysis used	Most affected body part(s)	Reported determinants/risk factors of work-related musculoskeletal symptoms	Preventive work strategies employed by PTs
Iqbal and Ahmad, 2015	Cross-sectional	75 PTs in Delhi, India (Response Rate: 75%)	Descriptive Statistics, Chi-square Test and Mann-Whitney U test	Lower Back (51%) Neck (17%) Shoulder (12%)	-	-
Nordin et al, 2011	Cross-sectional	81 PTs in Malaysia (Response Rate: 77%)	Descriptive Statistics, Frequency and Chi-square Test	Lower Back (51.7%) Neck (46.5%) Thoracic Spine (44.8%) ***(12-month prevalence)***	Manual Therapy Techniques Lifting or transferring activities	-
Rozenfeld et al, 2009	Cross-sectional	127 PTs in Israel (Response Rate: 69.8%)	Descriptive Statistics, Frequency, Chi-square Test, one-sample t-test and Binary logistic regression	Lower Back (67.0%) Neck (51.0%) Upper Back (46.0%) ***(12-month prevalence)***	Treating a large number of patients in one day Performing the same task over and over Lifting or transferring dependent patients	-
Rugelj, 2003	Cross-sectional	133 PTs in Slovenia (15% of the active PTs in Slovenia)	-	Low Back (73.3%) Neck (19.5%) Shoulder (15.0%) ***(Lifetime prevalence)***	Handling dependent patients	-

Table 2.1 (contd): Description of Included Studies and Key Findings

Study	Study Design	Participants	Data Analysis used	Most affected body part(s)	Reported determinants/risk factors of work-related musculoskeletal symptoms	Preventive work strategies employed by PTs
Salik and Ozcan, 2004	Cross-sectional	120 PTs in Turkey (Response Rate: 59%)	Descriptive Statistics, Frequency and Chi-square Test	Low Back (26.0%) Hand-Wrist (18.0%) Shoulders (14.0%) ***(Lifetime injury prevalence)***	Lifting Maintaining a position for prolonged period of time Performing repetitive tasks	Improvements in body mechanics Avoid lifting Change working positions frequently
Tsekoura et al, 2016	Cross-sectional	148 PTs in Athens, Greece (Response Rate: 59.2%)	Descriptive Statistics and Chi-square Test	Low Back (30.1%) Neck (26.8%) Hand-Wrist (19.4%) **(12-month prevalence)**	-	Change their posture during work Started a programme of therapeutic exercise
Vieira et al, 2016	Cross-sectional	121 PTs in Florida (Response Rate: Not reported)	Descriptive Statistics and general linear models	Low Back (66.0%) Neck (61.0%) Shoulder (42.0%) **(12-month prevalence)**	-	-

Table 2.1 (contd): Description of Included Studies and Key Findings

Study	Study Design	Participants	Data Analysis used	Most affected body part(s)	Reported determinants/risk factors of work-related musculoskeletal symptoms	Preventive work strategies employed by PTs
West and Gardner, 2001	Cross-sectional	217 PTs in Australia (Response Rate: 53%)	-	Low Back (22.0%) Neck (20.0%) Hands (14.0%) ***(12-month prevalence)***	Working in same position for long periods Working in static postures where flexion and/or rotation of the spine are greater than 20 degrees from neutral Continuing to work while injured or hurt	Modified your physiotherapy techniques Sought physiotherapy treatment Taken prescribed medication

2.4. Discussion

2.4.1. Overall Findings

This review of the literature in relation to the prevalence of work-related musculoskeletal symptoms in PTs showed that in spite of their knowledge of body mechanics, prevention and treatment of musculoskeletal injuries, they are susceptible to experiencing work-related musculoskeletal symptoms/injuries and report high prevalence rates across nearly all body parts. The low back is consistently reported across all 17 included articles as the most affected part in relation to injury for PTs which is in line with the findings of previous narrative and systematic reviews (74-76) showing the need to determine a scientific evidence base for the prevention of WRMSDs within PTs.

2.4.2. Critical Appraisal of Findings

Overall, the response rates across 16 of the 17 included studies ranged from moderate to excellent response rates, however, the possibility of selection bias needs to be taken into account, especially in the studies with lower response rates. In addition, it needs to be noted that one study did not report a response rate as the survey was advertised on four different occasions to all licensed PTs in Florida through their association's newsletter. This sampling method could have introduced selection bias into this study, as there was no methodology to determine any difference there may have been between those PTs who responded and those who did not respond (80). The measurement methodology used across the 17 included articles to determine the prevalence of work-related musculoskeletal symptoms was different across the studies. This reduces the ability to compare the findings directly across all 17 studies. In relation to the prevalence rates reported it is important to note that the majority of them, 16 out of the 17 included articles, were investigating musculoskeletal symptoms

not disorders or injuries (6-14, 18, 79, 80). Furthermore, only one article included in this review did not specify work-related or job-related ache, pain or symptoms (7). This is important as it can be inferred that the prevalence rates reported in 16 of the 17 included articles are evidence of the level of work-related musculoskeletal symptoms within PTs (6, 8-19). However, as the findings within each of the 17 articles were determined through the use of self-reported data, the prevalence rates reported need to be interpreted with caution due to the possibility of recall bias.

Of the 17 articles, 13 investigated workplace determinants/risk factors of work-related musculoskeletal symptoms (6, 8, 11, 13-19). These articles reported the most pertinent workplace determinants/risk factors of work-related musculoskeletal symptoms as attributed or perceived by PTs. Within 10 of the 13 studies, the analyses were purely descriptive and simply reported the attributed work determinants without correlating them to the actual symptoms. Other analyses did not control for confounders such as age, gender, number of hours worked per week, second job, among others. Therefore, it is important to accept with caution, the findings which showed that lifting/transferring patients, repetitive tasks, awkward or static postures and completing manual therapy as the most pertinent workplace determinants/risk factors of work-related musculoskeletal symptoms. Two of the 13 articles used statistical modelling (unconditional logistic regression) which allowed for adjustment of confounders (9, 12) with the final article calculating the relative risk of workplace determinants/risk factors of work-related musculoskeletal symptoms (10). Interestingly, when it came to the finding of "transfers and repositioning of patients" as pertinent workplace determinants/risk factors of work-related musculoskeletal symptoms, the two articles which used statistical modelling found conflicting results. This lack of consensus across the articles shows the need for more sophisticated

statistical analysis around workplace determinants/risk factors of work-related musculoskeletal symptoms for PTs, including psychosocial risk factors.

Of the 17 articles, nine investigated the preventive work strategies used by PTs suffering from work-related musculoskeletal symptoms (6, 8, 10, 11, 16-19, 79). The main preventive work strategies reported were mainly ergonomic adjustments to the work environment, to the PTs themselves or the patient. The statistical analyses used in these nine articles were purely descriptive. As discussed in the literature, the use of these preventive work strategies allows the PTs to adjust their method of working giving them the opportunity to stay in the profession in spite of the injury or discomfort (10). However, a question for further research which has been raised by this is whether PTs are choosing the best preventive work strategies and if training assists the PT to make changes which improve the musculoskeletal injury or discomfort.

The 17 articles in this review focussed on employed PTs in hospitals and clinical settings. However, as PTs work in various settings, with many working in a self-employed capacity, further research on work-related musculoskeletal symptoms/injuries is required to allow detailed investigation of the work environment and risk factors of self-employed PTs. Research including self-employed workers is generally sparse across all occupations. Each of the 17 included articles in this review have investigated the prevalence of both back and upper limb injury; however, the study populations have only included employed therapists and primarily investigated physical determinants/risk factors of WRMSDs along with relevant preventive work strategies. They did not investigate psychosocial risk factors such as social support, influence over the work, quantitative, emotional demands and scheduling issues. This indicates the need to assess psychosocial work factors in employed and self-employed

workers in relation to the development of WRMSDs, whilst taking account of the synergistic effects between physical and psychosocial determinants/risk factors (55).

2.5. Conclusions

Based on the findings of this review it is evident that no research has been completed to date on prevalence rates of WRMSDs in PTs in the Irish context. A study in the Irish context would be an important addition to the current literature as internationally, the terms 'physiotherapy' and 'physical therapy' have often been used interchangeably. However, in Ireland, these professions have been historically organised as two separate occupations with a distinct difference in the use of the terms "*physiotherapist"* and "*physical therapist"*. Physiotherapy has been described as a broad based health care profession that not only addresses musculoskeletal care of the physically active but also deals with a number of diverse medical fields, such as respiratory, cardiovascular and rheumatology. Chartered Physiotherapists have received several years of University training and are required to have had a hospital based internship on graduation. They can work in a variety of health care settings including private practice, hospitals, domiciliary health services, community services and outpatient services providing acute rehabilitation and specialist services. On the other hand, Physical Therapists in Ireland are certified, first contact practitioners who specialise in advanced palpatory and manual techniques to assess and treat pain and discomfort in the soft tissues (82). The duration of Physical therapy education is three years. They specialise in manual techniques exclusively, and are prepared for work mainly in private practice.

In addition, this review indicates that there is no research to date investigating WRMSDs, in both employed and self-employed PTs, and how the physical risk factors and psychosocial risk factors relevant to WRMSDs may vary depending on

employment status of the PTs. This review, also, indicates that PTs have a high prevalence of WRMSDs, however, there isn't any comparison group used, specifically the general working population. Finally, the investigation of preventive work strategies employed by PTs shows the need for further research to determine if the choice of preventive work strategy differs based on the provision of training to PTs.

2.6. Overarching aim for the thesis

The overarching aim for this thesis is to develop a scientific evidence base to assist in the prevention of work-related back, neck and upper limb pain/discomfort by investigating the potential risk factors of work-related back, neck and upper limb pain/discomfort in both employed and self-employed Chartered Physiotherapists (CPTs) and Physical Therapists/Athletic Therapists (PTs/ATs) in the Irish context and the effectiveness of current risk reduction strategies.

2.6.1. Theoretical Model of the Thesis

The theoretical model by Faucett, 2005, (3) (Figure 1.1), described previously was used as the basis for the theoretical model for this thesis. This model was applied to the specific context of this thesis with emphasis on specified aspects of the model. The systematic review (Chapter 3), and the paper on social support and WRMSDs (Chapter 5) both took account of the management systems and work environment aspects of Faucett's model. The paper on training, preventive work strategies and employment status (Chapter 6) also took account of the management systems aspect of Faucett's model. The LBP prevalence paper (Chapter 4), the paper on social support and WRMSDs (Chapter 5) and the paper on training, preventive work strategies and employment status (Chapter 6) took account of the WRMSD outcomes aspect of Faucett's model.

Within the model for this thesis, the management system influences the organisational culture, communication and feedback mechanisms for workers and resources available to workers, such as training (Figure 2.1). These systems will vary for organisationally employed workers versus self-employed workers. This, in turn, affects how the work environment is set up physically, ergonomically, organisationally (i.e. breaks, pace of work, among others) and on an interpersonal

level. The work environment has a direct impact on WRMSD outcomes such as symptom perception, self-care and absenteeism, in addition to worker health and well-being. This model indicates that the conditions within which work is completed have an impact on workers' health and well-being.

In Chapter 3, the investigation will focus on a systematic review of the literature to determine the effect of manual handling training (management systems) on achieving training transfer, employee's behaviour change and subsequent reduction of WRMSD outcomes, with a focus on LBP. In Chapter 4, the investigation will focus on LBP prevalence (WRMSD outcome) for employed and self-employed therapists compared to the national working population. In Chapter 5, the investigation will focus on the social support (psychosocial work factors) both peer and supervisor available in the work environment through the relevant management systems for employed and self-employed therapists and the association with WRMSD outcomes. In Chapter 6, the investigation will focus on training, employment status (management systems) and preventive work strategies available in the work environment and the association with WRMSD outcomes.

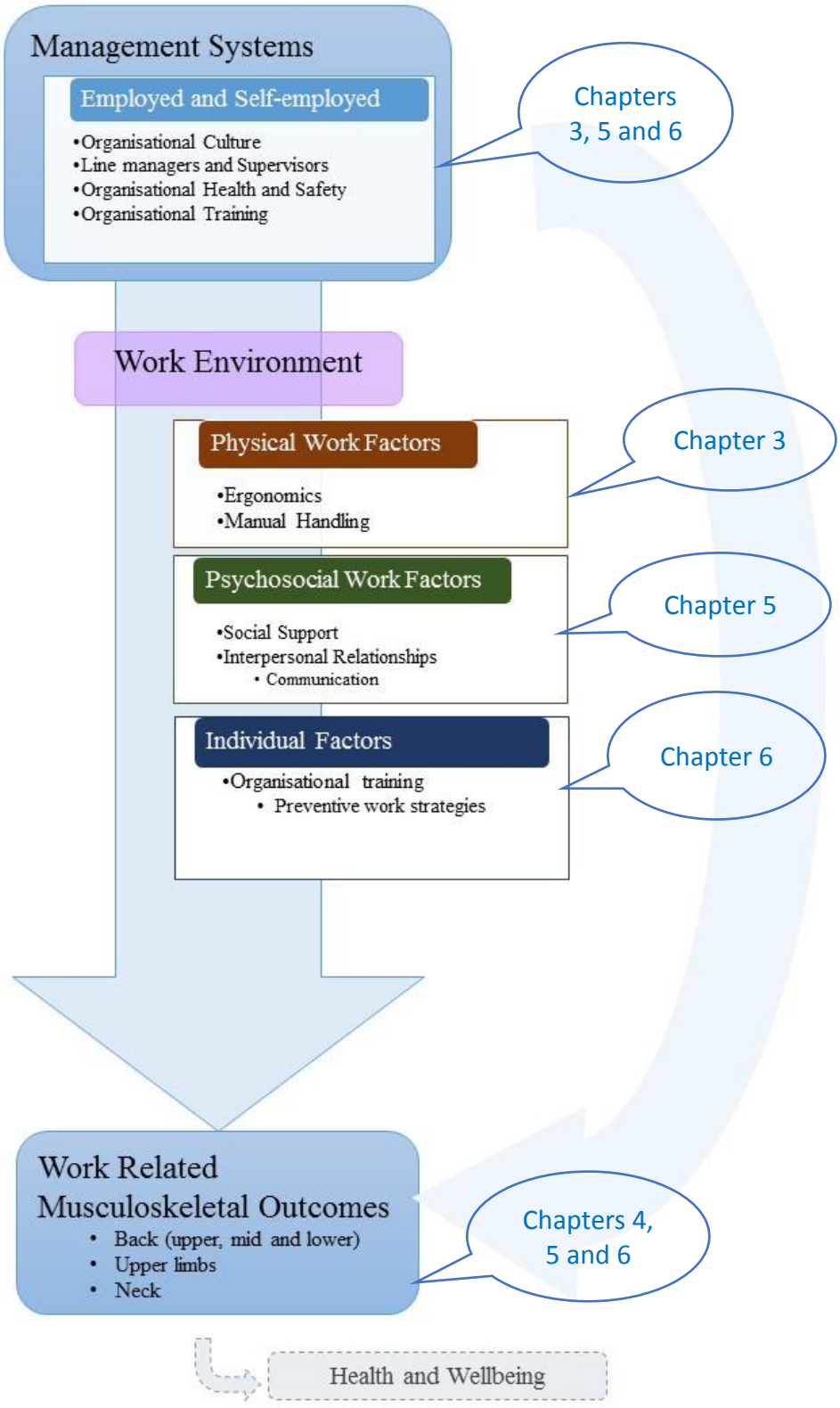

Figure 2.1: Diagram of Theoretical Model for the Thesis

2.6.2. Hypotheses for the Thesis

The hypotheses for this thesis are based on the gaps in the literature determined through the introduction and literature review. These hypotheses are discussed below under the four papers which make up this thesis.

Chapter 3: Paper 1 - The effect of manual handling training on achieving training transfer, employee's behaviour change and subsequent reduction of WRMSDs: a systematic review.

The introduction to this thesis indicates that manual handling in the workplace can be described as a pertinent physical risk factor to the development of WRMSDs. It has also been indicated in previous systematic reviews that there is very little quality evidence on the effectiveness of manual handling training in relation to prevention or reduction of WRMSDs with the focus on employed workers. The primary focus of these previous reviews was on the effectiveness of manual handling training on the reduction of WRMSDs (61, 83). The particular emphasis of this current review is on the hypothesised intermediate variables that link training to changes in employee knowledge, attitudes, skills and behaviour following manual handling training. This information is essential to understand if the theoretical expectations of training are transferred into practice. In addition, there is a need to determine the research completed to date on self-employed workers in relation to training and subsequent reduction of WRMSDs. Therefore, to investigate this further and determine if training is an effective recommendation, a systematic review of intervention research was undertaken with the following hypothesis:

a) The provision of Manual Handling Training results in training transfer, employee behaviour change and, subsequently, leads to a reduction in WRMSDs.

Chapter 4: Paper 2 – Are Irish Therapists at heightened risk for low back pain?

Previous research has mainly focused on employed therapists and does not provide data on the large group of self-employed therapists. Within the international literature, no studies have been identified by the authors that provide a comparison between prevalence rate of LBP for therapists and the nationally representative working population. Previously, if a comparison group was used it was generally a similar physically demanding occupational group (i.e. Occupational Therapists) (84). This comparison with the national working population is essential to determine whether therapists are a high-risk occupational group for the development of LBP. Therefore, this paper investigated the following hypotheses:

a) Therapists have a higher prevalence of LBP compared to the general working population.

b) Self-employed therapists have a higher prevalence of LBP across all age and gender strata, compared to their employed counterparts.

Chapter 5: Paper 3 – The association of social support and WRMSDs among employed & self-employed CPTs, PTs/ATs in Ireland.

Within the current literature, it has been indicated that low supervisor support is a relevant risk factor for the development of WRMSDs in employed workers, whilst low peer support does not appear to be a predictor. Self-employed workers appear to be

more at risk of suffering work-related musculoskeletal disorders (WRMSDs) compared to their employed counterparts. High levels of work-related social support can compensate for work-related strain which workers have to contend with. Therefore, it can be hypothesised that self-employed workers may have low work-related social support and are, therefore, more susceptible to WRMSDs. Hence, this paper was undertaken to investigate the following hypotheses:

a) Self-employed therapists who report having low social support have a higher prevalence of work-related back, neck and upper limb pain/discomfort, compared to those who report having high social support.

b) Employed therapists who report having low social support have a higher prevalence of work-related back, neck and upper limb pain/discomfort, compared to those who report having high social support.

c) Self-employed therapists who report having low social support have a higher prevalence of incapacitating upper limb symptom, compared those who report having high social support.

d) Employed therapists who report having low social support have a higher prevalence of incapacitating upper limb symptoms, compared those who report having high social support.

Chapter 6: Paper 4 – Training, preventive work strategies and employed & self-employed CPTs, PTs/ATs in Ireland.

The literature indicates that PTs adjust their work to reduce aggravation of musculoskeletal symptoms and/or injury. However, the literature does not indicate if PTs choose the most appropriate preventive work strategies to prevent further injury

or if the completion of injury prevention training affects their choice. Therefore, this paper investigated the following hypotheses:

a) Employed therapists engage in preventive work strategies more than self-employed therapists

b) Trained therapists engage in preventive work strategies more than untrained therapists

c) Therapists who report back, neck and/or upper limb pain/discomfort engage less in preventive work strategies compared to those who do not report pain/discomfort in these body parts.

Chapter 3: Paper 1 – The effect of manual handling training on achieving training transfer, employee's behaviour change and subsequent reduction of work-related musculoskeletal disorders: a systematic review

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Published: Hogan DAM, Greiner BA, O'Sullivan L. The effect of manual handling training on achieving training transfer, employee's behaviour change and subsequent reduction of work-related musculoskeletal disorders: a systematic review. Ergonomics. 2014;57(1):93-107.

Chapter 3: The effect of manual handling training on achieving training transfer, employees' behaviour change and subsequent reduction of work-related musculoskeletal disorders: a systematic review

3. Abstract

This systematic review investigated the effectiveness of manual handling training on achieving training transfer, leading to a positive change in employees' manual handling behaviours and a reduction of WRMSDs following training. Six electronic databases were searched for randomised controlled trials, non-randomised controlled trials or cohort studies with a control and/or comparison group which investigated the effectiveness of manual handling training. Thirteen articles met the inclusion and exclusion criteria. Following quality assessment, nine of the included articles were found to be high quality. This systematic review suggests there has been very little research focusing on the effectiveness of manual handling training on training transfer to employees' and the associated behavioural change. This review indicates that whilst employees report understanding and awareness following training, this does not always lead to the expected behavioural change. This review also suggests it cannot be demonstrated that training transfer will lead to a reduction of WRMSDs.

Keywords: training transfer; behavioural change; occupational low back pain; manual handling training; systematic review.

Practitioner Summary: This systematic review investigated the effect of manual handling training on behavioural change and WRMSDs. Thirteen articles met the inclusion and exclusion criteria. Overall, the evidence suggests manual handling training is not effective at causing a change in employee's manual handling behaviour following training or at reducing WRMSDs.

3.1. Introduction

Musculoskeletal disorders "include a wide range of inflammatory and degenerative conditions affecting the muscles, tendons, ligaments, joints, peripheral nerves and supporting blood vessels" (20, p13). Musculoskeletal disorders have a multi-causal aetiology including the individual's characteristics, psychosocial and physical factors (38). In the work context, they can be caused or aggravated by many physical hazards, including manual handling and excessive static work load, and also by psychosocial hazards and are termed Work Related Musculoskeletal Disorders (WRMSDs). Within Europe, backache has been reported as the most prevalent work-related health problem by workers (23). WRMSDs can result in direct and indirect financial costs for the employer (i.e. increases in insurance premiums, decreased productivity) and employee (i.e. loss of earnings). They can also result in a negative impact on the employee's quality of life (20). When manual handling tasks cannot be avoided in the workplace, the provision of manual handling training to employees is an essential element of the control of manual handling risks, i.e. possible injury. Therefore, the requirement for appropriate training in relation to manual handling has been outlined in Council Directive 90/269/EEC - manual handling of loads and has been included in the national legislation of European Union member states. A systematic review by Burdorf and Sorock (1997), (86), showed that 16 out of 19 studies reported a positive association between back disorders and manual handling in the workplace. The risk estimates ranged from 1.12 to 3.07 with attributable fractions between 11% and 54%. Punnett et al (2005), (25), discussed that globally, 37% of low back pain is attributed to occupational risk factors i.e. heavy lifting and whole body vibration.

Goldstein (1991), (87, p508), defined training as "the systematic acquisition of attitudes, concepts, knowledge, rules, or skills that result in improved performance at

work". From this definition, it can be inferred that there is an expectation that training should result in changes to how the task is completed. The following theory, by Fitts (1962), details that the method by which individuals acquire new and complex skills can be broken down into three stages. The first stage is skill development "where the learner needs to understand what the task will involve and so needs appropriate details". Following on from this is the associative stage, "where practice will help the learner to improve on association between knowledge and application". Finally, the autonomous stage is "where the skill becomes automatic" and requires less attention whilst using the new skill (60, p.283). The Training Transfer Framework model proposed by Baldwin and Ford (1988), (88), described the elements that account for learning and retention and, subsequently, for behaviour change to occur as dependent on the training design, trainee characteristics and work-environment characteristics. The theory indicates that manual handling training should result in a decrease in "at-risk" behaviours which combined with supportive work-environment characteristics should lead to a reduction in adverse bio-mechanical exposures. This in turn should result in decreased prevalence and/or severity of WRMSDs.

