Musculoskeletal pain among Workers in Portugal – the European Working Conditions Survey

Paula Alexandra Gouveia Batista

Orientadora:

Doutora Raquel Lucas Calado Ferreira (Departamento de Epidemiologia Clínica, Medicina Preditiva e Saúde Pública, Faculdade de Medicina da Universidade do Porto e Instituto de Saúde Pública da Universidade do Porto)

Coorientador:

Doutor Fernando Garcia Benavides (Centro de Investigação de Saúde Ocupacional, Universidade Pompeu Fabra, Barcelona, CIBER de Epidemiologia e Saúde Pública, Espanha)

Dissertação de candidatura ao grau de Mestre em Saúde Pública apresentada à Faculdade de Medicina da Universidade do Porto e ao Instituto de Ciências Biomédicas Abel Salazar.

Porto, 2016

U.PORTO
FMUP FACULDADE DE MEDICINA
UNIVERSIDADE DO PORTO

U.PORTO
INSTITUTO DE CIÊNCIAS BIOMÉDICAS ABEL SALAZAR
UNIVERSIDADE DO PORTO

Esta dissertação tem como base dois manuscritos, nos quais colaborei ativamente na definição das hipóteses, análise e interpretação dos dados. Fui responsável pela redação da versão inicial dos dois manuscritos:

I. Musculoskeletal pain in Portuguese and EU14 workers: a comparison study based on the European Working Conditions Survey, 1995-2010.

II. Musculoskeletal disorders in Portuguese workers: is it the job or the person?

Agradecimentos

À minha orientadora, Doutora Raquel Lucas, por todos os conhecimentos que me transmitiu ao longo destes últimos dois anos. Pelo seu espírito crítico, disponibilidade, pela constante motivação nas fases de maior fadiga, e por sempre me desfiar a mais.

Ao meu coorientador, Professor Fernando Benavides, pela sua inteira disponibilidade, pelo seu valioso contributo, e pela oportunidade única de me integrar numa equipa maravilhosa, numa cidade fantástica.

À minha família, em especial aos meus pais e ao meu irmão que, mesmo distantes fisicamente, estiveram sempre presentes, e pelo amor e apoio incondicional ao longo de todo o meu percurso.

Ao Tiago, pelo amor, pela compreensão e apoio incansável.

À "equipa dos ossos", particularmente à Teresa, à Sara e à Ana. O meu obrigado pela prontidão em auxiliar-me nos momentos em que mais precisei, pela transmissão de conhecimentos, e pelo carinho com que me receberam.

Aos meus colegas de trabalho da Saúde Ocupacional e da G21 pela amizade e apoio constante.

A toda a equipa do CiSAL (Universidade Pompeu Fabra, Barcelona) pela calorosa receção e amabilidade manifestada durante o período que estive em Barcelona, especificamente à Maria, à Montse, à Laura, à Monica, à Pamela, à Itzel, e ao Julio.

Aos meus amigos de infância e de licenciatura, em especial à Bárbara, ao Bruno, às Carolinas, à Cátia, à Eunice, ao Guilherme, à Nicole e ao Renato. Não há palavras que agradeça a vossa amizade, apoio, e por estarem presentes nas melhores e piores fases deste período.

A todos os meus amigos, que a encantadora cidade do Porto me deu a possibilidade de conhecer - Alex, Ana, Maria Fátima, Fátima, Marília, Nadine, Raquel, Tiago e Vanessa. Sem a vossa amizade, estes dois anos não teriam sido tão especiais.

Table of contents

List of Abbreviations

EU: European Union

EU14: Comprises the following countries from the European Union - Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Spain, Sweden and United Kingdom.

EU15: Comprises the following countries from the European Union - Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and United Kingdom.