Previous systematic and narrative reviews have been completed to investigate the effectiveness of manual handling training relating to the reduction of back pain and back injury (61, 83, 89). The findings of these reviews have been negative overall in relation to the effectiveness of manual handling training at reducing back pain and back injury. Clemes et al (2010), (83, p104), reported "there is little evidence for the effectiveness of educational- and technique-based manual handling training in all industries." The authors discussed that interventions including physical activity show promise, however, they feel further research is needed in this area. They also discussed a pressing need for "high-quality randomised control trials, involving sufficiently

large samples and incorporating long term follow-up periods" (83, p105). Verbeek et al (2011), (61, p16), reported "the studies included in this review do not provide evidence that training and advice prevent back pain when compared to no intervention or another intervention". Both these reviews emphasised that the quality of the current literature is an issue and that further research in the area needs to be more robust. The primary focus of these reviews was on the effectiveness of manual handling training on the reduction of back pain and back injury as primary outcomes. Previously, little attention was paid to the hypothesised intermediate variables that link training to changes in employee knowledge, attitudes, skills and behaviour. The focus on these intermediate variables may help us to clearly determine the issues which exist in relation to training transfer. For example, is the issue a lack of enhanced knowledge, skills and awareness of employees following training or is it the transfer by employees of the acquired knowledge and skills into daily practice?

The aim of this review was to investigate, from the published scientific literature, if manual handling training is effective at training transfer to employees and, subsequently, causing a positive change in employee's manual handling behaviour following training, leading to a reduction of WRMSDs. This information is essential to understand if the theoretical expectations of training around training transfer and subsequent behavioural change are transferred into practice. Therefore, from the authors' perspective, to determine the effectiveness of manual handling training, a holistic approach must be taken which allows evaluation beyond just the physical risk factors. This would allow the investigation of employee knowledge and behavioural change as potential causal links between manual handling training and reduction of WRMSDs.

3.2. Methods

3.2.1. Inclusion and exclusion criteria

The study design of all eligible articles had to be experimental (randomised controlled trials), quasi-experimental (non-randomised controlled trials, controlled before and after studies) or cohort studies with a control and/or comparison group as these study designs were considered to produce the strongest scientific evidence in this context. The focus of the intervention had to be on education/training around manual handling or patient handling. Interventions could also use an integrated approach by assessing the effectiveness of manual handling training and other preventative methods, i.e. lumbar support, physical exercise, on the reduction and/or prevention of WRMSDs. To be included in this systematic review, interventions with an integrated approach needed to investigate the education/training aspect individually in comparison with a control group without education/training, so the effect of education/training could be clearly determined.

All quantitative study types without a comparison and/or control group, laboratory based assessments of the effectiveness of manual handling training and qualitative studies were excluded from the review. Participants were working age adults, (aged 16 to 70 years), both male and female, who through their work or training, engaged in manual handling or patient handling tasks.

The outcome of this review was the effectiveness of manual handling training at achieving training transfer and, subsequently, potentially causing a positive change in employee's manual handling behaviour following training, leading to a reduction of WRMSDs.

3.2.2. Literature Search

The following six electronic databases were searched up until 21 March 2013: Pubmed, Embase, CENTRAL (Cochrane Central Register of Controlled Trials), CINAHL, EBSCO and Web of Science. Within the EBSCO database, the following databases were searched: SocINDEX with Full Text, PsychINFO and Psychology & Behavioral Sciences Collection. The literature search also involved manually hand searching the references of all potentially eligible articles found to check for further eligible articles. Only articles published in peer-reviewed journals in the English language were accepted. Therefore, book chapters, conference papers, government documents and other grey literature were excluded.

Prior to completion of the literature search, the following keywords were decided upon as the search words for this review: 'low back pain', 'back pain', 'back ache', 'musculoskeletal disorder', 'lifting', 'pulling', 'pushing', 'manual handling', 'manual materials handling', 'ergonomics', 'education' and 'training'. Different formats of these keywords were used to search each database with the separation of the Boolean Logic terms (AND, OR, AND NOT) when applicable.

The following search string developed and validated by Verbeek et al (2005), (90), was used in each search on each database, as it was determined to be the most sensitive search strategy for retrieving studies of occupational health interventions: "(effect* [tw] OR control* [tw] OR evaluation* [tw] OR program* [tw]) AND (work* [tw] OR occupation* [tw] OR prevention* [tw] OR protect*[tw])" (90).

3.2.3. Data extraction & management

All the search results were reviewed for duplicates both by reference management software and manually by the assessor (DH). For all the articles found during the search, both the titles and abstracts were scanned to allow the selection of potentially

eligible articles. The full text of each of these potentially eligible articles was reviewed to determine the appropriateness of the article for inclusion in the current review.

3.2.4. Quality Assessment

The quality of each included article was assessed using the Downs and Black (1998), (91), checklist for measuring the methodological quality of the study. This checklist was developed and validated to determine the quality of both randomised and non-randomised interventions, specifically, in health care. This checklist assessed reporting, external validity, internal validity (bias & confounding) and power of the study. Each of the 27 questions within this checklist had a clear "Yes/No" answering scale, with "Yes" assigned a score of one and "No" assigned a score of zero. A number of questions also contained the option of "Unable to Determine" which was also assigned a score of zero. One question relating to detail of principal confounders was scored differently with an answer of "Yes" assigned a score of two, an answer of "Partially" scored as one and "No" assigned a score of zero.

This review used a modified version of this scale, which as of 5th October 2013, was available on the Spinal Cord Injury Rehabilitation Evidence (SCIRE) project website. This modified scale adapted the final question relating to the power of the study, which had originally been scaled 0 – 5 and changes it to a scale of 0 – 1, "where 1 was scored if a power calculation or sample size calculation was present while 0 was scored if there was no power calculation, sample size calculation or explanation whether the number of subjects was appropriate". This revised checklist had a scoring scale which ranged from 0 – 28. This quality assessment was completed to allow for critical appraisal of the findings of each article i.e. weigh the evidence by the strength of the study quality score.

3.2.5. Data Synthesis

For this review, narrative synthesis was used as the methodology to synthesis the findings of all the included articles, which related to the outcomes of interest in this review i.e. the effectiveness of manual handling training at achieving training transfer and, subsequently, causing a positive change in employee's manual handling behaviour following training leading to a reduction of WRMSDs. The findings of each included article were extracted and the narrative synthesis was then completed with the aim of describing the findings in each article which related to the outcomes of interest in this review.

3.3. Results

3.3.1. Results of the literature search

The six databases searched yielded 209 articles in total. Following the removal of 40 duplicates across all six databases, 169 articles remained. These articles were screened for eligibility to be included in this review based on title and abstract. Of the 169 articles screened, 40 articles emerged as potentially eligible. The full text for each of these potentially eligible articles was obtained and reviewed. Of these 40 articles, five articles were accepted as eligible for this review based on the predetermined inclusion and exclusion criteria (27-29, 31, 92).

The reference lists of each of the 40 eligible articles were manually hand searched to determine further eligible articles. Following screening of the title alone, another 39 articles emerged as potentially eligible. After subsequent review of the abstracts, seven of the 39 articles were deemed to be potentially eligible (30, 93-98). The full text of these articles was obtained, reviewed and all were accepted as eligible for this review based on the same criteria as previous.

The reference lists of these seven articles were manually hand searched to determine further eligible articles. Following screening of the title alone, another 12 articles emerged as potentially eligible. Following subsequent review of the abstracts, only one of these articles was deemed to be potentially eligible. The full text of this article was obtained, reviewed and accepted as eligible for this review based on the same criteria as previous. No further articles were deemed to be potentially eligible. In conclusion, 13 eligible articles were included in this review (27-31, 92-99) (Figure 3.1).

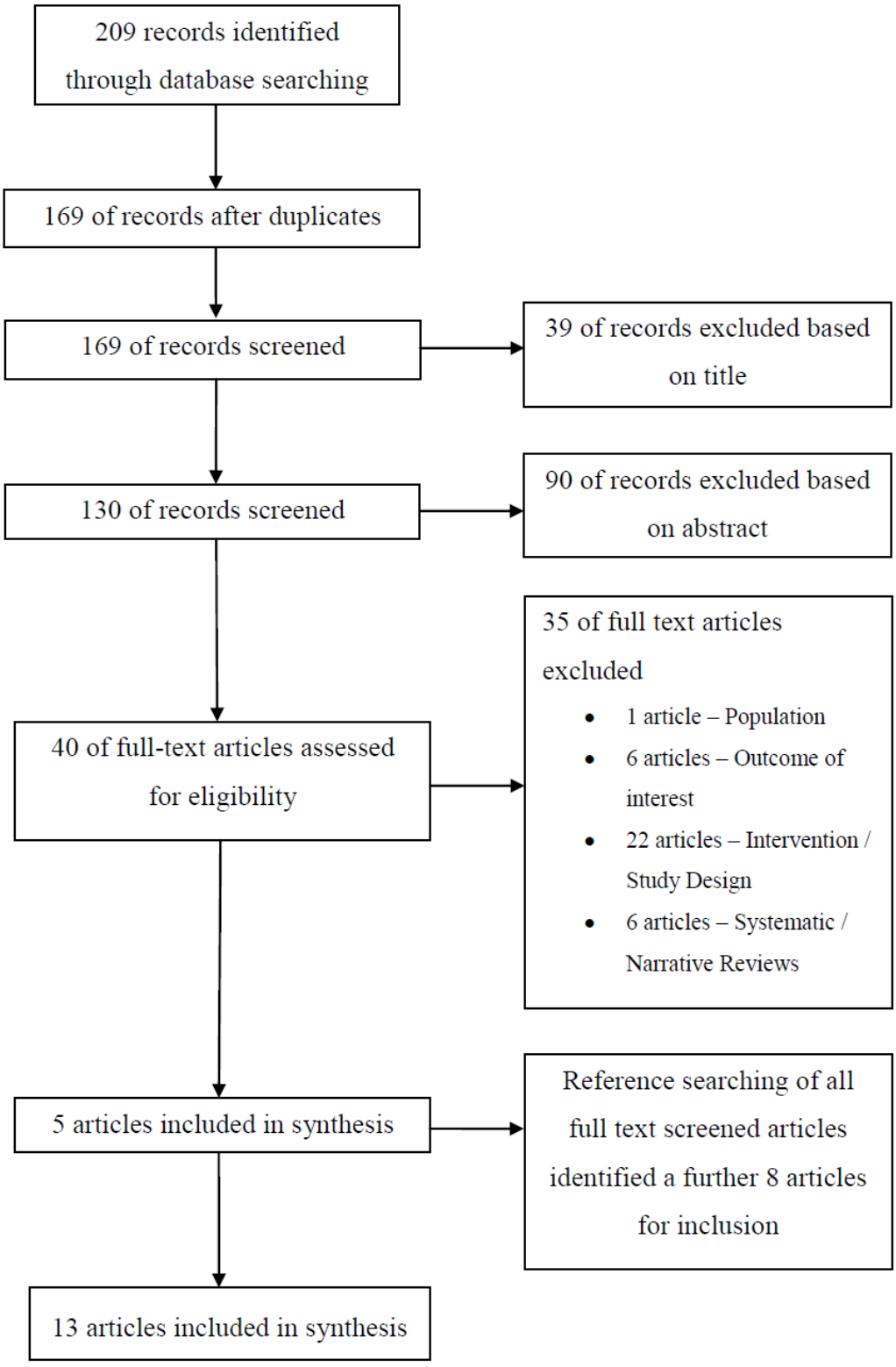

Figure 3.1: Flow chart of article selection process

3.3.2. Characteristics of the included articles

Of the 13 included articles, nine were randomised controlled trials, (27, 28, 31, 92, 93, 95-97, 99). The other four were controlled trials (non-randomised) (29, 30, 94, 98). Two of the included articles were based on the same randomised controlled trial with one reporting the effect on training transfer and employee behavioural change (99) and the other reporting the effect of the trial on low back injuries (93).

Nine of the included articles were completed in the health care sector (27-31, 92, 94, 95, 98), with the other four completed in the postal service (93, 99) and aviation industry (96, 97). Within the 13 articles, the participants in 12 of the articles were employees of the organisation, with one article using nursing students as the study population (98).

Nine of the included articles had either inclusion and/or exclusion criteria relating to study participants (28, 29, 31, 92-95, 97, 99). The final four articles did not report any specific inclusion and/or exclusion criteria (27, 30, 96, 98).

Daltroy et al (1993), (99), had "knowledge about safe lifting and posture" and behaviour change measures within its outcomes of interest, with Warming et al (2008), (92), investigating knowledge of transfer technique. Both Best (1997), (27), and Videman at al (1989), (98), had 'observed handling behaviour' within their outcomes of interest. Twelve of the included articles had either 'low back pain' or 'back pain' within their outcomes of interest. The final included article focused on injury rates (96).

Seven of the included articles compared the intervention(s) under investigation to a "placebo" i.e. a less intense form of training or usual routine (27, 29, 31, 92, 93, 98, 99). Four of the included articles compared the intervention(s) under investigation to a control undergoing no planned training (28, 94, 96, 97). Jensen et al (2006), (95),

compared the interventions under investigation to a control group undergoing unrelated training of their own choice i.e. chemical safety. The final article compared two models of learning relating to the training of patient moving and handling skills (30).

Eight of the included articles compared one intervention group to one control group. However, five of the included articles had more than one intervention group i.e. comparing lumbar support, training or combination of lumbar support & training (96, 97), training or training combined with physical fitness training (92), different levels of access to and training in the use of low tech ergonomic equipment (31) and psychosocial intervention or transfer technique training intervention (95) (Table 3.1).

Table 3.1: Characteristics of included articles

Study ID	Study Design	Setting	Duration	Participants	Inc/Exc criteria	Intervention	Comparison	Outcomes
Best 1997	Cluster RCT	Three nursing homes in Melbourne	12 months	Nurses and allied staff (n=55)	None stated	Hospital orientation & a 32-hour training course	In-house orientation training	• Self-reported Back Pain • MH Behaviour (observations)
Daltory et al. 1993	RCT	Postal service	2.5 years into a 5.5-year study	Random sample of 209 workers from 4,000 postal workers at two mail processing facilities	Inc. Mail handlers, maintenance workers and clerks	"Back Schools" with follow up training	No training	• Knowledge about safe lifting and posture / Perceived controllability of back safety • Worker and supervisor helping and reinforcement of safe lifting behaviours • Lifting on the job, posture on the job and exercise/stress reduction off the job / Having a tried back at the end of the day (all self-reported measures)
Daltroy et al. 1997	RCT	Postal service	5.5 years	4,000 postal workers at two mail processing facilities.	Inc. Mail handlers, maintenance workers and clerks	"Back Schools" with follow up training	No training	• Rates of Primary Low Back Injury / Other musculoskeletal injuries (company accident-report data) / Primary prevention of low back injury
Fanello et al. 2002	RCT	Regional Hospital of Le Mans (France)	2 years	136 'non-trained' employees & 136 'trained' employees.	Inc. Cleaning staff, nursing assistants and nurses	Theoretical lifting instruction (advice during work tasks)	No training	• Self-reported back pain in the presence of occupational health physician

Note: RCT – randomised controlled trial; NRCT – non- randomised controlled trial; Inc/Exc criteria – inclusion/exclusion criteria; MH – manual handling; PH- patient handling

Table 3.1 (contd): Characteristics of included articles

Study ID	Study Design	Setting	Duration	Participants	Inc/Exc criteria	Intervention	Comparison	Outcomes
Feldstein et al. 1993	NRCT	Two medical centres	1 month	55 nurses, aides and orderlies	Inc. Nurses, aides and orderlies	Training in lifting, body mechanics etc.	No training	• Composite back pain • Composite fatigue (both self-reported)
Hartvigsen et al. 2005	NRCT	4 Danish municipalities	2 years	345 home care nurses and nurses' aids	Inc. Home care nurses and nurses' aids	An educational and low-tech ergonomic intervention programme	Once off three-hour instruction in lifting technique	Number of days with self-reported LBP during the past year / Number of episodes of LBP • Care seeking for LBP during the past year
Jensen et al. 2006	RCT	3 Danish eldercare wards	6 months	210 home care workers, nurses & nurse's aides	Inc. Permanent staff engaged in client care at the 3 wards	Transfer Technique or Stress Management Intervention	Training in an unrelated topic i.e. skin care, chemical safety	• Self-reported LBP • Self-reported perceived physical and mental exertion
Johnsson et al. 2002	NRCT	One medical area of Stockholm County Council	6 months	51 nurses, occupational therapists and physio-therapists	None stated	Traditional training groups	Quality circles	• Prevalence of MS problems, job strain and perceived exertion (self-reported)
Reddell et al. 1992	RCT	Four international airports	8 months	642 fleet service clerks	None stated	Weightlifting belt, training class & both together	No training or weightlifting belt	• Injury incident rate (company statistics)

Note: RCT – randomised controlled trial; NRCT – non- randomised controlled trial; Inc/Exc criteria – inclusion/exclusion criteria; MH – manual handling; PH- patient handling

Table 3.1 (contd): Characteristics of included articles

Study ID	Study Design	Setting	Duration	Participants	Inc/Exc criteria	Intervention	Comparison	Outcomes
Van Poppel et al. 1998	RCT with a factorial design	Cargo department of a Dutch airline in Schiphol Airport	6 months	312 workers whose job included MH.	Exc. workers with work disability	Education or lumbar support & both together	No education or lumbar support	• Lower back pain incidence (self-reported).
Videman et al. 1989	NRCT	Nursing School	3 years follow up for both groups	Nursing students	None stated	40 hours of both practical and theoretical training spread over 2.5 years.	Traditional form of training	• Observed patient handling skill • Self-reported prevalence of back pain • Cumulative incidence of back pain
Warming et al. 2008	Cluster RCT	Bispebjerg University Hospital, Copenhagen	12 months	337 nurses on wards with no previous patient transfer technique.	Exc. temp & retired nurses, in a job-change situation, on long-term leave, with no patient contact & pregnant nurses	Transfer technique education programme alone or in combination with physical fitness training.	Follow usual routine	• Perceived LBP • Pain level • Disability and sick leave due to LBP • Knowledge of transfer technique (all self-reported)
Yassi et al. 2001	RCT	An acute and tertiary care hospital in Canada	1 year	346 nurses and unit assistants	Exc. float pool staff	No strenuous lifting arm & safe lifting arm	Control arm (usual practice)	• Frequency of PH tasks / Self-perceived frequency & intensity of physical discomfort associated with various PH tasks • Perceived general health, back pain & shoulder disability (self-reported)

Note: RCT – randomised controlled trial; NRCT – non-randomised controlled trial; Inc/Exc criteria – inclusion/exclusion criteria; MH – manual handling; PH- patient handling

3.3.3. Findings of the Quality Assessment

The methodology of quality assessment used in this review was similar to the methodology used in the previous systematic review by Clemes et al (2010), (83). Within the quality assessment, 49% or below was taken to describe articles of poor quality, with 50 to 59% describing articles of fair quality and 60 to 69% describing articles of good quality. To be determined as excellent quality, articles needed to score 70% or greater. The quality assessment was completed twice with a timeframe of six months between each assessment. This was completed to ensure the reliability of the quality score and resulted in very little difference to the quality score for each article.

Following quality assessment, three of the included articles obtained a percentage greater than 70, which showed them to be of excellent quality (29, 97, 99). Seven of the included articles obtained a percentage between 61 and 68 which showed them to be of good quality (31, 92-97). Three of the included articles obtained a percentage between 50 and 54 which showed them to be of fair quality (27, 28, 30). The non – randomised controlled trial on nursing students, by Videman at al 1989, (98), obtained the lowest quality assessment percentage of 36, therefore, this article was described as poor quality (Table 3.2).

Table 3.2: Quality Assessment for included articles

Study ID	Study Design	Reporting (out of 10)	External Validity (out of 3)	Internal validity – bias (out of 7)	Internal validity – confounding (out of 6)	Power (out of 1)	Study Quality Score (out of 28)	Study Quality Percentage (out of 100%)
Best 1997	Cluster RCT	6	1	5	2	0	14	50%
Daltory et al. 1993	RCT	8	3	4	4	1	20	71%
Daltroy et al. 1997	RCT	7	3	4	4	1	19	68%
Fanello et al. 2002	RCT	6	1	4	3	0	14	50%
Feldstein et al. 1993	NRCT	8	1	6	4	0	19	68%
Hartvigsen et al. 2005	NRCT	9	2	5	4	0	20	71%
Jensen et al. 2006	RCT	9	1	5	3	0	18	64%
Johnsson et al. 2002	NRCT	6	1	5	3	0	15	54%
Reddell et al. 1992	RCT (randomised [complete] block design)	8	3	3	3	0	17	61%
Van Poppel et al. 1998	RCT with factorial design	9	1	4	5	1	20	71%
Videman et al. 1989	NRCT	5	1	4	0	0	10	36%
Warming et al. 2008	Cluster RCT	8	1	4	4	0	17	61%
Yassi et al. 2001	RCT	7	2	5	4	0	18	64%

3.3.4. Findings of the Data Synthesis

To interpret the findings of this review, the evidence was weighted by the strength of the study quality as determined in the quality assessment. Of the thirteen included articles, five reported findings related to training transfer and behavioural change which showed a comparison between the intervention(s) group and the control group. The randomised controlled trial by Warming et al (2008) (92), showed an improvement in knowledge of patient transfer technique in the intervention group when completing a per protocol analysis. However, this improvement did not exist when an intention to treat analysis was completed. Daltroy et al (1993), (99), and Daltroy et al (1997), (93), reported evidence of knowledge acquisition, however, not to the level expected, at only 50% within the intervention group. Following on from this, there was no evidence of employee behavioural change. Hartvigsen et al (2005), (29), reported that over 94% of individuals in the intervention group stated that they used relevant patient transfer techniques in their daily work. Interestingly, in the control group, this figure was quite similar at 93%. Whilst, Videman et al (1989), (98), did not directly investigate employee behavioural change, the handling skills of the trained participants compared to control participants were assessed. This showed the trained participants to have significantly better handling skills. Two of these articles were of excellent quality (29, 99), with another two of good quality (92, 93) and the final article was of poor quality (98).

Four of the remaining eight articles, (27, 28, 30, 97), only reported descriptive results from surveying the intervention group to determine their opinions of the training programme. These articles discussed that a large percentage of trained employees, ranging from 73-94 %, reported using the techniques taught in the manual handling training sessions in their daily work. Of these four articles, one was of

excellent quality and the other three were of fair quality. The rest of the articles provided no results pertaining to training transfer or behavioural change (31, 94-96) (Table 3.3).

In relation to reduction of WRMSDs, two of the included articles (27, 28) showed a significant association and three (30, 94, 98) showed a partial association between manual handling training and reduction of WRMSDs. Seven of the thirteen articles (29, 31, 92, 93, 95-97) showed no significant association between manual handling training and reduction of WRMSDs.

The two articles which showed a significant association were of fair quality. Of the three articles which showed a partial association, one of them was of good quality, one of fair quality and the final one was of poor quality. In contrast, of the seven articles which showed no association, two were of excellent quality, with the other five of good quality. Therefore, these findings indicated that the scarce research completed on training transfer and behavioural change leading to a reduction of WRMSDs following manual handling training, suggests that manual handling training appears to be ineffective at reducing WRMSDs.

Table 3.3: Narrative synthesis of results for the included articles

Study ID	Analysis method	Effect on training transfer & behavioural change	Effect on WRMSDs reduction / prevention
Best 1997	Chi-square Mann-Whitney U test	94% (n=17) of intervention group, agreed that the training made their manual handling job easier.	**Significant association** Decrease incidence of back pain in the intervention group (55.6% - 43.8%) Increases in the incidence of back pain in both the comparison groups (68.3% - 81.8%, 55.6% - 75% respectively) ($p<0.1$)
Daltroy et al. 1993	Stepwise backward regression	**Partial association** Greater knowledge of safe lifting and posture in intervention group (mean score 4.2 out of 8) than controls (mean score 2.8 out of 8) ($p<0.0001$). No significant effect found on how they completed lifting on the job, maintained posture on the job, engaged in exercise/stress reduction off the job or if they had a tried back at the end of the day.	See Daltroy, Iversen (93) for findings relating to WRMSDs reduction / prevention
Daltroy et al. 1997	Extended log linear model	**Partial association** Increases in knowledge of safe behaviour for the intervention group compared to controls, however, no significant improvements in actual behaviour	**No significant association** No significant difference between the intervention group and the control group was found for rates of primary low back injury and other musculoskeletal injuries.
Fanello et al. 2002	Chi-square tests	82% of trained respondents thought that they now paid more attention to their gestures and postures than before the training program. However, 75% of these respondents were dissatisfied with the training	**Significant association** Rate of LBP remission was higher among the intervention group than the controls (36% compared to 17%; $p< 0.05$). The control group suffered a longer duration of LBP after two years (49% compared to 30%; $p= 0.01$)

Note: LBP – low back pain

Table 3.3 (contd): Narrative synthesis of results for the included articles

Study ID	Analysis method	Effect on training transfer & behavioural change	Effect on WRMSDs reduction / prevention
Feldstein et al. 1993	Student's t-tests	No evidence provided	**Partial association** Both composite back pain scores and composite fatigue scores decreased for the intervention group but not for the controls (p=0.20, p=0.78 respectively).
Hartvigsen et al. 2005	Chi-square tests Regression & Logistic Regression Models	Over 94% of the intervention group stated that they used relevant transfer techniques in their daily work. Interestingly, for the control group this figure was 93%.	**No significant association** No significant differences were found between the intervention and control group for "Number of days with self-reported LBP during the past year" (p=0.88, χ^2 test) and "number of episodes of LBP" (p=0.84, χ^2 test).
Jensen et al. 2006	Analysis of variance (ANOVA)	No evidence provided	**No significant association** No significant differences found between the two interventions groups and controls for LBP during the past year (p=0.10, p=0.85) or during the past 3 months (p=0.16, p=0.64).
Johnsson et al. 2002	Student's t-test Chi-square tests	92% of respondents to the follow up questionnaire, "mostly or always used the new technique."	**Partial association** Decrease in perceived exertion when transferring a patient from "Bed to chair" in the follow up data ($p \leq 0.05$). No decrease found for prevalence of musculoskeletal problems and job strain.
Reddell et al. 1992	Analysis of variance (ANOVA)	No evidence provided	**No significant association** There was no significance of treatment group differences on Total cases injury incident rate (p<0.1509).

Note: LBP – low back pain

Table 3.3 (contd): Narrative synthesis of results for the included articles

Study ID	Analysis method	Effect on training transfer & behavioural change	Effect on WRMSDs reduction / prevention
Van Poppel et al, 1998	Chi square tests	73% (n=104) lifted as taught some of the time, 11% (n=16) always lifted as taught & 11% (n=15) never lifted as taught.	**No significant association** There were no statistically significant differences present between groups.
Videman et al, 1989	Students t tests Chi-square test (Mantel-Haenszel) Logistic regression & Log linear analysis	**Significant association** Nurses in the intervention group scored higher in skills assessment (mean: 1.31, SD: 0.77) than the controls (mean: 0.50, SD: 0.55) ($p<0.001$).	**Partial association** Increase in the cumulative incidence of back pain among both intervention and control groups during training and during the first year after qualifying. Rate of back injuries during first year of study was 11% in the intervention group and 19% in controls.
Warming et al, 2008	Linear regression model	**No significant association** In the Intention-to-treat analysis, knowledge of transfer technique showed no significant differences between the intervention and control group at follow up.	**No significant association** In the intention-to-treat analysis, experienced LBP showed no significant differences between the intervention and control group at follow up.
Yassi et al, 2001	Multiway repeated measures analysis of variance (ANOVA) models Cox proportional hazard model	No evidence provided	**No significant association** At the 12 month follow up, only one of the intervention groups reported a significant decrease in the frequency of work-related low back pain ($p=0.012$) and shoulder pain ($p=0.012$) from baseline. Injury statistics were not significantly altered when compared to previous years (Mantel Haenszel x^2, all $P > 0.05$).

Note: LBP – low back pain

3.4. Discussion

3.4.1. Overall Findings

The main findings of this systematic review suggest that there has been very little research focusing on the effectiveness of manual handling training on training transfer and the subsequent behavioural change. The scarce research which has been conducted with mainly self-reported measurements, whilst limited, does suggest that whilst employees report understanding and awareness following training, this does not always lead to the expected behavioural change. This review suggests that it cannot be demonstrated that training transfer will lead to a reduction of WRMSDs. This builds on the results of previous reviews, (61, 83), in suggesting that manual handling training appears to be ineffective at reducing WRMSDs. From reading the literature, it can be inferred that achieving the behavioural change expected from training alone can be a challenge. This could be related to the concern that "training may distract attention from addressing the underlying risks" which may be present in the workplace (100, p210). The findings of this review indicate a need for further research in the area of training transfer during training and subsequent behavioural change of employees following training.

3.4.2. Quality Assessment

The 13 included articles in this review differed from each other, therefore, to allow interpretation and comparison of the findings, quality assessment was completed on each article to determine the higher quality articles. Nine of the included articles were deemed to be high quality articles, therefore, they were given more weight in the interpretation of the narrative synthesis (29, 31, 92-97, 99)

3.4.3. Effect on training transfer and behavioural change

Overall, the findings suggest that transfer of knowledge to employees occurs, however, not to the level expected and there was no evidence of employee behavioural change. Five of the included articles provided information relating to training transfer and behavioural change for both the intervention and the control group (29, 92, 93, 98, 99). Surprisingly, the findings of Hartvigsen et al (2005), (29), showed very similar, positive results in both the intervention and control group relating to use of relevant transfer techniques in their daily work. It could be inferred that perhaps the correct techniques learnt by the intervention group were been taken up by their colleagues in the organisation.

Within four of the included articles, only self-reported data from trained participants were provided as evidence of training transfer and behavioural change. A large percentage of participants, (73% to 94%), indicated that the training had a positive effect on the manual handling tasks completed in their daily work (27, 28, 30, 97). These results were determined through self-reported data, which on closer inspection were focused on assessing the training transfer to employees and satisfaction with the training course rather than providing an objective measure of employee behavioural change. It is also difficult to accept these results without careful consideration due to the small sample size associated with the percentages in some articles (27). Four of the articles did not report results relating to evaluation of training transfer and behavioural change. The current review demonstrates the need for future research to focus on investigating further objective measurements of behavioural change. To achieve this, the area of Ergonomics could look to the area of Health Promotion for existing frameworks and models. This has been completed by Barrett at al (2005), (101), through their use of the “Stage of Change” model developed by

Prochaska and DiClemente (1982), (102), in their study focusing on assessing attitudes and beliefs of health and safety. This model was described by Barrett et al (2005), (101, p886), as providing "a more structured approach to tailoring ergonomics interventions according to the knowledge, attitudes and beliefs of stakeholders at both individual and organisational levels".

3.4.4. Effect on WRMSDs reduction/prevention

Overall, this review suggests that training transfer does not always lead to a reduction of WRMSDs, in the health care setting with similar findings for other industries. Contrary to the overall findings, two of the included articles, completed in a health care setting, suggest that there may be a positive association between the provision of manual handling training and a reduction of WRMSDs, however, this evidence is limited in several ways (27, 28).

The study by Best (1997), (27), was determined to be of fair quality and had a very small sample size (n=55) with a subsequent high loss to follow up. Hence, there were very small numbers of participants at follow up (n=17). Despite the small sample size, a positive significant association was found, in that there was a decline in the incidence of back pain in the intervention group and visible increases in the incidence of back pain in both the comparison groups, however, this finding only approached significance at the 10% level ($p<0.1$). Therefore, this makes it difficult to compare to the other included articles which used the 5% level of significance. In addition, this study was completed on a specific method of manual handling training ('Manutention'). Hence, it may not be representative of the effectiveness of other manual handling training methodologies. However, if the positive association could be replicated in further robust research of this methodology, this may change the focus of future research from the effectiveness of manual handling training on the reduction

of WRMSDs to determining the most effective methodology of manual handling training.

Fanello (2002), (28), reported that the intervention group had a higher rate of low back pain remission when compared to the control group ($p< 0.05$). Interestingly, of all the included articles, participants' opinions towards the training were quite negative, with 75% dissatisfied with the training. Whilst the findings seemed promising, the authors did not reflect this positivity in their conclusions. It may be inferred that whilst the training had a positive effect on low back pain remission and duration, if such a large percentage of the participants were dissatisfied with the training, perhaps adjustments may be needed prior to recommending this training in its current form.

Hartvigsen et al (2005), (29), Reddell et al (1992), (96), Jensen et al (2006), (95), van Poppel (1998), (97) and Warming et al (2008), (92) suggested that manual handling training combined with other preventative measures, such as physical training, lumbar support, low tech ergonomic lifting aids and a psychosocial intervention does not lead to a reduction of WRMSDs. These findings showed that individual preventative measures, used solely or in combination, do not always appear to be effective at reducing WRMSDs. Although a comprehensive review of integrated prevention methods was not conducted in this review, this may be interpreted as indicating that manual handling training alone or even in combination with only one other preventative measure may not be adequate to prevent WRMSDs. This interpretation brings possible future research outside the remit of this review, to perhaps investigating what are the best combinations of preventative measures and training to minimise the risk and prevalence of WRMSDs.

3.4.5. Limitations of the review

As with all research, this review has limitations. Only publications for which the full text article could be obtained in the English language were assessed for inclusion in this review. This means that other relevant articles published in other languages may have been excluded. Another limitation focused on the article selection and evaluation process. This process was undertaken by a sole assessor, hereby, potentially introducing bias. However, this bias was somewhat mitigated by a repeat of the quality assessment for each article after six months of the initial quality assessment. The included articles generally presented results based on self-reported data in relation to back pain and/or back injuries. This self-reported data is more likely to suffer from recall bias of the participants when compared to the use of objective measures of musculoskeletal limitations i.e. trunk flexibility or company sick leave and injury statistics. In addition, company statistics are more likely to be work-related injuries than the self-reported data as they relate to a specific accident or incident in the workplace. In addition, most of the included studies did not use intensity measures of pain which would be more sensitive to change in pain levels. Finally, only articles published in peer-reviewed journals were included in this review. This may mean that relevant grey literature might have been excluded leading to the possibility of publication bias.

3.4.6. Strengths of the review

However, this review also has key strengths. This review had explicitly stated inclusion and exclusion criteria relating to study design. This was to ensure, in so far as possible, that the final included articles were of a strong study design which had the ability to assess the relationship between a possible cause and an outcome of interest. The final included articles were either of a randomised controlled trial or a non-

randomised controlled trial study design. Whilst randomised controlled trials are seen as the 'gold standard' for intervention research, non-randomised controlled trials were also included as in some occupational settings randomisation may not be possible (30, 94). Previous systematic reviews in the area have included studies without control groups, however, the authors of one of these reviews discussed that a limitation of their paper was the 'high proportion of low quality studies included' (83, p104). Nine of the thirteen articles included in this current review were of either excellent or good quality with robust study designs which provides greater reliability to the results yielded. The search strategy used in this review applied the search string for retrieving studies of occupational health interventions by Verbeek et al (2005), (90), which has a sensitivity of 89% and a specificity of 78%. This search string has a focus on back injuries. To ensure that no interventions relating to shoulder pain and/or neck pain were missed, these search terms were included into the search strategy and the searches were re-run in each database on 19th July 2013. The results of this search yielded the same final five papers as in the original search detailed in Figure 3.1.

3.5. Conclusion

This review builds on the results of previous reviews, (61, 83), which have suggested that manual handling training does not seem to be effective for reducing WRMSDs. However, this review focused in more detail on the effectiveness of manual handling training at achieving training transfer to employees and leading to the expected behavioural change in their day to day work tasks. The findings suggest that whilst employees report understanding and awareness following training, this does not always lead to the expected behavioural change.

Previous reviews have highlighted the need for high quality randomised controlled trials (RCT) to investigate the effectiveness of manual handling training on

reduction of WRMSDs robustly (61, 83). Prior to the completion of these RCTs, research focused on determining why an increase in employee's knowledge and awareness after training does not appear to result in the expected positive behavioural change would be required. Hence, further research to determine what inhibits the behavioural change which would have been expected and how to measure employee behavioural change in a reliable way is required. The development and application of reliable methods for the measurement of manual handling behaviour change after training remains a challenge. Self-reported measures are likely to be impacted by social desirability bias. Reliable observational methods to measure manual handling practice during work taking varying work environments into account are needed. This information would be essential to allow for the development of manual handling training which results in both training transfer and the expected positive change in employees' behaviour. Following on from this, high quality RCTs would be essential to evaluate the effectiveness of this training at reducing WRMSDs.

The development of an effective form of manual handling training remains an essential component in the reduction of absolute numbers of WRMSDs. Given the high prevalence of MSDs, well implemented training in many organisations leading in small changes in musculoskeletal health would most likely result in a considerable number of positive musculoskeletal health improvements within the general population even when taking into account the conservative estimate of 11% of back injuries that are attributable to manual handling (86).

Chapter 4: Paper 2 – Are Irish Therapists at heightened risk for low back pain?

Published: Hogan DA, O'Sullivan LW, Nolan S, Greiner BA. Are Irish therapists at heightened risk for low back pain? Occup Med (Lond). 2016;66(5):351-7.

Chapter 4: Are Irish Therapists at heightened risk for low back pain?

4. Abstract

Background: Within the international literature, no studies have been identified that provide a comparison between prevalence rate of Low Back Pain (LBP) for chartered physiotherapists, physical and athletic therapists and the national working population. This investigation is essential to determine whether therapists are a high-risk occupational group for the development of LBP.

Aims: The objectives of this study were [1] to establish the prevalence of LBP among therapists in Ireland for both the employed and self-employed [2] to compare employment status-, gender- and age-specific LBP prevalence rates among therapists and the national working population and [3] to estimate the adjusted odds of developing LBP among therapists relative to the national working population.

Methods: Data analysis of the Health In Hand Intensive Tasks and Safety (HITS) study and the third national Survey on Lifestyle, Attitudes and Nutrition (SLÁN) were conducted. The HITS study was a cross sectional study investigating work-related musculoskeletal disorders in practicing therapists. The Survey on Lifestyle, Attitudes and Nutrition (SLÁN) 2007 was a face-to-face interview study of adults.

Results: LBP prevalence in therapists was 49% with no significant difference by employment status. Therapists had a much higher prevalence compared to the national working population across all demographic strata, with therapists nearly five times more likely to suffer from LBP than the national working population after careful adjustment for differences in socio-demographics.

Conclusion: Therapists in Ireland are a high risk occupational grouping for the development of LBP warranting further research into the physical and psychosocial work risk factors.

Keywords: work-related musculoskeletal disorder, prevalence, physiotherapist, health care workers

4.1. Introduction

Musculoskeletal disorders (MSDs) "include a wide range of inflammatory and degenerative conditions affecting the muscles, tendons, ligaments, joints, peripheral nerves and supporting blood vessels" (20, p13) and they affect the upper and lower limbs and the back. Within Europe a number of occupational sectors, including health and social work, have been shown to display higher incident rates of MSDs than the national population (1.2 to 1.6 times higher). Interestingly, female workers in the health and social care sector reported higher than average levels of MSDs, such as backache at 28%. This was compared to backache in female workers at 22% and both genders at 25% across all other work sectors (23). Although not uniquely caused by work, MSDs can be caused or aggravated by many physical and psychosocial work factors. These are termed Work-related Musculoskeletal Disorders (WRMSDs) (20). It is interesting to note that recent literature has indicated that there now appears to be a decline in the incidence of WRMSDs. However, it isn't clear if this decline is just "an artefact of changes in clinical care-seeking preferences, compensation claim reporting practices and workers' perceptions of the role of work exposures in the onset of MSDs" (103, p256). The Global Burden of Disease Study 2010 (GBD 2010) indicated that work-related low back pain (LBP) accounted for one-third of all disability arising from the occupational risk factors included in GBD 2010 (104). Previous international research on the prevention and/or reduction of WRMSDs/symptoms, including LBP, in health care workers has focused predominantly on nurses, nursing assistants and nursing students (28, 29).

Therapists in health care, including physiotherapists, physical therapists and athletic therapists, have been proposed to be a high-risk occupational group for the development of LBP "due to the combination of prolonged stooping, repetitive low-

risk and infrequent high-risk lifts" as part of their workday tasks (5, p309). No investigation has been conducted to date in relation to prevalence rates of WRMSDs/symptoms with these occupations in Ireland. Whilst internationally the terms *physiotherapist* and *physical therapists* are used interchangeably, in Ireland there is a distinct difference in the use of these terms and they have been historically organised as two separate professions. Physiotherapists have been described as a broad based health care profession that not only addresses musculoskeletal care of the physically active but also deals with a number of diverse clinical fields. In contrast, Physical Therapists in Ireland are certified, first contact practitioners and specialise in advanced palpatory and manual techniques to assess and treat pain and discomfort in the soft tissues (82). Finally, Athletic Therapists specialise in musculoskeletal injuries related to physical activity. Chartered Physiotherapists, Physical Therapists and Athletic Therapists will be described as *therapists* in this paper. Whilst these groups are organised into distinct groups in Ireland, the type of work they engage in is very similar including direct patient contact and manual/manipulative therapy, therefore, this allows them to be deemed as comparable occupational groups in relation to WRMSDs. Studies have been completed worldwide to investigate the 12 month prevalence of WRMSDs/symptoms of physiotherapists/physical therapists with rates ranging from 92.4% in Korea to 32% in America (18, 19). Due to the differences between chartered physiotherapists, physical therapists and athletic therapists, a research study in the Irish context would be an important addition to the current literature.

Previous research has mainly focused on employed therapists and do not provide data on the large group of self-employed therapists (6-19). Within the international literature, no studies have been identified by the authors that provide a comparison

between prevalence rate of LBP for therapists and the nationally representative working population. This investigation is essential to determine whether therapists are a high-risk occupational group for the development of LBP.

The objectives of this study were [1] to establish the prevalence of LBP among chartered physiotherapists, physical therapists and athletic therapists for both employed and self-employed therapists in Ireland [2] to compare employment status-, gender- and age-specific LBP prevalence rates with the national working population and [3] to estimate the adjusted odds of developing LBP among therapists in Ireland relative to the national working population.

4.2. Methods

Two separate datasets were used. The Health In Hand Intensive Tasks and Safety (HITS) study conducted in 2011 (1) and the third national Survey on Lifestyle, Attitudes and Nutrition (SLÁN) conducted in Ireland in 2007 (105).

The HITS study was a cross sectional study design investigating WRMSDs in practicing chartered physiotherapists, physical therapists and athletic therapists. The sampling of Physical Therapists and Athletic Therapists was completed through three databases aiming for a representative Irish sample including the databases of the Institute of Physical Therapy and Applied Science (IPTAS), the Irish Association of Physical Therapists (I.A.P.T.) and the Athletic Rehabilitation Therapy Certified (A.R.T.C) organisation. Chartered Physiotherapists were sampled from two different populations, the population of chartered physiotherapists in private practice and from the population of chartered physiotherapists employed in hospitals. Study participants working in private practice were randomly selected from two databases. To sample chartered physiotherapists in private and public hospitals, one-stage proportionate clustered sampling was used. Hospitals were selected based on bed capacity to ensure

representation of physiotherapists working in different size hospitals reflecting approximately the proportionate distribution of different hospitals sizes in Ireland. Each study participant was sent an invitation letter to participate in the study which included an information sheet and a self-administered questionnaire along with a self-addressed stamped envelope.

The HITS questionnaire was pilot tested for content validity and question clarity by therapists in all work settings. Respondents provided self-reported data relating to gender, age, employment status and the occurrence of LBP in the past 12 months. The question on LBP, which was part of the administered Nordic Questionnaire on MSDs (106), asked the respondent 'have you at any time in the last 12 months had trouble such as ache, pain, discomfort, numbness in any of the low back' with options to answer "No", "Left", "Right" and "Both". For data analysis, an answer of "Left", "Right" and "Both" was recoded into "Yes". Age was recorded as a continuous variable and was later re-coded into a categorical variable for data analysis. Information was obtained from respondents in relation to their primary employment and any secondary employment they may have had. This information was gathered together to produce the employment status variable which was classified into 'employed', 'self-employed' and 'both' for the data analysis. "Both" indicating therapists who were both employed and self-employed based on their primary and secondary employment i.e. individual employed in the public health service and working part-time in their own practice.

The Survey on Lifestyle, Attitudes and Nutrition (SLÁN) 2007 was a face-to-face interview study of adults aged 18 years, performed at the participant's home address. SLÁN 2007 was a nationally representative survey involving 10,364 respondents. The sample was deemed representative of the general population in Ireland when

compared with Census 2006 figures. Complete details on the robust sampling for SLÁN 2007 can be found in the original report (105). The overall aim of SLÁN 2007 was to provide nationally representative data on the general health, health behaviours and health service use of adults living in Ireland.

Within SLÁN 2007, participants provided self-reported data relating to their gender, age, usual situation in regard to work and the occurrence of LBP in the past 12 months. The usual situation in regard to work was classified into 'employed', 'self-employed' and 'other'. Age was gathered from participants as a continuous variable and was later re-coded into a categorical variable for data analysis. The question on LBP asked respondents 'have you had lower back pain or other chronic back condition in the last 12 months?' with options to answer either "Yes" or "No".

Data were analysed using the Statistical Package for Social Science (SPSS) Version 21. Chi square analysis was used to determine significant differences in the prevalence of self-reported LBP with various demographic characteristics. Yates Continuity Correction was used in two by two tables and Chi square test for linear trend, where appropriate. Logistic regression models were built for both samples with LBP in past 12 months as the outcome simultaneously adjusting for gender, age and employment status. Three binary logistic regression models were run [1] a model for therapists, [2] a model for the SLÁN 2007 national working population and [3] a combined model for therapists and the SLÁN national working population.

Ethical approval for the HITS study was received from The Clinical Research Ethics Committee of the Cork Teaching Hospitals, Cork, Ireland. Informed consent was sought from all participants. Ethical approval for the Survey on Lifestyle, Attitudes and Nutrition (SLÁN) was provided by the Research Ethics Committee of the Royal College of Surgeons in Ireland (RCSI).

4.3. Results

The final sample size for data analysis in the HITS data was 347 therapists. This included 141 currently practicing physical therapists and athletic therapists (response rate: 76%), 135 chartered physiotherapists in private practice (response rate: 54%) and 71 hospital-based chartered physiotherapists (response rate: 31%). The overall sample size for SLÁN 2007 was 10,364 respondents, corresponding to a response rate of 62%. To ensure the SLÁN dataset was an appropriate comparator, only the working population of SLÁN 2007 was included in this analysis which resulted in a final sample size for SLÁN 2007 of 5,862 respondents.

Table 4.1 shows the demographic characteristics of therapists and the nationally representative working population sample of SLÁN 2007. A larger percentage of therapists were self-employed (46% and 57%, respectively), compared to only 20% of the SLÁN national working population. The gender distribution within chartered physiotherapists showed greater percentage of females (77%) compared to males (23%). On the contrary, the gender distribution within the other groupings was practically evenly distributed between males and females. Over one fifth of therapists were between 35 – 39 years of age, however, over a quarter of the national working population within SLÁN 2007 were 50 or more years of age.

Table 4.1: Characteristics of Chartered physiotherapists (n=206), physical therapists and athletic therapists (n=141) and the SLÁN 2007 nationally representative working population sample (n=5862)

	Chartered physiotherapists	Physical therapists and athletic therapists	SLÁN 2007 nationally representative working population sample
	***n* (%)**	***n* (%)**	***n* (%)**
Employment Status			
Employed	90 (44)	29 (21)	4657 (79)
Self-employed	94 (46)	81 (57)	1205 (21)
Both	22 (11)	31 (22)	..
Gender			
Male	48 (23)	66 (47)	2879 (49)
Female	158 (77)	75 (53)	2983 (51)
Age Group[a+b]			
<= 29 years	30 (15)	20 (14)	1240 (21)
30 – 34 years	47 (23)	21 (15)	865 (15)
35 – 39 years	45 (22)	32 (23)	824 (14)
40 – 44 years	28 (14)	29 (21)	773 (13)
45 – 49 years	18 (9)	26 (19)	660 (11)
50+ years	37 (18)	12 (9)	1500 (26)

[a] 1 missing value for age group in Chartered physiotherapists
[b] 1 missing value for age group in Physical and athletic therapist

Table 4.2 shows the prevalence of LBP among therapists and the SLÁN 2007 national working population. The overall LBP prevalence over the past 12 months was 49% (95% CI 43-54) in therapists with very little difference by employment status. No significant differences for any of the included variables were determined within the sample populations of therapists. The LBP prevalence in the past 12 months within the national working population of SLÁN 2007 was 16% (95% CI 15-17). Self-employed individuals had a significantly higher prevalence of LBP (18 %) compared to their employed counterparts (16%) ($P<0.05$). The prevalence of LBP showed a linear trend with age group by increasing significantly from 11% (95% CI 9-13) in individuals less than or equal to 29 years up to 19% (95% CI 17-21) in individuals aged 50 years or more ($P<0.001$)

Table 4.2: Prevalence of Low Back Pain (LBP) over the past 12 months in Irish chartered physiotherapists, physical therapists and athletic therapists and the SLÁN 2007 nationally representative working population sample

	Chartered physiotherapists		Physical therapists and athletic therapists		All therapists		SLÁN 2007 nationally representative working population sample	
	***n* (%)**	**95% CI**	***n* (%)**	**95% CI**	***n* (%)**	**95% CI**	***n* (%)**	**95% CI**
Total	206[a] (51)	44-57	141[b] (46)	38-55	347[c] (49)	44-54	5862[d] (16)	15-17
Employment Status								
Employed	90 (49)	39-59	26 (46)	27-65	116 (48)	39-57	4617 (16)	15-17
Self-employed	94 (49)	39-59	81 (48)	37-59	175 (49)	41-56	1199 (18)	16-20
Both	22 (64)	44-84	31 (42)	25-60	53 (51)	38-64	..	..
Gender								
Male	48 (40)	26-53	65 (43)	31-55	113 (42)	33-51	2860 (16)	14-17
Female	158 (54)	43-62	73 (49)	38-61	231 (52)	46-59	2956 (17)	15-18
Age Group								
<= 29 years	30 (53)	35-71	19 (63)	42-85	49 (57)	43-70	1234 (11)	9-13
30 – 34 years	47 (38)	24-52	20 (45)	23-61	67 (40)	29-52	859 (14)	12-17
35 – 39 years	45 (44)	30-59	31 (36)	19-52	76 (41)	30-52	820 (16)	13-18
40 – 44 years	28 (64)	47-82	29 (52)	34-70	57 (58)	45-70	762 (19)	16-21
45 – 49 years	18 (56)	33-79	26 (42)	23-61	44 (48)	34-62	655 (18)	15-21
50+ years	37 (57)	41-73	12 (50)	22-78	49 (55)	41-68	1486 (19)	17-21

[a] 1 missing value for age group in Chartered Physiotherapists.
[b] 3 missing values for gender and employment status in Physical and Athletic therapists. 4 missing values for age group in Physical and Athletic therapists.
[c] 3 missing values for gender and employment status in all therapists. 5 missing values for age group in all therapists.
[d] 46 missing values for LBP prevalence over past 12 months in SLÁN 2007 nationally representative working population sample

Table 4.3 shows the results of the logistic regression models. In the model for the therapists, neither gender, age nor employment status were an independent predictor of LBP prevalence. In the model for the national working population, age group was the only independent predictor of LBP prevalence. In the combined model, the adjusted odds ratio indicates that therapists were nearly five times more likely to suffer from LBP than the national working population (adjusted odds ratio: 4.8, 95% confidence limits 3.8 – 6.1, $P<0.001$)

Table 4.3: Logistic Regression model to identify the odds ratio of having LBP in the past 12 months for chartered physiotherapists, physical therapists & athletic therapists, the SLÁN 2007 nationally representative working population sample and the therapists and the SLÁN 2007 nationally representative working population sample combined

Variable	Adjusted odds ratio	95% CI	p value
All therapists (n=347)			
Employment status (reference: employed)			
Self-employed	1.0	0.6 – 1.7	NS
Both	1.1	0.6 – 2.1	NS
Gender (reference: male)			
Female	1.5	0.9 – 2.4	NS
Age Group (reference: <= 29 years)			
30-34 years	0.5	0.2 – 1.1	NS
35-39 years	0.6	0.3 – 1.2	NS
40-44 years	1.1	0.5 – 2.4	NS
45-49 years	0.7	0.3 – 1.6	NS
50+ years	0.9	0.4 – 2.1	NS
SLÁN 2007 nationally representative working population sample (n=5,862)			
Employment status (reference: employed)			
Self-employed	1.1	0.9 – 1.3	NS
Gender (reference: male)			
Female	1.1	1.0 – 1.3	NS
Age Group (reference: <= 29 years)			
30-34 years	1.3	1.0 – 1.7	*
35-39 years	1.5	1.1 – 1.9	**
40-44 years	1.8	1.4 – 2.3	***
45-49 years	1.7	1.3 – 2.2	***
50+ years	1.8	1.5 – 2.3	***
All therapists and SLÁN 2007 nationally representative working population sample (n=6,209)			
Therapists (reference: SLÁN population)	4.8	3.8 – 6.1	***

*$P \leq 0.05$; **$P \leq 0.01$; ***$P \leq 0.001$

4.4. Discussion

Therapists reported an overall 12 month LBP prevalence of 49% (95% CI 44-54). This prevalence compared well to worldwide rates for therapists, specifically European prevalence rates. Within Europe, 12-month prevalence of LBP in physiotherapists ranged from 37% in the United Kingdom to 30% in Sweden (11, 12). The national working population in Ireland reported an overall LBP prevalence of 16% (95% CI 15-17). When comparing the LBP prevalence rates for the different groups, it was clear that therapists suffered from a higher prevalence of LBP compared to the national working population across all demographic strata, with therapists nearly five times more likely to suffer from LBP than the national working population after careful adjustment for differences in socio-demographics.

The key strengths of this study were the careful sampling method, the inclusion of self-employed workers and the comparison with the national working population. Research including self-employed workers is generally very sparse across all occupations and, to the authors' knowledge, no research to date has investigated the LBP prevalence rates of self-employed therapists. Self-employed individuals in the national working population had a significantly higher prevalence of LBP over the past 12 months compared to their employed counterparts, however, these significant differences in employment status disappeared when adjusting for age and gender. There were no significant differences for employment status within the sample population of therapists. This may have been due to a small sample size (n=347) resulting in a lack of power. A significant difference would have been expected as the literature indicates that self-employed workers seem to be more exposed to musculoskeletal disorders risk factors, such as repetitive movements, carrying/moving heavy loads, prolonged standing or walking, painful and tiring positions, and are more

affected by the related health problems than their employed counterparts (73). Therefore, as these differences were not found in relation to LBP, this shows the need to investigate the prevalence of upper limb disorders in therapists to determine if the expected significant differences in employment status occur. Within the international research on LBP of therapists, only one paper compared prevalence rates in therapists to a reference group. This comparison group was limited as it included occupational therapists which are a similarly physically demanding group (84). This current paper provides a comparison with nationally representative data on the prevalence of LBP.

This paper also has some key limitations. This study was a cross-sectional study design using self-reported data. Although measured by the widely used Nordic Questionnaire, the reported prevalence estimates of low back pain do not reflect medical diagnosis based on a physical examination and other diagnostic measures. They are indicative self-reported symptoms. Therefore, the prevalence rates reported need to be interpreted with caution due to the possibility of recall and reporting bias. However, the Nordic Questionnaire has been shown to be a useful instrument for the screening of MSDs with acceptable predictive validity along with very good construct, content and face validity when compared to medical diagnosis (107, 108). In addition, therapists are an occupational grouping with excellent awareness and knowledge on the topic of LBP, therefore, their self-reported data may hold even stronger validity. The response rate for the physical therapists was high making us confident that this sample was fairly representative of the population, however, in chartered physiotherapists working in hospitals it was very low at 31 %, for further detail see (1). One possible contributing factor to this low response rate from hospital based physiotherapists is the negotiations with the Irish Minister for Health in relation to the title of ‘physiotherapist’ and ‘physical therapist’, which were ongoing at the time of

the study. With lower response rates, the possibility of selection bias needs to be taken into account. In this sample, this particularly applies to hospital-based chartered physiotherapists. It is unclear if the potential systematic selection bias inflated or deflated the prevalence rates for specific groups. However, potential systematic selection bias, by gender and province of residence/professional practice, was investigated in a non-responder analysis for self-employed therapists. No systematic response bias was detected by gender or province (1). In addition, although assessing the same outcome LBP, there was a slight difference in the wording of the LBP prevalence question between the HITS Study and SLÁN 2007 national working population questionnaire which may have influenced the self-reports. Along with this it is also worth noting that the mode of data collection varied in the HITS Study (self-report questionnaire) and SLÁN 2007 (face to face interview survey). The possible information bias due to the use of two different data collection methods may have been mitigated due to the LBP prevalence questions being an unambiguous question. The interpretation of unambiguous questions has been shown to be "relatively independent of the mode of data collection" (109, p207). Finally, the lag in time periods between the SLÁN study in 2007 and the HITS Study in 2011 needs to be acknowledged. The SLÁN study was completed just prior to the global financial crisis in 2008, however, the HITS Study was completed within the recent worldwide recession. Based on the observed declining trend in WRMSDs in recent years, it could be argued that potentially even higher estimates for therapists would have been obtained if the HITS study would have been conducted at the same time (2007) as the SLAN study was done"

In conclusion, to the authors' knowledge, this is the first paper to establish prevalence rates of LBP in health care therapists and compare prevalence rates of

therapists to the national working population. This study demonstrates a higher prevalence of reported LBP in both employed and self-employed therapists than the national working population suggesting that this group may be involved in work practices that place them at increased risk. Therefore, further research to investigate workplace risk factors affecting this unique occupational grouping is warranted, including targeting this group with prevention measures and providing guidance on appropriate coping strategies to reduce and mitigate against the prevalence of LBP.

Key Points

To the author's knowledge, this is the first paper to compare prevalence rates of therapists to the national working population.

Therapists are nearly five times more likely to suffer from LBP than the national working population after careful adjustment for differences in age, gender and employment status.

There were no significant differences of LBP prevalence for employment status in the population of therapists, this indicates the need to investigate the prevalence of upper limb disorders in therapists to determine if the expected significant differences in employment status occur.

Funding

This work was supported by the Research grant (R&D funding, Principal Investigator: Dr B. Greiner) from the Institution of Occupational Safety and Health (IOSH)

Acknowledgements:

The authors would like to thank all chartered physiotherapists, physical therapists, athletics therapists for their participation in the survey. We would also like to thank

the professional bodies and training institutions for their co-operation and encouragement of participation in this study, including the Institute of Physical Therapy and Applied Science.

Chapter 5: Paper 3 – The association of social support and work-related musculoskeletal disorders among employed and self-employed Chartered Physiotherapists, Physical Therapists and Athletic Therapists in Ireland.

Publication Plan: To be submitted to *Occupational and Environmental Medicine*

Chapter 5: The association of social support and work-related musculoskeletal disorders among employed and self-employed Chartered Physiotherapists, Physical Therapists and Athletic Therapists in Ireland.

5. Abstract

Within the international literature, it has been indicated that a lack of support from immediate supervisors along with work or time pressures, are important contributors to work-related musculoskeletal disorders (WRMSDs), among workers across a range of industries. Although self-employed workers appear to be more at risk of suffering WRMSDs compared to their employed counterparts, there is still a dearth of research evidence in this area for self-employed workers. This indicates the need to study the role of psychosocial work factors, specifically social support, for employed and self-employed workers in relation to the prevalence of self-reported symptoms of work-related musculoskeletal pain and discomfort. Employed and self-employed chartered physiotherapists, physical and athletic therapists in Ireland have reported a higher prevalence of low back pain than the national working population suggesting that this group may be involved in work practices that place them at increased risk of WRMSDs. Therefore, further research to investigate workplace risk factors, including psychosocial work factors, affecting this specific occupational grouping taking account of employment status is warranted.

The hypotheses for this study were that [1] self-employed therapists who report having low social support have a higher prevalence of work-related back, neck and upper limb pain/discomfort compared to those who report having high social support, [2] Employed therapists who report having low social support have a higher prevalence of work-related back, neck and upper limb pain/discomfort compared to those who report having high social support, [3] Self-employed therapists who report

having low social support have a higher prevalence of incapacitating upper limb symptoms compared those who report having high social support and [4] Employed therapists who report having low social support have a higher prevalence of incapacitating upper limb symptoms compared those who report having high social support.

This research used data from the HITS study, which was a cross sectional study investigating back, neck and upper limb pain/discomfort in practicing chartered physiotherapists, physical therapists and athletic therapists in Ireland. Self-administered questionnaires were completed on socio-demographics, musculoskeletal disorder symptoms, psychosocial work factors and physical work factors. Logistic regression models were built with pain/discomfort in back, neck and upper limb, along with incapacitating upper limb symptoms, in the past 12 months as the outcome and social support scales for employed and self-employed therapist as the predictor whilst adjusting for relevant socio-demographic, physical work factors and other psychosocial work factors.

The findings indicate that self-employed therapists had a significantly higher prevalence of pain/discomfort in any upper limb (86.6 %) compared to their employed counterparts (76.8 %) (P=0.04). Interestingly, a significantly higher percentage of employed therapists (32.7 %) reported suffering from incapacitating upper limb symptoms compared to self-employed therapists (21.5 %). A lack of supervisor support is a risk factor to the prevalence of upper limb pain/discomfort in employed therapists [OR 0.67, 95% CI (0.52-0.87)], whilst low peer support does not appear to have any prediction towards back, neck or any upper limb pain/discomfort. Both employed and self-employed therapists who reported higher levels of peer support are

significantly less likely than those with lower levels to report incapacitating upper limb pain/discomfort [OR 0.77, 95% CI (0.60-0.97) and OR 0.82, 95% CI (0.73-0.93)].

In conclusion, this paper indicates the importance of (a) supervisor support in relation to the prevention and/or reduction of work-related upper limb pain/discomfort prevalence in employed therapists, and (b) peer support in both employed and self-employed therapists for prevention and/or reduction incapacitating upper limb pain/discomfort prevalence. This indicates that work-related social support, both supervisor and peer, needs to be taken into account, in both employed and self-employed therapists, when investigating the development of WRMSDs along with physical and organisational work factors.

5.1. Introduction

The European Agency for Safety and Health at Work, (EU-OSHA), describe psychosocial risk factors as those "which are related to the way work is designed organised and managed, as well as the economic and social contexts of work" (44, p6). Musculoskeletal Disorders (MSDs) "include a wide range of inflammatory and degenerative conditions affecting the muscles, tendons, ligaments, joints, peripheral nerves and supporting blood vessels" and they affect the upper and lower limbs and the back (20, p13). Although not uniquely caused by work, MSDs can be caused or aggravated by many physical and psychosocial work factors. These are termed Work-Related Musculoskeletal Disorders (WRMSDs) (20).

It has been indicated within musculoskeletal injury causation theories that psychosocial factors; such as low job satisfaction, highly monotonous tasks, low supervisor support, high job demands, low job control, low decision authority and high job strain; influence WRMSDs (34, 38, 39). Evidence from a systematic review of longitudinal studies shows that a lack of support from immediate supervisors along with work pressures and/or time pressures, are important contributors to WRMSDs, specifically low back, neck and/or shoulder symptoms, among workers across a range of industries (110). High levels of work-related social support can compensate for work-related strain which workers have to contend with in the workplace (42). Existing literature has shown that groups of workers with high physical and high psychosocial demands may have an increased risk of self-reported back and upper limb disorders (55, 56). There is much debate in the literature on the definition of social support with several definitions proposed. It has been detailed that there are a number of different domains in social support which include 'emotional support, appraisal and affirmation, informational assistance, intimacy, comfort and physical

affection' (53, p270, 54, p276). Within this paper the focus is on social support from peers and supervisors.

For employed workers, low supervisor support is a relevant risk factor for the development of WRMSDs, however, low peer support does not appear to predict the development of WRMSD symptoms (110). Within the current literature, self-employed workers appear to be more at risk of suffering WRMSDs compared to their employed counterparts (42). It can be hypothesised that self-employed workers lack supervisor support similar to that available for employed workers and generally only have the support of fellow self-employed workers in their field. There is a dearth of research evidence in this area for self-employed workers. This indicates the need to assess psychosocial work factors, specifically social support, in employed and self-employed workers in relation to the prevalence of WRMSDs.

One occupational grouping of interest with employed and self-employed workers, are physiotherapists, physical and athletic therapists. Employed and self-employed chartered physiotherapists, physical and athletic therapists in Ireland report a higher prevalence of reported LBP than the national working population suggesting that this group may be involved in work practices that place them at increased risk of MSDs. Therefore, further research to investigate workplace risk factors, including psychosocial work factors, such as social support, affecting this specific occupational grouping is warranted.

Whilst internationally the terms *physiotherapist* and *physical therapists* are used interchangeably, in Ireland, there is a distinct difference in the use of these terms and they have been historically organised as two separate professions. Physiotherapists have been described as broad based health care professionals that not only addresses musculoskeletal care of the physically active but also deals with a

number of diverse clinical fields. In contrast, Physical Therapists in Ireland are certified, first contact practitioners and specialise in advanced palpatory and manual techniques to assess and treat pain and discomfort in the soft tissues (82). Finally, Athletic Therapists specialise in musculoskeletal injuries related to physical activity. Chartered Physiotherapists, Physical Therapists and Athletic Therapists will be described as *therapists* in this paper.

The hypotheses for this study were that [1] self-employed therapists who report having low social support have a higher prevalence of work-related back, neck and upper limb pain/discomfort compared to those who report having high social support, [2] Employed therapists who report having low social support have a higher prevalence of work-related back, neck and upper limb pain/discomfort compared to those who report having high social support, [3] Self-employed therapists who report having low social support have a higher prevalence of incapacitating upper limb symptoms compared those who report having high social support and [4] Employed therapists who report having low social support have a higher prevalence of incapacitating upper limb symptoms compared those who report having high social support.

These hypotheses led to the following study objectives: [1] to establish and compare the prevalence of back, neck and upper limb pain/discomfort, along with incapacitating upper limb symptoms, among both employed and self-employed therapists in Ireland, [2] to determine the relationship between social support and back, neck and upper limb pain/discomfort, along with incapacitating upper limb symptoms, by employment status and [3] to estimate and compare the adjusted odds of developing back, neck and upper limb pain/discomfort, along with incapacitating upper limb symptoms, based on exposure to social support for employed and self-employed

therapists in Ireland while adjusting for relevant socio-demographic, physical and other psychosocial work factors.

5.2. Methods

5.2.1. Study Design

This research was performed using data collected on the Health In Hand Intensive Tasks and Safety (HITS) study conducted in 2011 (1). This was a cross sectional study design investigating back, neck and upper limb pain/discomfort in practicing chartered physiotherapists, physical therapists and athletic therapists in Ireland.

5.2.2. Study Sample

The sampling of Physical Therapists and Athletic Therapists was completed through three databases aiming for a representative Irish sample including the databases of the Institute of Physical Therapy and Applied Science (IPTAS), the Irish Association of Physical Therapists (I.A.P.T.) and the Athletic Rehabilitation Therapy Certified (A.R.T.C) organisation. Chartered Physiotherapists were sampled from two different populations; the population of chartered physiotherapists in private practice and from the population of chartered physiotherapists employed in hospitals. Study participants working in private practice were randomly selected from two databases. To sample chartered physiotherapists in private and public hospitals, one-stage proportionate clustered sampling was used. Hospitals were selected based on bed capacity to ensure representation of physiotherapists working in different size hospitals reflecting approximately the proportionate distribution of different hospital sizes in Ireland. Each study participant was sent an invitation letter to participate in the study which included an information sheet and a self-administered questionnaire along with a self-addressed stamped envelope.

The final sample size for data analysis in the HITS data was 347 therapists. This included 141 currently practicing physical therapists and athletic therapists (response rate: 76 %), 135 chartered physiotherapists in private practice (response rate: 54 %) and 71 hospital-based chartered physiotherapists (response rate: 31 %). During data cleaning, it became clear that there was a systematic respondent error in completing the social support scales i.e. some respondents were clearly employed, however, they completed the self-employed social support scale. From reviewing the data, this appears to be error on the part of the respondent when completing either the primary employment question or the social support scales as these answers did not match. This occurred for 30 respondents, of which 29 were employed and one was self-employed. These 30 respondents were removed from the final sample size for data analysis, which left 317 therapists. The final sample size consisted of 115 employed therapists and 202 self-employed therapists, however, six of these did not answer the social support scales and where, therefore, classed as missing values. This left 110 employed and 201 self-employed respondents, respectively.

5.2.3. Questionnaire

The HITS questionnaire was pilot tested for content validity and question clarity by therapists in all work settings. Respondents provided self-reported data relating to the occurrence of back pain/discomfort (upper, mid and low back pain), neck pain/discomfort and upper limb pain/discomfort (shoulders, elbow, wrist, finger and thumb pain) in the past 12 months. The questions on pain/discomfort in each of the mentioned body parts were part of the administered Nordic Questionnaire on MSDs (106) and they asked the respondent 'have you at any time in the last 12 months had trouble such as ache, pain, discomfort, numbness in any of the following regions' with options to answer "No", "Left", "Right" and "Both". For incapacitating symptoms,

the respondent was asked ‘During the past 12 months have you ever been prevented from carrying out normal activities (job, housework, hobbies) because of discomfort or pain in any of the following body regions’ with options to answer “No”, “Left”, “Right” and “Both”. For data analysis within all these questions, an answer of “Left”, “Right” and “Both” was recoded into “Yes”. In addition, a variable ‘pain/discomfort in any upper limb’ was developed. This variable indicates that at least one upper limb site is affected versus none

Information was obtained from respondents in relation to their primary employment and any possible secondary employment they may have had. This information was compiled together to produce the employment status variable which was classified into ‘mainly employed’, ‘mainly self-employed’ for the data analysis. The term mainly was used as some therapists were both employed and self-employed based on their primary and secondary employment i.e. individual employed in the public health service and working part-time in their own practice. The classification of ‘mainly employed’ and ‘mainly self-employed’ was based on the hours worked in each employment, the main employment was classed as the one within which the respondent spent 50% or more of their weekly working hours.

In relation to the demographic variables, age was measured in years as a continuous variable and gender was measured as a dichotomous variable. The occupational grouping variable was developed for analysis based on whether the respondent was a “physiotherapist” or a “physical/athletic therapist”. In relation to work factors, respondents were asked ‘how long have you worked as a therapist?’, with options of “<5 years”, “5-10 years”, “11-15 years”, “16-20 years” and “>20 years”. This was followed by ‘during an average week, how many hours of manual therapy do you practice?’, with options of “1-10 hours”, “11-20 hours”, “21-30 hours”,

"31-40 hours" and "40+ hours". Respondents were also asked to 'give the approximate hours per week spent in direct patient / client care'. This was requested as a continuous variable, however, for the data analysis, this was converted into a categorical variable, with options of "20 hours or less", "21-30 hours" and "31 hours or more".

The contribution of psychosocial work factors specific to therapists was measured by selected scales from the Copenhagen Psychosocial Questionnaire (COPSOQ) (long version) (58). For self-employed therapists, the social support scales of the COPSOQ questionnaire were modified which allowed for separate scales for both employed and self-employed therapists. For employed therapists, the scales measured were peer support and supervisor support. Both of these scales were three item scales. The peer support scale was measured with the following items: [1] how often do you get help and support from your colleagues, [2] how often are your colleagues willing to listen to your problems at work and [3] how often do your colleagues talk with you about how well you carry out your work. The supervisor support scale was measured with the following items: [1] how often is your nearest supervisor willing to listen to your problems at work, [2] how often do you get help and support from your nearest supervisor and [3] how often does your nearest supervisor talk with you about how well you carry out your work. For self-employed therapists, the scales measured were peer support and social support from other professionals. Both of these scales were three item scales. The peer support scale was measured with the following items: [1] how often do you get help and support from your colleagues who are also self-employed, [2] how often are your colleagues who are also self-employed, willing to listen to your problems at work and [3] how often do your colleagues who are also self-employed talk with you about how well you carry out your work. The social support from other professionals was measured with the following items: [1] how

often are other informed professionals in your area willing to listen to your problems at work, [2] how often do you get help and support from other informed professionals in your area and [3] how often do other informed professionals in your area talk with you about how well you carry out your work. Within this paper, the scales investigating peer support and supervisory support in employed therapists and peer support and professional support in self-employed therapists were included in the analysis. These scales showed acceptable reliability measured as internal consistency (adjusted Cronbach's alpha) measured as part of the broader HITS study. The adjusted Cronbach's alpha for the peer support scale in employed was 0.72 with the supervisory support scale at 0.84 and for peer support scale in self-employed was 0.83 with the professional support scale at 0.86 (1). Each of these scales were analysed as continuous variables on a scale from zero to twelve.

In relation to other psychosocial work factors, respondents completed the 12-item General Health Questionnaire (GHQ), which investigated how respondents felt their health had been in general, over the last few weeks, prior to completion of the questionnaire. For the data analysis, the binary scoring method was used (with the two least symptomatic answers scoring 0 and the two most symptomatic answers scoring 1). For the 12-item GHQ, a threshold value of 3 is classed as achieving 'psychiatric caseness'. (111)

5.2.4. Data Analysis

Data were analysed using the Statistical Package for Social Science (SPSS) Version 22. Descriptive analysis was completed to determine the mean age in years for employed and self-employed therapists and to describe the other characteristics of employed and self-employed therapists. Cross tabulations and Chi-square tests were completed to determine significant differences in the prevalence of self-reported

pain/discomfort in back, neck and upper limbs, along with incapacitating upper limb symptoms, according to employment status. One-way ANOVA analysis was used to compare means of back, neck and upper limb pain/discomfort, along with incapacitating upper limb symptoms, against social support for employed and self-employed therapists.

Logistic regression models were built with pain/discomfort in back, neck and upper limb, along with incapacitating upper limb symptoms, in past 12 months as the outcome and social support scales for employed and self-employed therapist as the predictor whilst adjusting for relevant socio-demographic, physical work factors and other psychosocial work factors. Model 1 adjusted for age and gender. Model 2 adjusted for age, gender, time working as a therapist, direct patient hours per week, time providing manual therapy per week and occupational group. Finally, model 3 adjusted for age, gender, time (years) working as a therapist, direct patient hours per week, time providing manual therapy per week, occupational group and total GHQ score. Within, these models, only age and social support scales were continuous variables, with all others as categorical variables. Prior to running the logistic regression models, linear modelling of all the independent variables was completed to test for multicollinearity and none of the independent variables were closely correlated.

5.2.5. Ethical Approval

Ethical approval for the HITS study was received from The Clinical Research Ethics Committee of the Cork Teaching Hospitals, Cork, Ireland. Informed consent was sought from all participants.

5.3. Results

Table 5.1 shows the demographic characteristics of employed and self-employed therapists. Self-employed therapists (mean age 41.2) were older on average than employed therapists (mean age 34.5). The gender distribution within both self-employed and employed therapists showed a greater percentage of females (66.3% and 72.2%, respectively) compared to males (33.7% and 27.8%, respectively). Within employed therapists, there was a greater percentage of Chartered Physiotherapists (73 %) compared to Physical/Athletic Therapists (27%). On the contrary, within self-employed therapists, the percentage of Chartered Physiotherapists (48.5%) and Physical/Athletic Therapists (51.5%) were practically evenly distributed. Approximately 70% of employed therapists worked between one and ten years, however, the same percentage of self-employed workers have worked between one and fifteen years. A larger percentage of self-employed therapists completed over 30 hours of manual therapy per week (20%) compared to employed therapists (4.6%). Over one fifth of both employed and self-employed therapists had 31 or more direct patient hours per week (23.2% and 24.8%, respectively). Both employed and self-employed therapists showed percentage rates of 'psychiatric caseness' (23.6% and 17%, respectively) which are higher compared to previous studies of the representative national working population in England (112).

Table 5.2 shows the prevalence of back, neck, upper limb pain/discomfort and incapacitating upper limb symptoms in the past 12 months for employed and self-employed therapists. Self-employed therapists had a significantly higher prevalence of pain/discomfort in any upper limb (86.6%) compared to their employed counterparts (76.8%) (P=0.04). Contrary to this, employed therapists had a significantly higher prevalence of incapacitating upper limb pain/discomfort (32.7%)

compared to their self-employed counterparts (21.5%) (P=0.04). No significant differences were determined between employed and self-employed therapists for back pain/discomfort and neck pain/discomfort.

Table 5.1: Descriptive characteristics of employed and self-employed therapists

	Employed Therapists (n=115)	Self-employed Therapists (n=202)
Age in years[a]	34.5 (7.76)	41.2 (8.38)
Gender[b]		
Male	32 (27.8)	68 (33.7)
Female	83 (72.2)	134 (66.3)
Occupational group[b]		
Physical/Athletic Therapists	31 (27)	104 (51.5)
Chartered Physiotherapists	84 (73)	98 (48.5)
Time working as Therapist[b]		
<5 years	39 (34.5)	43 (21.4)
5-10 years	39 (34.5)	47 (23.4)
11-15 years	15 (13.3)	45 (22.4)
16-20 years	8 (7.1)	20 (10.0)
>20 years	12 (10.6)	46 (22.9)
Hours of Manual Therapy per week[b]		
1-10 hours	56 (52.3)	37 (18.5)
11-20 hours	27 (25.2)	75 (37.5)
21-30 hours	19 (17.8)	48 (24.0)
31-40 hours	4 (3.7)	28 (14.0)
40+ hours	1 (0.9)	12 (6.0)
Direct Patient Hours per week[b]		
20 hours or less	39 (34.8)	88 (43.6)
21-30 hours	47 (42.0)	64 (31.7)
31 hours or more	26 (23.2)	50 (24.8)
Total GHQ Score[b]		
'Caseness'	26 (23.6)	33 (17)
Non 'caseness'	84 (76.4)	161 (83)

[a] Mean (Standard Deviation), [b] Number (proportion), Some totals vary due to missing data

Table 5.2: Cross Tabulation & Chi-square test - prevalence of back, neck and upper limb pain/discomfort in the past 12 months for employed and self-employed therapists

	Back Pain/discomfort		**Neck Pain/discomfort[a]**		**Pain/discomfort in any Upper Limb[a]**		**Incapacitating Upper Limb pain/discomfort[b+c]**	
	***n* (%)**	**95% CI**	***n* (%)**	**95% CI**	***n* (%)**	**95% CI**	**n (%)**	**95% CI**
Employed Therapists (n=115)	82 (71.3)	63.0-79.6	54 (48.2)	39.0-57.6	**86 (76.8)**	**69.0-84.6**	**36 (32.7)**	**23.9-41.5**
Self Employed Therapists (n=202)	149 (73.8)	67.7-79.9	100 (49.5)	42.6-56.4	**175 (86.6)**	**81.9-91.3**	**43 (21.5)**	**15.8-27.2**

[a] 3 missing values in employed therapists
[b]5 missing values in employed therapists
[c]2 missing values in self-employed therapists

Table 5.3 shows the results of the one-way ANOVA for social support and back and upper limb pain/discomfort. Within employed therapists, those who indicated suffering from incapacitating upper limb pain/discomfort reported significantly lower peer support than those employed therapists who did not report incapacitating upper limb pain/discomfort (P=0.03). Those employed therapists who indicated suffering from back, any upper limb and incapacitating upper limb pain/discomfort reported significantly lower supervisor support than those who did not report these forms of pain/discomfort (P=0.05, P≤0.01 and P=0.03, respectively). For self-employed therapists, those who indicated suffering from any upper limb and incapacitating upper limb pain/discomfort reported significantly lower self-employed peer support than those who did not report these forms of pain/discomfort (P≤0.01 and P≤0.01, respectively). Social support from other professionals for self-employed therapists doesn't show any significant findings.

Table 5.3: One-way ANOVA - back, neck and upper limb pain/discomfort in the past 12 months by social support for employed and self-employed therapists

	Employed Therapists				Self-employed Therapists			
	Social Support Peers (Scale Range 0-12) (N=110)		Social Support Supervisors (Scale Range 0-12) (N=108)		Social Support from self-employed peers (Scale Range 0-12) (N=201)		Social Support from other professionals (Scale Range 0-12) (N=201)	
	M (SD)	p-value	*M (SD)*	p-value	*M (SD)*	p-value	*M (SD)*	p-value
Back Pain/discomfort								
Yes	7.53 (2.38)	0.15	**6.04 (3.12)**	**0.05**	5.64 (3.01)	0.10	4.83 (3.08)	0.82
No	8.23 (1.85)		**7.34 (2.57)**		6.43 (3.04)		4.94 (2.92)	
Neck Pain/discomfort								
Yes	7.75 (2.40)	0.90	5.88 (3.13)	0.10	5.51 (3.23)	0.11	4.70 (3.03)	0.45
No	7.70 (2.14)		6.86 (2.87)		6.19 (2.79)		5.02 (3.03)	
Pain/discomfort in any Upper Limb								
Yes	7.57 (2.38)	0.20	**5.85 (3.08)**	**≤0.01**	**5.61 (3.06)**	**≤0.01**	4.88 (3.02)	0.83
No	8.23 (1.75)		**8.29 (1.88)**		**7.37 (2.36)**		4.74 (3.13)	
Incapacitating Upper Limb pain/discomfort								
Yes	**7.09 (2.32)**	**0.03**	**5.51 (2.96)**	**0.03**	**4.47 (3.30)**	**≤0.01**	4.09 (3.12)	0.07
No	**8.07 (2.16)**		**6.83 (2.98)**		**6.24 (2.86)**		5.06 (3.00)	

Table 5.4 shows the results of the logistic regression models. Employed therapists who reported higher levels of peer support were significantly less likely to report incapacitating upper limb pain/discomfort than those who reported lower levels following adjustment for relevant socio-demographic, physical work factors and other psychosocial work factors [OR 0.77, 95% CI (0.60-0.97)]. Employed therapists who reported higher levels of supervisor support were significantly less likely to report any upper limb pain/discomfort than those who reported lower levels following adjustment for relevant socio-demographic, physical work factors and other psychosocial work factors [OR 0.67, 95% CI (0.52-0.87)]. Self-employed therapists who reported higher levels of peer support were significantly less likely to report any upper limb and incapacitating upper limb pain/discomfort than those who reported low levels following adjustment for relevant socio-demographic, physical work factors and other psychosocial work factors [OR 0.81, 95% CI (0.68-0.96) and OR 0.82, 95% CI (0.73-0.93), respectively]. There was no significant association between social support from other professionals for self-employed therapists and reported pain/discomfort in employed or self-employed therapists.

Table 5.4: Logistic Regression – the association between pain/discomfort in back, neck and upper limbs and social support in employed and self-employed therapists

	Back Pain/Discomfort		**Neck Pain/Discomfort**		**Pain/discomfort in any Upper Limb**		**Incapacitating Upper Limb pain/discomfort**	
	OR (95% CI)	**p-value**	***OR (95% CI)***	**p-value**	***OR (95% CI)***	**p-value**	**OR (95% CI)**	**p-value**
				Employed Therapists				
Social Support Peers								
M1	0.87 (0.71-1.06)	0.16	1.00 (0.83-1.19)	0.96	0.89 (0.72-1.09)	0.25	**0.81 (0.66-0.98)**	**0.03**
M2	0.89 (0.72-1.09)	0.26	1.02 (0.83-1.24)	0.87	0.87 (0.69-1.12)	0.28	**0.77 (0.62-0.96)**	**0.02**
M3	0.93 (0.74-1.18)	0.56	1.07 (0.86-1.32)	0.57	0.90 (0.70-1.17)	0.44	**0.77 (0.60-0.97)**	**0.03**
Social Support Supervisors								
M1	**0.83 (0.71-0.98)**	**0.03**	0.86 (0.75-0.99)	0.04	**0.70 (0.56-0.86)**	**≤0.01**	**0.86 (0.74-0.99)**	**0.03**
M2	0.84 (0.71-1.002)	0.053	0.86 (0.74-1.002)	0.053	**0.67 (0.52-0.86)**	**≤0.01**	0.88 (0.76-1.03)	0.10
M3	0.87 (0.73-1.04)	0.13	0.87 (0.74-1.03)	0.10	**0.67 (0.52-0.87)**	**≤0.01**	0.88 (0.75-1.03)	0.10
				Self-employed Therapists				
Social Support from peers								
M1	0.92 (0.82-1.03)	0.16	0.93 (0.84-1.02)	0.12	**0.83 (0.71-0.97)**	**0.02**	**0.82 (0.73-0.92)**	**≤0.01**
M2	0.94 (0.84-1.05)	0.24	0.92 (0.84-1.02)	0.10	**0.83 (0.70-0.98)**	**0.02**	**0.81 (0.72-0.92)**	**≤0.01**
M3	0.92 (0.83-1.04)	0.18	0.93 (0.84-1.02)	0.13	**0.81 (0.68-0.96)**	**0.02**	**0.82 (0.73-0.93)**	**≤0.01**
Social Support from other professionals								
M1	0.99 (0.89-1.10)	0.84	0.97 (0.88-1.06)	0.47	1.02 (0.89-1.17)	0.81	0.91 (0.80-1.01)	0.08
M2	0.99 (0.88-1.10)	0.78	0.95 (0.87-1.05)	0.33	0.99 (0.86-1.15)	0.92	0.89 (0.79-1.001)	0.052
M3	1.00 (0.89-1.11)	0.94	0.95 (0.86-1.05)	0.32	0.96 (0.83-1.12)	0.61	0.89 (0.79-1.01)	0.07

M1: Adjusted for age and gender
M2: Adjusted for age, gender, time working as a therapist, direct patient hours per week, time providing manual therapy per week and occupational group
M3: Adjusted for age, gender, time working as a therapist, direct patient hours per week, time providing manual therapy per week, occupational group and total GHQ score

5.4. Discussion

The international literature reports that self-employed workers appear to be more at risk of suffering any WRMSDs than their employed counterparts (42). Generally, the findings support this and the study hypotheses in relation to upper limb pain/discomfort only. However, contrary to this, a significantly higher percentage of employed therapists (32.7 %) reported suffering from incapacitating upper limb symptoms compared to self-employed therapists (21.5 %). The literature indicates that self-employed workers can have poorer health outcomes than their employed counterparts, however, counterintuitively, they visit doctors and miss work less frequently (68, 72). Therefore, it can be inferred that self-employed workers may be less likely to report poor health outcomes. This, along with socio-demographic differences, could explain why less self-employed therapists reported incapacitating upper limb symptoms compared to their employed counterparts. Interestingly, both employed and self-employed therapists with higher levels of peer support are significantly less likely than those with lower levels of peer support to report incapacitating upper limb pain/discomfort, after adjustment for demographics.

The findings, further, support the current literature, as they indicate that a lack of supervisor support is a risk factor to the development and/or progression of upper limb pain/discomfort in employed therapists (110). Whilst low peer support does not appear to have any prediction towards the development of back, neck or any upper limb pain/discomfort in employed therapists, unlike incapacitating upper limb symptoms.

The findings also add to the limited research available in relation to self-employed workers in general, as they indicate that low peer support is a risk factor for prevalence of upper limb pain/discomfort in self-employed therapists. However, low

social support from other professionals, such as self-employed workers across other occupations, does not appear to have any prediction towards the development of back, neck or any upper limb pain/discomfort for self-employed therapists. This is an interesting finding and indicates the need for further qualitative investigation. This is required to investigate why peer support in self-employed therapists has been shown to have a protective effect on the development of back, neck or any upper limb pain/discomfort for self-employed therapists, however, social support from other professionals does not. As discussed previously, there are a number of domains within the construct of social support. Within this paper, the key focus based on the questions asked has been on the 'emotional support', 'appraisal and affirmation' and 'informational assistance' domains. The 'intimacy' and 'comfort and physical affection' domains have not been explored in this paper. It would be important to investigate these domains further, especially in relation to social support from other professionals for self-employed therapists as it could be hypothesised that these support bases may be more personal than professional and the domains of intimacy' and 'comfort and physical affection' may be more applicable.

The key strengths of this study were the careful sampling method and the inclusion of self-employed workers. Research including self-employed workers and contrasting them with employed workers is generally very sparse across all occupations. Previous research on this sample investigating low back pain indicated there were no significant differences by employment status within the sample population of therapists (113). A significant difference would have been expected, in this previous research, as the literature indicates that self-employed workers seem to be more exposed to musculoskeletal disorders risk factors, such as repetitive movements, carrying/moving heavy loads, prolonged standing or walking, painful and

tiring positions, and are more affected by the related health problems than their employed counterparts (73). These expected significant differences in upper limb pain/comfort according to employment status have been found in this study. This highlights the importance of further research investigating self-employed and employed therapists in relation to the organisational work factors available to them and how these reduce or prevent upper limb and incapacitating upper limb pain/discomfort. Another strength of this study was the logistic regression modelling method used, three models were run adjusting for key confounders. This allowed the determination of the significance of the association between different forms of social support and back and upper limb pain/discomfort, along with incapacitating upper limb symptoms, whilst adjusting for different confounders, in employed and self-employed therapists.

This paper also has some key limitations. This study was a cross sectional study design using self-reported data. Cross-sectional study designs do not allow for causation and/or temporal sequence to be determined, for example, this study design doesn't allow us to determine if the level of social support affected pain/discomfort or if having pain/discomfort first affected reporting of social support levels. Self-administered questionnaires are widely used in epidemiological and occupational research. They have many advantages, for example, cost-effectiveness for obtaining information from a large population sample and gathering information on a representative sample, among others (114). The main disadvantage centres on reporting bias, for instance, what is driving the responses? This means that the responses received may not just be based on characteristics of the workplace but may also be based on the employee's personality and current health status, among other factors (115). This can result in both non-differential and differential misclassification

which can lead to under and overestimations of effects on the reporting of pain/discomfort prevalence rates (115). Therefore, the prevalence rates reported need to be interpreted with caution due to the possibility of recall and reporting bias. Common methods variance bias also needs to be taken into account when using only self-reported measurements, as this can inflate the associations found (116).

The response rate for the physical therapists was high making us confident that this sample was fairly representative of the population. However, hospital based chartered physiotherapists' response rate was very low at 31% [for further detail see (1)]. With lower response rates, the possibility of selection bias needs to be taken into account. Following a non-responder analysis by gender and province of work for Physical Therapists / Athletic Therapists and Chartered Physiotherapists in Private Practice, no systematic response bias was detected (1). It was not possible to complete the non-responder analysis for hospital based Chartered Physiotherapists. In relation to bias, we also have to acknowledge the possible bias introduced into the results by the removal of the 30 respondents who completed either primary employment or the social support scales inconsistently. Twenty-nine of these respondents were employed and one was self-employed. This systematic misunderstanding of these respondents was not expected, therefore, if they were left in the data analysis, there was a chance that this may introduce a systematic bias.

In conclusion, this paper indicates the importance of supervisor support in relation to the prevention and/or reduction of work-related upper limb pain/discomfort prevalence in employed therapists. The findings also highlight the relevance of peer support in both employed and self-employed therapists for prevention and/or reduction of incapacitating upper limb pain/discomfort prevalence. This indicates that work-related social support, both supervisor and peer, needs to be taken into account when

investigating the prevention of WRMSDs and the design/management of systems of work along with physical and organisational work factors for both employed and self-employed workers.

Chapter 6: Paper 4 – Training, preventive work strategies and employed and self-employed Chartered Physiotherapists, Physical Therapists and Athletic Therapists in Ireland.

Publication Plan: To be submitted to *Applied Ergonomics*

Chapter 6: Training, preventive work strategies, work-related musculoskeletal disorders and employed and self-employed Chartered Physiotherapists, Physical Therapists and Athletic Therapists in Ireland.

6. Abstract

The current literature indicates that whilst employees report understanding and awareness of the skills and knowledge imparted during a training programme, in particular manual handling training, this does not always result in the expected behavioural change. Furthermore, there is little evidence of a reduction of WRMSDs. Taking this into account, the scientific research has shown that whilst training may not be as effective as expected, in relation to reduction of WRMSDs, it does improve skill and knowledge awareness, to a certain extent, within employees. It is, therefore, important to ask if this heightened awareness due to training assists employees in choosing preventive work strategies to reduce WRMSDs. Whilst also assessing if the existence of back, neck and/or upper limb pain/discomfort reduces a workers' engagement with preventive work strategies. These preventive work strategies could assist the worker in coping with the physical risk factors in the workplace. Coping is defined as 'constantly changing cognitive and behavioural efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person'. Within the international literature, the preventive work strategies used by employed physiotherapists/physical therapists to reduce and/or prevent WRMSDs have been investigated. However, it is worth considering if training assists the physiotherapists/physical therapists to make changes which prevent/reduce musculoskeletal injury or discomfort and if there are any differences by employment status.

The hypotheses of this study are that [1] employed therapists engage in preventive work strategies more than self-employed therapists, [2] trained therapists engage in preventive work strategies more than untrained therapists and [3] therapists who report back, neck and upper limb pain/discomfort engage less in preventive work strategies compared to those who do not report back, neck and upper limb pain/discomfort.

This research used data from the HITS study, which was a cross sectional study investigating back, neck and upper limb pain/discomfort in practicing chartered physiotherapists, physical therapists and athletic therapists in Ireland. Self-administered questionnaires were completed on socio-demographics, musculoskeletal disorder symptoms, psychosocial work factors and physical work factors. Logistic regression models were built with pain/discomfort in back, neck and upper limb, along with incapacitating upper limb symptoms, in past 12 months as the outcome and training for therapists as the predictor whilst adjusting for age, gender and employment status.

The findings indicate that **e**mployed therapists who had reported completing training had significantly lower prevalence rates for back and neck pain/discomfort (69.2% and 41.8%, respectively) compared to those who reported no training (88.9% and 61.1%, respectively) (P=0.01 and P=0.04, respectively). Therapists who had reported back, neck and upper limb pain/discomfort reported significantly lower use of stopping doing a treatment if it aggravates their discomfort (35.1%, 32.3% and 37.1%, respectively) compared to those who reported no pain/discomfort (59.3%, 50.0% and 61.4%) (P<0.01, for all). Interestingly, those therapists who reported incapacitating upper limb pain/discomfort reported significantly higher use of the external coping strategy ‘changing job because of fear of suffering from long-term MSD’ (12.8%) compared to those who did not report incapacitating upper limb

pain/discomfort (4.8%) (P=0.02).The logistic regression model indicates that whilst taking training status into account, self-employed therapists are nearly twice as likely to report upper limb pain and discomfort compared to their employed counterparts [OR 1.96, 95% CI (1.07-3.61)].

In conclusion, this paper indicates that, even when taking account of training, self-employed therapists are still twice as likely to report upper limb pain pain/comfort compared to employed therapists. This shows the need for further research on MSD health in self-employed therapists and self-employed workers in general. The findings also highlight the need for further review of the preventive work strategies scale used in research on therapists.

6.1. Introduction

Musculoskeletal disorders "include a wide range of inflammatory and degenerative conditions affecting the muscles, tendons, ligaments, joints, peripheral nerves and supporting blood vessels" (20, p13). MSDs have a multi-causal aetiology (38). In the work context, they can be caused or aggravated by many physical and psychosocial hazards including poor manual handling, poor ergonomics, excessive static work load and psychosocial hazards. With this in mind, it could be hypothesised that the provision of training, around manual handling and ergonomics among others, would reduce work-related MSDs. However, the current literature indicates that whilst employees report understanding and awareness of the skills and knowledge provided following a training programme, in particular manual handling training, this does not always lead to the expected behavioural change, which would result in the reduction of WRMSDs (117). The systematic review by Hogan et al (2014) showed that whilst training may not be as effective as expected, in relation to reduction of WRMSDs, it does improve skill and knowledge awareness, to a certain extent, within employees (117). It is, therefore, important to ask if this heightened awareness due to training assists employees in choosing preventive work strategies to reduce WRMSDs. Whilst also assessing if the existence of back, neck and/or upper limb pain/discomfort reduces workers' engagement with preventive work strategies.

One occupational grouping of interest when it comes to the provision of training for the reduction of WRMSDs are employed and self-employed chartered physiotherapists, physical and athletic therapists. The international literature has indicated that this occupational grouping may be involved in work practices that place them at increased risk of MSDs (75). This is ironic when their education, knowledge and skills are taken into account. There is discussion in the literature in relation to the

importance of external coping strategies, specialised training programmes and an emphasis on preventive work strategies in the prevention of WRMSDs for physiotherapists/physical therapists (75). These preventive work strategies could assist the worker in coping with the physical risk factors in the workplace.

Coping is defined as 'constantly changing cognitive and behavioural efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person' (118, p141). Within the international literature, the preventive work strategies used by employed physiotherapists/physical therapists to reduce and/or prevent WRMSDs have been investigated. The main preventive work strategies reported were adjust plinth/bed height before treating a patient and modify their position and/or the patient's position (6, 8, 10, 11, 16-19). The use of these preventive work strategies allows the physiotherapists/physical therapists to adjust their method of working and their working conditions to allow them to stay in the profession in spite of the injury or discomfort (10). However, with this in mind, it is worth considering if training assists the physiotherapists/physical therapists to make changes which prevent/reduce musculoskeletal injury or discomfort.

The hypotheses of this study are that [1] employed therapists engage in preventive work strategies more than self-employed therapists, [2] trained therapists engage in preventive work strategies more than untrained therapists and [3] therapists who report back, neck and upper limb pain/discomfort engage less in preventive work strategies compared to those who do not report back, neck and upper limb pain/discomfort.

These hypotheses led to the following study objectives: [1] to compare the prevalence of back pain, neck pain and upper limb pain in employed and self-employed therapists who engage in training compared to those who do not [2] to establish the prevalence of use of preventive work strategies for therapists based on

completion of training, [3] to determine the prevalence of use of preventive work strategies for therapists based on pain/discomfort in back, neck and upper limb and [4] to estimate the adjusted odds of having back pain, neck pain and/or upper limb pain following completion of training, whilst adjusting for age, gender and employment status.

6.2. Methods

6.2.1. Study Design

The Health In Hand Intensive Tasks and Safety (HITS) study was conducted in 2011 (1). This was a cross-sectional study design investigating back, neck and upper limb pain/discomfort in practicing chartered physiotherapists, physical therapists and athletic therapists in Ireland.

6.2.2. Study Sample

The sampling of Physical Therapists and Athletic Therapists was completed through three databases aiming for a representative Irish sample including the databases of the Institute of Physical Therapy and Applied Science (IPTAS), the Irish Association of Physical Therapists (I.A.P.T.) and the Athletic Rehabilitation Therapy Certified (A.R.T.C) organisation. Chartered Physiotherapists were sampled from two different populations, the population of chartered physiotherapists in private practice and from the population of chartered physiotherapists employed in hospitals. Study participants working in private practice were randomly selected from two databases. To sample chartered physiotherapists in private and public hospitals, one-stage proportionate clustered sampling was used. Hospitals were selected based on bed capacity to ensure representation of physiotherapists working in different size hospitals reflecting approximately the proportionate distribution of different hospitals sizes in Ireland.

Each study participant was sent an invitation letter to participate in the study which included an information sheet and a self-administered questionnaire along with a self-addressed stamped envelope. The final sample size for data analysis in the HITS data was 347 therapists. This included 141 currently practicing physical therapists and athletic therapists (response rate: 76 %), 135 chartered physiotherapists in private practice (response rate: 54 %) and 71 hospital-based chartered physiotherapists (response rate: 31 %).

6.2.3. Questionnaire

The HITS questionnaire was pilot tested for content validity and question clarity by therapists in all work settings. Respondents provided self-reported data relating to the occurrence of back pain/discomfort (upper, mid and low back pain), neck pain/discomfort and upper limb pain/discomfort (shoulders, elbow, wrist, finger and thumb pain) in the past 12 months. The questions on pain/discomfort in each above body part were part of the administered Nordic Questionnaire on MSDs (106) and they asked the respondent 'have you at any time in the last 12 months had trouble such as ache, pain, discomfort, numbness in any of the following regions' with options to answer "No", "Left", "Right" and "Both". For data analysis, an answer of "Left", "Right" and "Both" was recoded into "Yes". For incapacitating symptoms, the respondent was asked 'During the past 12 months have you ever been prevented from carrying out normal activities (job, housework, hobbies) because of discomfort or pain in any of the following body regions' with options to answer "No", "Left", "Right" and "Both". For data analysis, an answer of "Left", "Right" and "Both" was recoded into "Yes".

Information was obtained from respondents in relation to their primary employment and any secondary employment they may have had. This information was aggregated together to produce the employment status variable which was classified into ‘mainly employed’ and ‘mainly self-employed’ for data analysis. The term ‘mainly’ was used as some therapists were both employed and self-employed based on their primary and secondary employment (i.e. individual employed in the public health service and working part-time in their own practice).

In relation to the demographic variables, age was measured in years as a continuous variable and gender was measured as a dichotomous variable, with options of “male” or “female”. In relation to training, respondents were asked ‘Have you ever received injury prevention (self-care) training in relation to your work?’ with ‘Yes/No’ answer options. This was followed by ‘If Yes, please specify what type of self-care training you had’. This question was asked as an open-ended question, with these answers being later categorised for data analysis. Respondents were also asked about coping strategies they used in practice, in order to reduce the strain on their body and arms when working. The answer options for this question included ‘Always’. ‘Often’, ’Sometimes’, ‘Seldom’ and ‘Never / hardly ever’ (10) and these were collapsed into ‘Coping strategies used’ (‘always’ and ‘often’) and ‘Coping strategies rarely used’ (’sometimes’, ‘seldom’ and ‘never / hardly ever’) for data analysis.

6.2.4. Data Analysis

Data were analysed using the Statistical Package for Social Science (SPSS) Version 22. Descriptive analysis was completed to describe self-care training of employed and self-employed therapists. Cross tabulations and Chi-square tests were performed for training in employed and self-employed therapists, to determine significant differences in their prevalence of self-reported pain/discomfort in back, neck and

upper limbs, along with incapacitating upper limb symptoms. Cross tabulations and Chi-square tests were also completed to determine the prevalence of use of coping strategies in employed and self-employed therapists based on completion of self-care training and pain/discomfort in back, neck and upper limb. Logistic regression models were built with pain/discomfort in back, neck and upper limb, along with incapacitating upper limb symptoms, in past 12 months as the outcome and self-care training for therapist as the predictor. This model was adjusted through a hierarchical entry method for age, gender and employment status.

6.2.5. Ethical Approval

Ethical approval for the HITS study was received from The Clinical Research Ethics Committee of the Cork Teaching Hospitals, Cork, Ireland. Informed consent was sought from all participants.

6.3. Results

Table 6.1 shows detail of types of training in employed and self-employed therapists. Over 60% of employed therapists and 50% of self-employed therapists reported having had some form of training. The most common form of training reported was 'manual/patient handling', at 43.6% within employed therapists and 17.2% in self-employed therapists.

Table 6.2 shows the prevalence of back, neck and upper limb pain/discomfort in the past 12 months based on completion of training in therapists. Employed therapists who had indicated completing training reported significantly lower prevalence rates for back and neck pain/discomfort (69.2% and 41.8%, respectively) compared to those who reported no training (88.9% and 61.1%, respectively) (P=0.01 and P=0.04, respectively). No significant differences were found for self-employed therapists or within the complete sample of therapists.

Table 6.3 shows the prevalence of use of preventive work strategies in therapists based on completion of training. The only preventive work strategy to indicate a statistically significant result based on completion of training was to 'modify patient / client position'. Employed therapists who had reported completing training reported significantly higher use of modifying the patient / client (75.9%) compared to those who reported no training (58.5%) (P=0.05). Within the complete sample of therapists, a similar finding was determined (56.8% with no training compared to 71.4% with training).

Table 6.4 shows the prevalence of use of preventive work strategies in therapists based on pain/discomfort in back, neck and upper limbs. The findings indicate that therapists who reported back, neck and upper limb pain/discomfort reported significantly lower use of a number of the preventive work strategies. The

preventative work strategy which showed statistically significant results across back, neck and upper limb pain/discomfort was ‘stop doing a treatment if it aggravates your discomfort’. Therapists who had reported back, neck and upper limb pain/discomfort reported significantly lower use of this preventive work strategy (35.1%, 32.3% and 37.1%, respectively) compared to those who reported no pain/discomfort (59.3%, 50.0% and 61.4%) (P=0.00, for all). Interestingly, those therapists who reported incapacitating upper limb pain/discomfort reported significantly higher use of the preventive work strategy ‘changing job because of fear of suffering from long-term MSD’ (12.8%) compared to those who did not report incapacitating upper limb pain/discomfort (4.8%) (P=0.02).

Table 6.5 shows the logistic regression model investigating the association between pain/discomfort in back, neck and upper limbs and training in therapists. This model indicates that therapists with training are 0.5 times less likely to report upper limb pain/discomfort compared to those therapists with no training [OR 0.53, 95% CI (0.28-0.99)]. In addition, whilst taking training status into account, self-employed therapists are nearly twice as likely to report upper limb pain and discomfort compared to their employed counterparts [OR 1.96, 95% CI (1.07-3.61)].

Table 6.1: Descriptive analysis - training in employed and self-employed therapists

	Employed Therapists (n=149)	Self-employed Therapists (n=198)
Training	**n (%)**	**n (%)**
Yes	91 (62.8)	98 (50.5)
No	54 (37.2)	96 (49.5)
Type of Training		
Manual/Patient Handling	65 (43.6)	34 (17.2)
Ergonomics/Biomechanics	7 (4.7)	31 (15.7)
Physical exercise training	2 (1.3)	4 (2.0)
Self-care training during college	8 (5.4)	16 (8.1)
Other training	3 (2.0)	11 (5.6)
No training	64 (43)	102 (51.5)

Some totals vary due to missing data

Table 6.2: Cross Tabulation & Chi-square test - prevalence of Back, Neck and Upper Limb pain/discomfort in the past 12 months based on completion of training in therapists

	Back Pain/discomfort		**Neck Pain/discomfort**		**Pain/discomfort in any Upper Limb**		**Incapacitating Upper Limb pain/discomfort**	
	***n* (%)**	**95% CI**	***n* (%)**	**95% CI**	***n* (%)**	**95% CI**	**n (%)**	**95% CI**
Employed Therapists								
Training								
Yes (n=91)	**63 (69.2)**	**61.1-76.7**	**38 (41.8)**	**33.8-49.8**	66 (72.5)	65.2-79.8	28 (31.1)	23.5-38.7
No (n=54)	**48 (88.9)**	**83.8-94.0**	**33 (61.1)**	**53.2-69.0**	47 (87.0)	81.5-92.5	17 (31.5)	23.9-39.1
Self-employed Therapists								
Training								
Yes (n=98)	73 (74.5)	68.4-80.6	50 (51.0)	44.0-58.0	83 (84.7)	79.6-89.8	21 (21.9)	16.0-27.8
No (n=96)	67 (69.8)	63.3-76.3	44 (45.8)	38.8-52.8	84 (87.5)	82.9-92.2	21 (22.1)	16.2-28.0
All Therapists								
Training								
Yes (n=189)	136 (72.0)	67.2-76.8	88 (46.6)	41.3-51.9	149 (78.8)	74.5-83.2	49 (26.3)	21.6-31.0
No (n=150)	115 (76.7)	72.2-81.2	77 (51.3)	46.0-56.6	131 (87.3)	83.8-90.8	38 (25.5)	20.8-30.2

Table 6.3: Cross Tabulation & Chi-square test - prevalence of use of preventive work strategies in therapists based on completion of training

	Fewer manual techniques		Use of other personnel		Modify patient / client position		Modify own position		Take more rest breaks	
	***n* (%)**	**95% CI**	***n* (%)**	**95% CI**	***n* (%)**	**95% CI**	***n* (%)**	**95% CI**	**n (%)**	**95% CI**
Employed Therapists										
Training										
Yes (n=87)	11 (12.9)	7.3-18.5	12 (13.8)	8.1-19.5	**66 (75.9)**	**68.8-83.0**	72 (82.8)	75.6-89.1	11 (12.6)	7.1-18.1
No (n=53)	12 (23.1)	16.0-30.2	5 (9.4)	4.6-14.2	**31 (58.5)**	**50.3-66.7**	40 (75.5)	68.4-82.6	6 (11.3)	6.1-16.5
Self-employed Therapists										
Training										
Yes (n=98)	17 (17.3)	12.0-22.6	5 (5.2)	2.0-8.4	66 (67.3)	60.7-73.9	76 (77.6)	71.7-83.5	12 (12.2)	7.6-16.9
No (n=96)	9 (9.5)	5.4-13.6	4 (4.4)	1.5-7.3	53 (55.8)	48.8-62.8	66 (69.5)	63.0-76.0	15 (15.8)	10.7-21.0
All Therapists										
Training										
Yes (n=149)	28 (15.3)	11.4-19.2	17 (9.2)	6.1-12.3	**132 (71.4)**	**66.6-76.3**	148 (80.0)	75.7-84.3	23 (12.4)	8.9-15.9
No (n=185)	21 (14.3)	10.5-18.1	9 (6.3)	3.7-8.9	**84 (56.8)**	**51.5-62.1**	106 (71.6)	66.8-76.4	21 (14.2)	10.5-18.0

Table 6.3 (contd): Cross Tabulation & Chi-square test - prevalence of use of preventive work strategies in therapists based on completion of training

	Exercises before performing manual techniques		Use acupuncture etc		Pause regularly to stretch and change position		Adjust plinth / bed height	
	n (%)	**95% CI**	**n (%)**	**95% CI**	***n* (%)**	**95% CI**	***n* (%)**	**95% CI**
Employed Therapists								
Training								
Yes (n=87)	6 (7.0)	2.8-11.2	8 (9.4)	4.5-14.3	20 (23.0)	10.7-23.3	75 (88.2)	82.8-93.6
No (n=53)	1 (1.9)	-0.4-4.2	9 (17.0)	10.8-23.2	8 (15.1)	9.1-21.1	43 (81.1)	74.6-87.6
Self-employed Therapists								
Training								
Yes (n=98)	9 (9.2)	5.1-13.3	32 (33.3)	26.6-40.0	24 (25.5)	19.3-31.7	84 (85.7)	80.7-90.6
No (n=96)	11 (11.5)	7.0-16.0	25 (26.3)	20.1-32.5	19 (19.8)	14.1-25.5	83 (86.5)	81.7-91.3
All Therapists								
Training								
Yes (n=149)	15 (8.2)	5.3-11.2	40 (22.1)	17.6-26.6	44 (24.3)	19.7-28.9	159 (86.9)	83.3-90.5
No (n=185)	12 (8.1)	5.2-11.0	34 (23.0)	18.5-27.5	27 (18.1)	14.0-22.3	126 (84.6)	80.7-88.5

Table 6.3 (contd): Cross Tabulation & Chi-square test - prevalence of use of preventive work strategies in therapists based on completion of training

	Select techniques that will not aggravate your discomfort		Stop doing a treatment if it aggravates your discomfort		Improved body mechanics		Changing job because of fear of suffering from long-term MSD	
	***n* (%)**	**95% CI**	***n* (%)**	**95% CI**	***n* (%)**	**95% CI**	***n* (%)**	**95% CI**
Employed Therapists								
Training								
Yes (n=87)	41 (47.1)	38.8-55.4	36 (41.4)	33.2-49.6	62 (72.1)	64.6-79.6	5 (5.7)	1.9-9.5
No (n=53)	26 (49.1)	40.8-57.4	18 (34.0)	26.2-41.9	29 (55.8)	47.5-64.1	3 (5.7)	1.9-9.5
Self-employed Therapists								
Training								
Yes (n=98)	57 (58.2)	51.3-65.1	44 (45.4)	38.4-52.4	68 (70.1)	63.6-76.6	9 (9.2)	5.1-13.3
No (n=96)	56 (58.3)	51.4-65.2	39 (41.1)	34.1-48.1	66 (68.8)	62.3-75.3	8 (8.3)	4.4-12.2
All Therapists								
Training								
Yes (n=149)	98 (53.0)	47.7-58.4	80 (43.5)	38.2-48.8	130 (71.0)	66.1-75.9	14 (7.6)	4.8-10.4
No (n=185)	82 (55.0)	49.7-60.3	57 (38.5)	33.3-43.7	95 (64.2)	59.0-69.4	11 (7.4)	4.6-10.2

Table 6.4: Cross Tabulation & Chi-square test - prevalence of use of preventive work strategies in therapists based on pain/discomfort in back, neck and upper limbs

	Fewer manual techniques		Use of other personnel		Modify patient / client position		Modify own position		Take more rest breaks	
	***n* (%)**	**95% CI**	***n* (%)**	**95% CI**	***n* (%)**	**95% CI**	***n* (%)**	**95% CI**	**n (%)**	**95% CI**
					All Therapists					
Back pain/discomfort										
Yes (n=251)	39 (15.7)	11.8-19.6	21 (8.5)	5.5-11.5	158 (63.2)	58.1-68.3	189 (75.3)	70.7-79.9	28 (11.2)	7.8-14.6
No (n=88)	10 (11.5)	8.1-14.9	5 (5.9)	3.4-8.4	62 (70.5)	65.6-75.4	69 (79.3)	75.0-83.6	17 (19.5)	15.3-23.7
Neck pain/discomfort										
Yes (n=167)	24 (14.5)	10.7-18.3	14 (8.5)	5.5-11.5	106 (63.9)	58.8-69.0	129 (77.2)	72.7-81.7	17 (10.2)	7.0-13.4
No (n=172)	25 (14.8)	11-18.6	12 (7.1)	4.3-9.9	114 (66.3)	61.3-71.3	129 (75.4)	70.8-80.0	28 (16.4)	12.5-20.4
Pain/discomfort in any Upper Limb										
Yes (n=281)	41 (14.7)	10.9-18.5	19 (6.9)	4.2-9.6	**174 (62.1)**	**56.9-67.3**	**208 (74.0)**	**69.3-78.7**	33 (11.7)	8.3-15.1
No (n=58)	8 (14.0)	10.3-17.7	7 (12.5)	9.0-16.1	**48 (79.3)**	**75.0-83.6**	**50 (87.7)**	**84.2-91.2**	12 (21.1)	16.8-25.5
Incapacitating Upper Limb pain/discomfort										
Yes (n=86)	17 (20.2)	15.9-24.5	11 (12.9)	9.3-16.5	54 (62.8)	57.6-68.0	66 (76.7)	72.2-81.2	12 (14.0)	10.3-17.7
No (n=249)	32 (13.0)	9.4-16.6	15 (6.1)	3.5-8.7	162 (65.3)	60.2-70.4	189 (76.2)	71.6-80.8	31 (12.5)	9.0-16.1

Table 6.4 (contd): Cross Tabulation & Chi-square test - prevalence of use of preventive work strategies in therapists based on pain/discomfort in back, neck and upper limbs

	Exercises before performing manual techniques		**Use acupuncture etc**		**Pause regularly to stretch and change position**		**Adjust plinth / bed height**	
	n (%)	**95% CI**	**n (%)**	**95% CI**	***n* (%)**	**95% CI**	***n* (%)**	**95% CI**
					All Therapists			
Back pain/discomfort								
Yes (n=251)	19 (7.6)	4.8-10.4	55 (22.2)	17.7-26.7	**44 (17.8)**	**13.7-21.9**	209 (83.9)	26.8-36.8
No (n=88)	8 (9.1)	6.0-12.2	20 (23.3)	18.8-27.8	**28 (31.8)**	**26.8-36.8**	80 (90.9)	87.8-94.0
Neck pain/discomfort								
Yes (n=167)	16 (9.6)	6.5-12.7	38 (22.9)	18.4-27.4	31 (18.9)	14.7-23.1	141 (84.9)	81.1-88.7
No (n=172)	11 (6.4)	3.8-9.0	37 (22.0)	17.6-26.4	41 (24.0)	19.4-28.6	148 (86.5)	82.9-90.2
Pain/discomfort in any Upper Limb								
Yes (n=281)	24 (8.6)	5.6-11.6	63 (22.7)	18.2-27.2	55 (19.9)	15.6-24.2	235 (84.2)	80.3-88.1
No (n=58)	3 (5.2)	2.8-7.6	12 (21.4)	17.0-25.8	17 (29.3)	24.4-34.2	54 (93.1)	90.4-95.8
Incapacitating Upper Limb pain/discomfort								
Yes (n=86)	6 (7.1)	4.4-9.9	17 (20.5)	16.1-24.9	15 (17.9)	13.8-22.0	73 (85.9)	82.2-89.6
No (n=249)	19 (7.6)	4.8-10.4	57 (23.1)	18.6-27.7	56 (22.7)	18.2-27.2	212 (85.5)	81.7-89.3

Table 6.4 (contd): Cross Tabulation & Chi-square test - prevalence of use of preventive work strategies in therapists based on pain/discomfort in back, neck and upper limbs

	Select techniques that will not aggravate your discomfort		**Stop doing a treatment if it aggravates your discomfort**		**Improved body mechanics**		**Changing job because of fear of suffering from long-term MSD**	
	***n* (%)**	**95% CI**	***n* (%)**	**95% CI**	***n* (%)**	**95% CI**	***n* (%)**	**95% CI**
					All Therapists			
Back pain/discomfort								
Yes (n=251)	**125 (49.8)**	**44.5-55.1**	**88 (35.1)**	**30.0-40.2**	162 (65.3)	60.2-70.4	23 (9.2)	6.1-12.3
No (n=88)	**58 (65.9)**	**60.9-71.0**	**51 (59.3)**	**54.1-64.6**	67 (76.1)	71.5-80.7	2 (2.3)	0.7-3.9
Neck pain/discomfort								
Yes (n=167)	89 (53.3)	48.0-58.6	**54 (32.3)**	**27.3-37.3**	107 (64.5)	59.4-69.6	17 (10.2)	7.0-13.4
No (n=172)	94 (54.7)	49.4-60.0	**85 (50.0)**	**44.7-55.3**	122 (71.8)	67.0-76.6	8 (4.7)	2.5-7.0
Pain/discomfort in any Upper Limb								
Yes (n=281)	150 (53.4)	48.1-58.7	**104 (37.1)**	**31.9-42.3**	**182 (65.2)**	**60.1-70.3**	24 (8.5)	5.5-11.5
No (n=58)	33 (56.9)	51.6-62.2	**35 (61.4)**	**56.2-66.6**	**47 (82.5)**	**78.4-86.6**	1 (1.7)	0.3-3.1
Incapacitating Upper Limb pain/discomfort								
Yes (n=86)	43 (50.0)	44.7-55.4	35 (40.7)	35.4-46.0	59 (69.4)	64.4-74.4	**11 (12.8)**	**9.2-16.4**
No (n=249)	138 (55.4)	50.1-60.7	103 (41.7)	36.4-47.0	168 (68.0)	63.0-73.0	**12 (4.8)**	**2.5-7.1**

Table 6.5: Logistic Regression – the association between pain/discomfort in back, neck and upper limbs and training in therapists

	Back Pain/Discomfort		**Neck Pain/Discomfort**		**Pain/discomfort in any Upper Limb**		**Incapacitating Upper Limb pain/discomfort**	
	OR (95% CI)	**p-value**	***OR (95% CI)***	**p-value**	***OR (95% CI)***	**p-value**	**OR (95% CI)**	**p-value**
Training (reference: no training)								
Training	0.69 (0.41-1.16)	0.17	0.77 (0.49-1.21)	0.25	**0.53 (0.28-0.99)**	**0.05**	1.03 (0.62-1.73)	0.90
Gender (reference: male)								
Female	1.50 (0.89-2.54)	0.13	**2.39 (1.47-3.88)**	**0.00**	1.37 (0.74-2.53)	0.31	1.74 (0.99-3.07)	0.06
Age Group (reference: <= 29 years)								
30-34 years	**0.30 (0.11-0.81)**	**0.01**	0.76 (0.36-1.63)	0.48	0.61 (0.21-1.78)	0.36	**0.34 (0.13-0.86)**	**0.02**
35-39 years	0.39 (0.14-1.08)	0.07	0.65 (0.30-1.39)	0.26	0.46 (0.16-1.31)	0.15	0.98 (0.43-2.25)	0.97
40-44 years	0.55 (0.19-1.63)	0.29	1.51 (0.66-3.42)	0.32	0.82 (0.25-2.68)	0.74	1.00 (0.41-2.40)	0.99
45-49 years	**0.33 (0.11-1.00)**	**0.05**	0.72 (0.31-1.70)	0.46	0.51 (0.15-1.73)	0.28	1.15 (0.45-2.92)	0.77
50+ years	0.35 (0.12-1.03)	0.13	0.49 (0.21-1.14)	0.10	0.36 (0.12-1.10)	0.07	1.11 (0.45-2.76)	0.82
Employment status (reference: employed)								
Self-employed	0.83 (0.49-1.41)	0.49	1.05 (0.66-1.68)	0.84	**1.96 (1.07-3.61)**	**0.03**	**0.55 (0.32-0.93)**	**0.03**

Adjusted for age, gender and employment status

6.4. Discussion

The international literature states the most commonly used preventive work strategies used by therapists are to modify their position and/or the patient's position and adjust plinth/bed height before treating a patient (6, 8, 10, 11, 16-19, 79). These findings go a step further by investigating the most commonly used preventive work strategies based on training of the therapist. These findings also indicate that employed therapists who had completed training reported significantly higher use of modifying the patient/client position (75.9%) compared to those who reported no training (58.5%) (P=0.05). A similar finding was determined within the complete sample of therapists (56.8% compared to 71.4%). Employed therapists with training reported significantly lower prevalence rates for back and neck pain/discomfort (69.2% and 41.8%, respectively) compared to those who reported no training (88.9% and 61.1%, respectively). This significant result disappeared within the adjusted logistic regression model. The findings also add to the limited research on preventive work strategies in therapists by indicating that therapists reporting incapacitating upper limb pain/discomfort reported significantly higher use of the preventive work strategy 'changing job because of fear of suffering from long-term MSD' (12.8%) compared to those who did not report any incapacitating upper limb pain/discomfort (4.8%). This indicates the effect of incapacitating upper limb symptoms on therapist's ability to continue working in their profession. Whilst the findings do not indicate if these therapists eventually left the profession, it can be inferred that incapacitating upper limb symptoms in therapists may lead to the 'healthy worker effect', rather than just back, neck or upper limb pain/discomfort. Finally, the findings, again, support the literature in relation to self-employed workers appearing to be at greater risk of suffering any WRMSD than their employed counterparts (42). Whilst taking training

status into account, self-employed therapists are nearly twice as likely to report upper limb pain and discomfort compared to their employed counterparts [OR 1.96, 95% CI (1.07-3.61)].

The key strengths of this study were the careful sampling method, the inclusion of self-employed workers and the statistical analysis method used. Research including self-employed workers is generally sparse across all occupations. This study adds to the investigation of the musculoskeletal health of self-employed workers. In the current international literature, the preventive work strategies used by therapists were generally described as a percentage of respondents who reported using that strategy. This study used cross tabulations and chi-square tests to determine usage of preventive work strategies based on levels of training and back, neck and upper limb pain/discomfort, along with incapacitating upper limb symptoms. This gives greater depth to the findings.

This paper also has some key limitations. This study was a cross-sectional study design using self-reported data. Therefore, a number of bias including recall, reporting and common methods variance bias need to be taken into account when interpreting the prevalence rates reported. The response rate for the physical therapists was high making us confident that this sample was fairly representative of the population, however, in hospital based chartered physiotherapists it was very low at 31% [for further detail see (1)]. With lower response rates, the possibility of selection bias needs to be taken into account. Following a non-responder analysis by gender and province of work for Physical Therapists / Athletic Therapists and Chartered Physiotherapists in Private Practice, no systematic response bias was detected (1). However, it was not possible to complete the non-responder analysis for hospital based Chartered Physiotherapists. Finally, the scale used to measure preventive work

strategies was comprised of individual one item questions (10), therefore, it could be considered to be weak from a statistical perspective. However, this scale has been used across all the international literature to determine preventive work strategies in therapists, therefore, it has become a standard for this measurement. To determine, the validity of this scale, further statistical analysis would need to completed, such as factor analysis.

In conclusion, this paper indicates that, in relation to preventive work strategies, ‘modifying the patient/client’ is the most used approach with trained employed therapists and within the complete sample of therapists. In addition, even when taking account of training, self-employed therapists are still twice as likely to report upper limb pain pain/comfort compared to employed therapists. This shows the need for further research on musculoskeletal health in self-employed therapists and self-employed workers in general. The findings also highlight the need for further review of the preventive work strategies scale used in research on therapists.

Chapter 7: Thesis Discussion

Chapter 7: Thesis Discussion

7. Discussion

Within this thesis, the candidate investigated employed and self-employed Chartered Physiotherapists, Physical Therapists and Athletic Therapists in Ireland, hereafter known as therapists, from data collected within the HITS study. This was investigated under the thesis theoretical model which detailed [1] training provision, [2] social support, [3] preventive work strategies and their involvement with WRMSD outcomes, whilst taking account of [4] employment status (Figure 2.1). This chapter will be synthesised using these four main areas, firstly, for each area a brief summary of the main results will be presented followed by a discussion.

7.1. Training provision

Within Paper 1 (117), it was determined that whilst employees report understanding and awareness following training, this does not always lead to the expected behavioural change and, subsequent, reduction of WRMSDs. This was an addition to the international literature on the area of manual handling training (61, 83, 89) and broadened the scope to start investigating the secondary intermediate variables in training, such as training transfer and behavioural change. In contrast to this, Paper 4 indicates that employed therapists with training, reported significantly lower prevalence rates for back and neck pain/discomfort compared to those who reported no training. However, it is important to note that this significance disappeared when adjusted for age, gender and employment status. Both of these findings indicate the need for further qualitative and quantitative review of training provision for the reduction of WRMSDs. Qualitative research may be required to determine issues relating to training transfer and behaviour change. Based on the current thesis, topics

such as ‘why does training transfer not always occur to expected levels’ / ‘when training transfer does occur why does it not translate into behaviour change in the workplace’ need further exploration. This qualitative exploration is required and should be used to inform the completion of randomised controlled trials focused on rigorous training sessions and follow up, with the use of objective measures (company injury statistics, medical data, physical measurements, among others) for WRMSDs. To allow further investigation of the secondary intermediate variables, training transfer and behaviour change, it would be essential to include process evaluation within the randomised controlled trials. This is to ensure the practical application of effective manual handling training, leading to a reduction of WRMSDs in the workplace in the future. It is essential that the research investigating the effectiveness of manual handling on the reduction of WRMSDs informs the development of training programmes which can be integrated as part of national policy and provided within the workplaces to the national workforce.

7.2. Social support

The importance of social support, as a psychosocial work factor, was investigated in this thesis for both employed and self-employed therapists. In relation to upper limb pain/discomfort, supervisor support was seen as protective in employed therapists, however, peer support didn’t indicate any significant findings. On the other hand, low levels of peer support were identified as a risk factor for the prevalence of incapacitating upper limb pain/discomfort in both employed and self-employed therapists (Paper 3). These findings are in line with the international literature in respect to the protective nature of supervisor support in the development of WRMSDs for employed workers (110). Within the international literature, low peer support does not appear to predict the development of WRMSD symptoms (110). However, whilst

the findings support this for employed workers in relation to the development of upper limb pain/discomfort, this was not the case for the prevalence of incapacitating upper limb pain/discomfort in both employed and self-employed therapists, with low peer support seen as a risk factor. The proposed protective nature of supervisor support and peer support for employed therapists in relation to upper limb pain/discomfort and incapacitating upper limb symptoms, respectively, is interesting. It can be hypothesised that since employed therapists are reporting significantly higher prevalence of incapacitating upper limb symptoms than self-employed workers, they could be lacking the appropriate level of peer and supervisor support to control their pace of work and appointment timings leading to heightened risk of upper limb pain/discomfort and incapacitating upper limb symptoms. Further investigation is required to determine why employed therapists appear to be suffering from higher levels of upper limb symptom progression than self-employed therapists. When interpreting the findings for the construct of social support in this thesis, it is important to remember which domains were measured versus those domains not measured in this thesis. The domains measured included 'emotional support', 'appraisal and affirmation' and 'informational assistance' domains (53, p270, 54, p276). The 'intimacy' and 'comfort and physical affection' domains (53, p270, 54, p276) were not measured in this thesis. Further research would be required to determine what affect the inclusion of the measurement 'intimacy' and 'comfort and physical affection' domains would have on the findings, specifically for self-employed therapists, as their support networks may be less formal than employed therapists.

7.3. Preventive work strategies and WRMSD outcomes

In relation to preventive work strategies, to the knowledge of the candidate, this thesis investigated these strategies in the occupational group of therapists in more detail than

had been completed in the international literature to date. Within the international literature, the use of these preventive work strategies was mainly described through the use of basic percentages (6, 8, 10, 11, 16-19, 79). The findings indicated that employed therapists and the entire sample of therapists (employed and self-employed) who had completed training reported a higher use of 'modifying the patient / client position' compared to those who reported no training. This finding is interesting as it indicates that those with training have engaged in training transfer and this has translated into a learned behaviour in relation to this preventive work strategy. Previously the international literature only reported percentage use of the preventive work strategies within the occupational group of therapists, however, 'modifying the patient / client position' was detailed as one of the main preventive work strategies employed by therapists (6, 10, 11, 18), which indicates that the findings are in line with the international literature. Interestingly, therapists reporting incapacitating upper limb pain/discomfort reported significantly higher use of the preventive work strategy 'changing job because of fear of suffering from long-term MSD' compared to those who did not report any incapacitating upper limb pain/discomfort. This indicates the need for further qualitative research to determine under which circumstances incapacitating upper limb pain/discomfort may lead to therapists leaving the profession. In addition, the qualitative research could investigate why this finding appears to be specific to incapacitating upper limb pain/discomfort and not upper limb, neck and/or back pain. Finally, whilst taking training status into account, self-employed therapists are nearly twice as likely to report upper limb pain and discomfort compared to their employed counterparts (Paper 4). This is in line with the international literature which indicates the self-employed workers appear to be more at risk of suffering WRMSDs compared to their employed counterparts (42). This

shows that further research on the musculoskeletal health of self-employed therapists/workers is required to determine why is this the case and what is required to reduce this finding.

7.4. Employment status

Within Paper 1 (117), the population was comprised of employed workers in the studies included in the systematic review. This indicated a gap in the literature in relation to self-employed worker's musculoskeletal health. In addition, the studies on the health and social care sector mainly investigated nurses, nursing aids and/or nursing students (27-31). This indicated the need to investigate other high risk occupations for MSD development in the health and social care sector, such as, therapists. Therapists are deemed to be a high risk occupational grouping (5), however, there is very limited evidence in the literature comparing them to other occupational groupings or the general working population. This lead to the development of Paper 2 through which it was determined that therapists were shown to be nearly five times more likely to suffer from LBP than the national working population, after careful adjustment for differences in socio-demographics (Paper 2) (113). However, there was no significant difference in LBP between employed and self-employed workers. In follow up to this, it was shown that self-employed therapists have a higher prevalence of upper limb pain discomfort compared to employed therapists. Conversely, when it comes to incapacitating upper limb symptoms employed therapists have a higher prevalence compared to self-employed therapists. These conflicting findings are interesting and could be explained in a number of ways. One hypothesis is that employed therapists have access to sick leave benefits, unlike self-employed therapists. Therefore, self-employed therapists cannot financially afford to have incapacitating upper limb symptoms which could prevent them from earning their

income. Another hypothesis may be that employed therapists have less control over their work schedule and appointment timings. Thus, they may be more at risk of developing incapacitating upper limb symptoms due to work demands. These hypotheses weren't tested in this thesis, however, they would make interesting areas of further research, including but not limited to, qualitative investigation with employed and self-employed therapists to determine the factors involved in the development of incapacitating upper limb symptoms. Finally, it is worth reviewing these findings from a methodological perspective. These findings were based on self-reported data, which could have resulted in reporting bias, for example, employed therapists may interpret the definition of incapacitating upper limb symptoms, as provided in the questionnaire, in a different way to self-employed therapists, leading to conflicting findings. Qualitative investigation would assist in determining therapists' interpretation of incapacitating upper limb symptoms to assist in future questionnaire based studies.

7.5. Overall findings of the thesis

In line with the theoretical model of the thesis (Figure 2.1), the findings of the thesis investigated the management systems and work environment factors which lead to work-related musculoskeletal outcomes. The management systems in place for organisationally employed workers are different to those for self-employed workers. These systems include the organisational culture, communication and feedback mechanisms for workers, such as social support, and the resources available to workers, such as training. These findings show differences and commonalities in the relevant work environment factors between employed and self-employed therapists in Ireland as detailed above. To explain the overall findings of this thesis, it is important to link back to the overarching aim of the thesis which was to develop a scientific

evidence base to assist in the prevention of work-related back, neck and upper limb pain/discomfort by investigating the potential risk factors of work-related back, neck and upper limb pain/discomfort in both employed and self-employed Chartered Physiotherapists (CPTs) and Physical Therapists/Athletic Therapists (PTs/ATs) in the Irish context and the effectiveness of current risk reduction strategies. One of the main current risk reduction strategies, currently used, to reduce prevalence of WRMSDs is manual handling training. The findings indicated that in its current form manual handling training is not effective, however, training within therapists resulted in significantly lower prevalence rates for back and neck pain/discomfort compared to those who reported no training. This infers that the issue with manual handling training effectiveness may rest with the type of training provided rather than overall ineffectiveness of manual handling training. However, further investigation, with robust study designs, would be required to determine the best form of manual handling training to reduce prevalence of WRMSDs. If supervisor (employed) and peer support (employed and self-employed), under the construct of social support, are low in the workplace, the findings shown them to be a potential risk factor for upper limb pain/discomfort and incapacitating upper limb symptoms, however, not for back pain/discomfort or neck pain/discomfort. This indicates that any future investigation into the effectiveness of manual handling training methodologies needs to investigate beyond just the physical outcomes and include psychosocial and employment conditions, as has been completed in this thesis.

7.6. Strengths of the thesis

Based on the dearth of research in relation to self-employed workers, their inclusion in this thesis is a key strength. In addition to this, the comparison with the national working population is an additional strength, as it indicates that both employed and

self-employed therapists are at high risk of suffering LBP compared to the national working population. From a methodology perspective, the outcomes examined in this thesis were measured through the HITS study using measurements taken from validated questionnaires including the Nordic Musculoskeletal Questionnaire and COPSOQ (long version). The HITS study included a careful sampling method. The systematic review methodology was strong, with a defined search strategy and robust quality assessment process. The international literature shows the synergies between psychosocial and physical work characteristics and their association with health outcomes, specifically WRMSDs. The importance of this holistic review of work has been a cornerstone of this thesis, in looking beyond the physical and taking account of the psychosocial and employment conditions.

7.7. Limitations of the thesis

One of the main limitations in this thesis relates to the bias which could be caused through the use of self-reported data. Retrospective reporting of musculoskeletal pain/discomfort can result in recall bias. Therefore, the reported prevalence rates need to be interpreted with caution. Although, the COPSOQ showed acceptable reliability in the group studied (adjusted Cronbach alpha), the findings are also subject to recall bias as they are based on self-report. In addition, common-method variance bias, which can cause a false variance introduced by the form of measurement technique, can result in observed associations differing from the true association (116). This is likely as both the exposure and the outcome were measured by self-reports. This could be mitigated against through statistical analysis (structural equation modelling) and alternative data collection methodology. If the self-reports of musculoskeletal symptoms were combined with objective measures to measure both outcome and exposure, such as medical records detailing diagnosis, ergonomic analyses and

worksite observations, a more valid assessment of musculoskeletal pain/discomfort could be obtained. Cross-sectional study design does not allow for the determination of causation, therefore, the direction of the causal pathways for the associations found in this thesis are not clear.

7.7.1. Implications for future work

This thesis provides evidence in relation to WRMSD prevalence in employed and self-employed therapists. Studies investigating self-employed workers are sparse across the international literature. Furthermore, occupational research in relation to WRMSDs has focused mainly on employed workers in the past. This thesis has set the scene for further research on self-employed therapists and their musculoskeletal health.

This thesis raises a number of interesting research questions. Based on the dearth of literature in relation to self-employed workers, it would be essential to undertake qualitative research to delve into the differences between employed and self-employed therapists in relation to their workplace, psychosocial work factors, including and beyond social support, and individual risk factors. What are these differences? What effects do these differences have on the way employees complete their work? These questions among others need to be answered so research in relation to self-employed workers can be developed and work towards influencing national policy decisions.

Leading out of the findings of the proposed qualitative research, the findings could be used to frame further quantitative work with the inclusion of more objective measures to supplement the findings of the self-reported data around the musculoskeletal health of the self-employed worker, in line with research of WRMSDs in employed workers (33-35). These objective measures could include

improvements in the collection of accurate medical data on injuries and biomechanical measurements, among others. With increases in self-employment, the continued investigation of these worker's health and well-being can inform government decision makers and policy makers, especially in relation to the benefits and legislative protection available to self-employed workers.

7.8. Conclusion

The findings of this thesis indicate the need for further research on self-employed workers and their musculoskeletal health, as detailed above. From an applied occupational health and safety perspective, it also has key implications for legislation, policy and practice. In Ireland, Health and Safety legislation is controlled under the Safety, Health and Welfare at Work Act, 2005 (119). Workplaces in Ireland are required by law to have a safety statement and the related risk assessments on record. Training records are part of this process. This legislation and the associated statutory instrument provides guidance for both physical and psychosocial risk factors in the workplace, aiming to eliminate or control them. However, this legislation currently only relates to employers with more than five employees. Therefore, this legislation does not relate to self-employed workers. This means that the legal protections in place pertaining to health and safety for therapists working in a hospital or large private practice do not exist for self-employed therapists or those working in smaller practices. Researchers, policy-makers and practitioners need to work together to ensure that health and safety legislation is not seen as a block to small business and instead develop legislation that is integral to worker's health and wellbeing, whilst being a key, functioning and supportive part of small business.

The findings of this thesis indicate that therapists are in fact a 'high risk' occupational group for the development of WRMSDs, which supports the

international literature (5). The international literature has indicated that therapists are changing roles and/or leaving the profession due to injury (75). The findings of this thesis can be used in practice to start supporting therapists to remain in their roles and reduce the prevalence of WRMSDs among this occupational grouping, taking account of their physical, psychosocial and organisational environments based on employment status. In addition, these findings can be used to lead into further research and influence the development of future campaigns, nationally and with the European Commission, in the area of Occupational Health and Safety in the health and social care sector, taking account of employment status.

In conclusion, future research needs to focus on both employed and self-employed workers' health and wellbeing to explicitly examine the effects of work on today's changing workforce. In relation to therapists, this thesis indicates that self-employment appears to be predictive of upper limb pain/discomfort, however, not for back pain. This requires further investigation in relation to WRMSD prevalence and related factors in employed and self-employed therapists through both qualitative and quantitative methods with the use of more objective measures.

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Appendices

Appendix 1: Dissemination of research from thesis and research outputs

Findings from this thesis have been published in peer-reviewed journals, in addition to being presented by the candidate at national and international conferences.

Peer-reviewed Published Papers

Hogan DA, O'Sullivan LW, Nolan S, Greiner BA. Are Irish therapists at heightened risk for low back pain? Occup Med (Lond). 2016;66(5):351-7.

Hogan, D. A. M., Greiner, B. A. & O'Sullivan, L. 2014. The effect of manual handling training on achieving training transfer, employee's behaviour change and subsequent reduction of work-related musculoskeletal disorders: a systematic review. Ergonomics, 57, 93-107.

Conference Presentations (Oral and Poster)

Hogan, D.A.M, Nolan, S., O'Sullivan, L.W, Greiner, B. (2016) Relationship between social support and upper limb pain in employed and self-employed healthcare therapists in Ireland. [Oral Presentation], Ninth International Conference on the Prevention of Work-Related Musculoskeletal Disorders, Toronto, Canada, 20-June-16 to 23-June-16

Hogan, D.A.M, O'Sullivan, L.W, Greiner, B. (2016) Relationship between social support and upper limb pain in employed and self-employed chartered physiotherapists, physical therapists and athletic therapists in Ireland. [Oral Presentation], Irish Ergonomics Review 2016, Proceedings of the Irish Ergonomics Society Annual Conference, 2016, ISSN 1649-2102.

Hogan, D.A.M, Nolan, S., O'Sullivan, L.W, Greiner, B. (2016) Prevalence of low back pain in employed and self-employed Physiotherapists, Physical and Athletic Therapists in Ireland compared with the national working population. [Oral

Presentation], 12th European Academy of Occupational Psychology Conference, Athens, Greece, 11-April-16 to 13-April-16.

Hogan, D.A.M, Nolan, S., Greiner, B. (2014). Occupational Safety and Health research informing practice – the magnitude of Work-related Musculoskeletal Disorders in Therapists. [Oral Presentation], Workingonsafety.net 2014, Glasgow, Scotland, 30-Sept-14 – 03-Oct-14

Hogan, D., Greiner, B., O'Sullivan, L. (2014). Manual Handling training and behavioural change: Do they lead to a reduction of work-related musculoskeletal disorders? – A systematic review. [Poster Presentation], XX World Congress on Safety and Health at Work 2014, Frankfurt, Germany, 24-Aug-14 - 27-Aug-14.

Hogan, D., Greiner, B., O'Sullivan, L. (2014). The effectiveness of manual handling training on knowledge transfer to employees, behavioural change and, subsequent, reduction of work-related musculoskeletal disorders: a systematic review. [Oral Presentation], European Academy of Occupational Health Psychology Conference, London, United Kingdom, 14-April-14 - 16-April-14.

Hogan, D., Greiner, B., O'Sullivan, L. (2012) Is Manual Handling Training effective in prevention and/or reduction of work related musculoskeletal disorders and if not, why not? – A Systematic Review. [Oral Presentation], 1st Conference of Creating a Scientific Evidence Base for Practice - Prevention of Work-related Musculoskeletal Disorders, University College Cork , 27-Nov-12 - 27-Nov-12.

Additional Dissemination of Findings

Paper 2 – Layman Summary

Dervla A.M. Hogan. Are Irish therapists at increased risk of low back pain? – Comparison with national working population. Published 1st September 2016 http://atlasofscience.org/are-irish-therapists-at-increased-risk-of-low-back-pain-comparison-with-national-working-population/

Appendix 2: HITS Study Questionnaire

Appendix 3: Published Papers

Musculoskeletal Injury as "part of the job"

Prevalence, risk factors, the importance of self-care education and coping strategies in hand intensive occupations in healthcare workers in Ireland

Survey questionnaire on work-related musculoskeletal upper limb disorders (WRULDs) in physiotherapists and physical therapists (PT)

Version 2.0

H ealth
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S afety

Section A: PERSONAL DETAILS

STUDY ID: PT……

---

1. Sex: □ Male □ Female

2. Age: ……..years

3. Height: ft……. ins…… / cms……...

4. Weight: st…… lbs…… / kgs…….

5. Handedness: □ Right
□ Left
□ Ambidextrous

6. Year of graduation from physiotherapy / physical therapy training ……..

7. In what country did you complete your training?

□ Ireland □ UK □ US

□ Other (please specify)……

8. College / school from which qualification was obtained……
……

OCCUPATIONAL HISTORY

9. Who is your primary employer? (Please tick only one). If retired or not currently working please tick the box that refers to your current status **and** the box that refers to your last working status, if appropriate

□ HSE □ Private healthcare sector
□ Voluntary Sector □ Sports Club
□ Industry □ Self employed
□ Employed in private practice
□ Other □ Retired
□ Not currently working

If you have more than one employment / job please continue with Q 10,
if you have no other employment / job please skip to Q12

10. Title of current *secondary* occupational employment……..
Commencement Year:……..
Hours worked per week……..
Employed □ Self employed □

11. Other current paid occupations
……..
Commencement Year:……..
Hours worked per week……..
Employed □ Self employed □

12. Please indicate your current area of practice. (Tick √ all that apply).

□ Paediatrics □ General surgery □ Elderly Care

□ Orthopaedics □ Neuro (acute) □ Neuro (rehab)

□ Amputee □ Rheumatology

□ Women's / Men's Health

□ Occupational Health □ Teaching / Research / Training

□Cardio/respiratory care

□General musculoskeletal outpatients

□Other (specify)……

13. Have you participated in any of the following hobbies or sports in the past 12 months? Tick √ all that apply.

□ tennis □ golf □ weight training

□ gardening □ fishing □ bowling

□ hockey □ volleyball □ basketball

□ camogie □ hurling □ cycling

□ swimming/water sports □ climbing sports

□ throwing sports (e.g. shot put, javelin)

□ playing a musical instrument (specify)……

□ home exercise (e.g. WII games, Kinect)

If you answered Yes to Q 13, please continue.
*If you answered **No, skip to Q. 15.***

14. How often did you participate in any of the above hobbies or sports in the past 12 months?

□once every 6 months or less □ once every 2 – 3 months

□ once a month □once a week

□ more than once a week

15. How long have you worked as a PT?

□ < 5 years □ 5-10 years □ 11-15 years

□ 16-20 years □ > 20 years.

16. How many hours per week do you usually work including overtime)? …… hours/week

17. Please give the approximate hours per week you spend in direct patient / client care

……hours/week

18. On average, how many patients / clients would you treat in a typical day?

……patients/clients/ day

19. During an average week, how many hours of manual therapy do you practice?

□ 1-10 hrs □11-20 hrs □21-30hrs

□31-40 hrs □ 40+ hrs

20. What is the average time you spend giving manual therapy to a client?

□ Less than 15 mins □15 mins < 30 mins

□30 mins < 1 hour □More than 1 hour

21. How much rest time do you normally allow yourself after treating a client?

□< 5min □5 – 10mins □11 – 20mins

□21 – 30mins □31mins – 1 hr □>1hr

22. Who usually schedules your appointments? Tick √ <u>one</u> box

□ myself □ secretary/ assistant

□ electronic booking □

(Other Specify)……

23.

(a) Has your work or the organisation of your work with patients / clients been subject to a *risk assessment* in relation to *your own* health and safety?

□ YES: Regularly (annually)

□ YES: Irregularly (less than once a year)

□ YES: Once in the last 5 years

□ NO

(b) If YES to (a), were any changes made afterwards to reduce the risks?

□ YES □ NO

(c) If yes to (b), do you think the changes were adequate to put you at less risk?

□ YES

□ NO <u>if no,</u> was this because of (please tick one of the boxes below.

□ Cost □ Changes did not address the issue

□ Changes partially addressed the issue

□ Other ……..

24. What is your current smoking status?

□ Never smoker □ ex smoker □ current smoker

SECTION B: Manual Therapy Practice

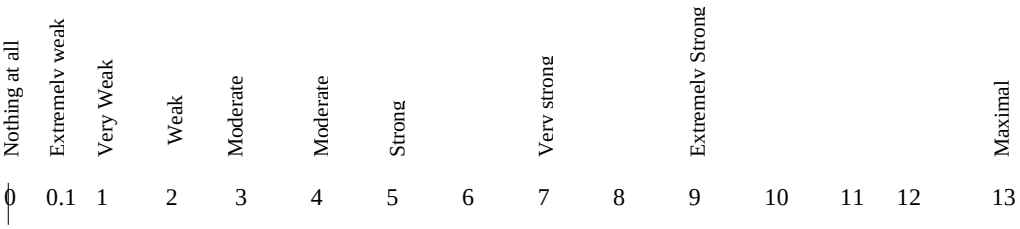
25. For your manual therapy practice only, on the following lines, **mark an X** that best describes how often during the day you spend…….

	Hardly Ever		Every couple of seconds			Once a second
	1	2	3	4	5	6	7
….. Bending your **wrist**							
Applying force with **thumbs**							
Bending or twisting your **neck**							
objects, patients' skin or muscles) Raising your arms or extending your **arms** forward							
Grasping or holding (for example between thumb and fingers							

26. For your manual therapy practice only, on the following lines, **mark an X** that best describes how much of the day do you usually (or on average) work in the following positions?

	0%	**50%**	**100%**
Bending your **wrist**			
Applying force with **thumbs**			
Bending or twisting your neck			
Raising your arms or extending your arms forward			
Grasping or holding (for example objects, patients' skin, or muscles) between thumb and fingers			

27. Using the following scale, **please mark an X** to indicate your **experience of effort or exertion while performing** the following:



Standing for long periods

Working in **awkward static Postures**

Repetitive **finger** movements

Repetitive **thumb** movements

Repetitive **arm** movements

Repetitive **wrist** movements

Bending your wrist

Bending your neck

Bending your elbow

Precise movements

Section C: Musculoskeletal pain and discomfort

28. Have you ever experienced work-related pain or discomfort in any part of your body that lasted for more than 3 days in the last 12 months?

□ **YES** □ NO

29. Have you at any time in the last 12 months had trouble such as ache, pain, discomfort, numbness in any of the following regions: Please tick √ all that apply.

	NO	Right	Left	Both
Shoulders				
Elbows				
Wrists				
Fingers				
Thumbs				
Neck				
Low back				
Mid back				
Upper back				

30. Have you at any time in the last 7 days had trouble such as ache, pain, discomfort, numbness in any of the following: Please tick √ all that apply.

	NO	Right	Left	Both
Shoulders				
Elbows				
Wrists				
Fingers				
Thumbs				
Neck				
Low back				
Mid back				
Upper back				

31. During the past 12 months have you ever been prevented from carrying out normal activities (job, housework, hobbies) because of discomfort or pain in any of the following body regions. Please tick √ all that apply

	NO	Right	Left	Both
Shoulders				
Elbows				
Wrists				
Fingers				
Thumbs				
Neck				
Low back				
Mid back				
Upper back				

*If you **do not have** **work related musculoskeletal** pain or discomfort, please skip to **Q. 34***

*If you **do experience** work related pain and discomfort, please continue with **Q 32***

32. If you experience work-related musculoskeletal pain or discomfort, when did it first occur?
Please mark all that apply with an X

N=Neck; S = Shoulders; E=Elbows;
W= Wrist; F = Fingers; T = Thumbs

	N	S	E	W	F	T
Before training as a PT						
As a PT student						
In the first 5 years after graduation						
5-10 years after graduation						
11-15 years after graduation						
> 15 years after graduation						
Don't know						
Does not apply						

33. Was the onset of the pain/discomfort of most affected body part

□ Gradual □Sudden □As a result of an accident

34. Did you see a medical doctor for work related musculoskeletal pain or injury?

□ YES □ NO □ Not Applicable

35. Has a clinical diagnosis been made for any of the following musculoskeletal conditions?

	Yes	No
Overuse syndrome		
Tendinitis		
De Quervain disease of the wrist		
Shoulder Capsulitis (Frozen Shoulder)		
Shoulder tendinitis		
Lateral epicondylitis (Tennis elbow)		
Medial epicondylitis (Golfer's elbow)		
De Quervain's Thumb		
Muscle Tension		
Other: please specify		

If you answered YES to Q. 34 please continue

If you answered NO, please skip to Q. 37

36. What type of treatment, if any, was applied?

Tick √ all that apply

□ Surgical □ Medical □ Physiotherapy

□ Massage □ Rest □ Self Management

□ Other □ No Treatment

37. How many days of work have you missed because of work related musculoskeletal pain or discomfort during the past 4 weeks?

*Please indicate **0** if you did not miss any work days.*

…… Days

38. How many days of work have you missed because of work-related musculoskeletal pain or discomfort during the past 12 months?

*Please indicate **0** if you did not miss any work days.*

…… Days

39. If you have missed work in the past 12 months as a result of work related musculoskeletal pain or discomfort, how many episodes (consecutive days) of absenteeism have you had?

*Please indicate **0** if you did not miss any work days.*

……..episode

40. Do you have back, neck, arm or a hand injury as a result of an accident during leisure time activities?

□ **NO** ***skip to Q 42*** **If *YES*, please specify**

……

……

41. Which year did it occur? ……..

42. Have you ever received injury prevention (self care) training in relation to your work?

□ Yes □ **No** ***Skip to Q 44***

43. *If you answered YES to Q. 42,* please specify what type of self care training you had:

……

……

44. Which of the following do you do regularly to protect your own health? *(Tick all that apply)*

□ Stretching □ Receive massage

□ Aerobic Exercise □ Self massage

□ Strength building exercises

Other(specify)……

……

45. Do you have an injury reporting policy in your workplace?

□ Yes □ No

□ Don't know □ Does not apply

If you answered NO, skip to Q 47, If you answered YES go to Q 46

46. To whom do you or your colleagues report an injury? (*Tick all that apply)*

□ Immediate Supervisor □ Occupational Health Nurse

□ Health and Safety Officer/ Representative

□Other - ……

□ Don't know

47. Is there a health surveillance programme in your workplace for the early detection of injury?

□ Yes □ No

□ Don't know □ Does not apply

Section D Job risk factors

48. This list describes factors that contribute to work related discomfort or injury.
In your opinion, how have the following factors contributed to your work-related discomfort or injury?
If you do not have work-related injury or discomfort, skip to Q. 49

Task	Irrelevant	Minor / significant	Moderately significant	Major significant
Performing the same task over and over	☐	☐	☐	☐
Repeating the same motions every few seconds	☐	☐	☐	☐
Repeating a sequence of movements more than twice per minute	☐	☐	☐	☐
Performing the same sequence of motions more than 50% of the cycle time	☐	☐	☐	☐
Awkward or extreme joint positions	☐	☐	☐	☐
Joints held in fixed positions	☐	☐	☐	☐
Treating a large number of clients / patients	☐	☐	☐	☐
Performing joint / soft tissue mobilization	☐	☐	☐	☐
Working in awkward or cramped positions	☐	☐	☐	☐
Not enough rest breaks during the day	☐	☐	☐	☐
Working in the same position for long periods	☐	☐	☐	☐
Standing for long periods of time	☐	☐	☐	☐
Working when injured or hurt	☐	☐	☐	☐
Over time	☐	☐	☐	☐
Irregular shifts	☐	☐	☐	☐
Not enough staff	☐	☐	☐	☐
Inadequate training in injury prevention	☐	☐	☐	☐
Poor work place ergonomics	☐	☐	☐	☐
Unsuitable equipment	☐	☐	☐	☐

49. <u>Working Condition:</u>

Please refer your answers to your <u>principal employment.</u>

49 (a)

	Always	Often	Sometimes	Seldom	Never / hardly ever
Is your workload unevenly distributed so it piles up?	☐	☐	☐	☐	☐
How often do you not have time to complete all your work tasks?	☐	☐	☐	☐	☐
Do you get behind with your work?	☐	☐	☐	☐	☐
Do you have enough time for your work tasks?	☐	☐	☐	☐	☐
Do you have to work very fast?	☐	☐	☐	☐	☐
Does your work put you in emotionally disturbing situations?	☐	☐	☐	☐	☐
Do you have to relate to other people's personal problems as part of your work?	☐	☐	☐	☐	☐
Do you have a large degree of influence concerning your work?	☐	☐	☐	☐	☐
Do you have a say in choosing who you work with?	☐	☐	☐	☐	☐
Can you influence the amount of work assigned to you?	☐	☐	☐	☐	☐
Do you have any influence on what you do at work?	☐	☐	☐	☐	☐
	To a very large extent	To a large extent	Somewhat	To a small extent	To a very small extent
Do you work at a high pace throughout the day?	☐	☐	☐	☐	☐
Is it necessary to keep working at a high pace?	☐	☐	☐	☐	☐
Is your work emotionally demanding?	☐	☐	☐	☐	☐
Do you get emotionally involved in your work	☐	☐	☐	☐	☐
Do you feel that the work you do is important?	☐	☐	☐	☐	☐
Do you feel motivated and involved in your work?	☐	☐	☐	☐	☐
At your place of work, are you informed well in advance concerning for example, important decisions, changes, or plans for the future?	☐	☐	☐	☐	☐
Do you receive all the information you need in order to do your work well?	☐	☐	☐	☐	☐
Do you know exactly what is expected of you at work?	☐	☐	☐	☐	☐

If you are employed, please continue with 49(b) below.

If you are <u>self –employed</u> please skip to 49(c) below.

49(b) Employed only

	To a very large extent	To a large extent	Somewhat	To a small extent	To a very small extent
To what extent would you say that your immediate supervisor gives high priority to job satisfaction?	☐	☐	☐	☐	☐
To what extent would you say that your immediate supervisor is good at planning?	☐	☐	☐	☐	☐
	Always	Often	Sometimes	Seldom	Never / hardly ever
How often do you get help and support from your colleagues?	☐	☐	☐	☐	☐
How often are your colleagues willing to listen to your problems at work?	☐	☐	☐	☐	☐
How often do your colleagues talk with you about how well you carry out your work?	☐	☐	☐	☐	☐
How often is your nearest supervisor willing to listen to your problems at work?	☐	☐	☐	☐	☐
How often do you get help and support from your nearest supervisor?	☐	☐	☐	☐	☐
How often does your nearest supervisor talk with you about how well you carry out your work?	☐	☐	☐	☐	☐

49 (c) Self- employed only

	Always	Often	Sometimes	Seldom	Never / hardly ever
How often do you get help and support from your colleagues who are also self- employed?	☐	☐	☐	☐	☐
How often are your colleagues who are also self employed, willing to listen to your problems at work?	☐	☐	☐	☐	☐
How often do your colleagues who are also self employed talk with you about how well you carry out your work?	☐	☐	☐	☐	☐
How often are other informed professionals in your area willing to listen to your problems at work?	☐	☐	☐	☐	☐
How often do you get help and support from other informed professionals in your area?	☐	☐	☐	☐	☐
How often do other informed professionals in your area talk with you about how well you carry out your work?	☐	☐	☐	☐	☐

50. General Health

We would like to know how your health has been in general, OVER THE LAST FEW WEEKS. Please answer by **placing a circle** around your chosen answer.

HAVE YOU RECENTLY

Been able to concentrate on whatever you're doing?	Better than usual	Same as usual	Less than usual	Much less than usual
Lost much sleep over worry	Not at all	No more than usual	Rather more than usual	Much more than usual
Felt that you are playing a useful part in things?	More so than usual	Same as usual	Less useful than usual	Much less useful
Felt capable of making decisions about things?	More so than usual	Same as usual	Less useful than usual	Much less useful
Felt constantly under strain	Not at all	No more than usual	Rather more than usual	Much more than usual
Felt that you couldn't overcome your difficulties?	Not at all	No more than usual	Rather more than usual	Much more than usual
Been able to enjoy your day-to-day activities?	More so than usual	Same as usual	Less useful than usual	Much less useful
Been able to face up to your problems?	More so than usual	Same as usual	Less useful than usual	Much less useful
Been feeling unhappy and depressed?	Not at all	No more than usual	Rather more than usual	Much more than usual
Been losing confidence in yourself?	Not at all	No more than usual	Rather more than usual	Much more than usual
Been thinking of yourself as a worthless person?	Not at all	No more than usual	Rather more than usual	Much more than usual
Been feeling reasonably happy, all things considered?	More so than usual	Same as usual	Less useful than usual	Much less useful

51. Coping Strategies

The response to the following statements should reflect what you actually do in practice rather than what you would do or think you should do.

In order to reduce the strain on my body and arms when working

	Always	Often	Sometimes	Seldom	Never / hardly ever
I do fewer manual techniques	☐	☐	☐	☐	☐
I increase use of other personnel	☐	☐	☐	☐	☐
I modify patient/client position	☐	☐	☐	☐	☐
I modify my position	☐	☐	☐	☐	☐
I take more rest breaks	☐	☐	☐	☐	☐
I do warm up and stretch exercises before performing manual techniques	☐	☐	☐	☐	☐
I use acupuncture / dry needling / thermal therapy instead of manual techniques to avoid stressing an injury	☐	☐	☐	☐	☐
I pause regularly so I can stretch and change position	☐	☐	☐	☐	☐
I adjust plinth/bed height before treating a patient / client	☐	☐	☐	☐	☐
I select techniques that will not aggravate or provoke my discomfort	☐	☐	☐	☐	☐
I stop doing a treatment if it aggravates or provokes my discomfort	☐	☐	☐	☐	☐
I use improved body mechanics	☐	☐	☐	☐	☐
Have you ever considered changing your job because you fear suffering from long-term musculoskeletal injury?	☐	☐	☐	☐	☐

52. Please suggest from your experience, any approaches to your work as a physiotherapist, physical therapist or physiotherapy assistant you think would help minimise the risk of sustaining a work-related musculoskeletal injury?

_____

_____

_____

_____

Thank you for your participation.

The final report of the study will be made available to all study participants via short summary reports on your accredited organisation website or presentations at professional conferences.

This questionnaire was compiled by Sheilah Nolan (MScOH, RGN OHN, CMIOSH) and Dr.Birgit Greiner (Dr.rer.med.habil, PhD, MPH, MSc)
Department of Epidemiology and Public Health
University College Cork
Brookfield Health Sciences Complex
College Road
Cork

28 February 2011

The use of this questionnaire has been granted ethical approval from the Cork Clinical Research Ethics Committee.