Eurofund: European Foundation for the Improvement of Living and Working Conditions

Eurozone: Monetary union that comprises the following countries - Austria, Belgium, Cyprus, Slovakia, Slovenia, Spain, Finland, France, Greece, Holland, Ireland, Italy, Luxembourg, Malta, Portugal

EWCS: European Working Conditions Survey

GDP: Gross Domestic Prouct

ISCO-88: International Standard Classification of Occupations

MSDs: Musculoskeletal disorders

NUTS II: Level 2 of Nomenclature of Territorial Units for Statistics

PR: Prevalence ratio

OSH: Occupational Safety and Health

TX: Texas

UK: United Kingdom

USA: United States of America

WRMSDs: Work-related musculoskeletal disorders

List of Figures

List of tables

List of appendixes

Resumo

Resumo

Objetivos: Analisar perturbações músculo-esqueléticos nos trabalhadores em Portugal e identificar os seus determinantes, através dos seguintes objetivos: (1) Descrever as tendências seculares da prevalência de sintomas músculo-esqueléticos auto reportados em trabalhadores portugueses entre 1995 e 2010 e compará-los aos restantes países europeus; (2) Estimar a associação de fatores de risco ocupacionais e pessoais com o reporte de sintomas músculo-esqueléticos nos trabalhadores portugueses.

Métodos: Esta tese utiliza dados do segundo ao quinto Inquérito Europeu sobre as Condições de Trabalho (IECT), um estudo periódico e de carácter transversal realizado a cada cinco anos para avaliar as condições de trabalho na Europa. Em todos os questionários, a amostra de cada país é selecionada de modo a ser representativa dos indivíduos com idade igual ou superior a 15 anos. As análises são restritas a indivíduos que se encontravam empregados no período da avaliação e cujo local de residência fosse um dos países da União Europeia que participaram em todos IECT (Bélgica, Dinamarca, Alemanha, Grécia, Espanha, França, Irlanda, Itália, Luxemburgo, Países Baixos, Áustria, Portugal, Finlândia, Suécia e Reino Unido). As características dos participantes foram descritas através de proporções. Prevalência de sintomas músculo-esqueléticos foram estimados e estratificados por sexo. Preditores dos sintomas músculo-esqueléticos foram identificados recorrendo à regressão de Poisson e as associações apresentadas como razão de prevalência e respetivos intervalos de confiança de 95%.

Resultados: Objetivo 1 - Entre 1995 e 2010, os trabalhadores portugueses apresentaram maior prevalência de todos os tipos de dor músculo-esquelética em comparação aos trabalhadores EU14. A força da associação entre o país de residência e a dor músculo-esquelética aumentou com a idade nos trabalhadores portugueses. Embora houvesse diferenças ocasionais entre os grandes grupos ocupacionais, nenhuma ocupação parecia desproporcionalmente afetada nos trabalhadores portugueses quando comparados aos trabalhadores EU14. Objetivo 2 - Nos trabalhadores portugueses, as exposições a fatores de risco físico no local de trabalho foram fortemente associadas com o reporte da dor músculo-esquelética: posições cansativas ou dolorosas foram associadas com todas as queixas músculo-esqueléticas. Adicionalmente, padrões de exigência física aumentada, tais como

vibrações, manter-se em pé e levantar ou mover pessoas mostraram uma associação com dor nos membros inferiores. Movimentos repetitivos da mão ou do braço foram associados com dor no pescoço/ombros/membros superiores. Fatores de risco psicossocial relacionados com o trabalho e fatores de risco pessoal não mostraram qualquer associação com queixas músculo-esqueléticas.

Conclusão: Os resultados desta tese demonstram que a dor músculo-esquelético é um fenómeno comum nos trabalhadores portugueses. De facto, com o aumento da idade, os trabalhadores portugueses estão mais propensos a reportar dor músculo-esquelética. Embora houvesse diferenças ocasionais entre os principais grupos ocupacionais, nenhuma ocupação parecia desproporcionalmente afetada. Ao longo dos anos, as diferenças no reporte da dor músculo-esquelética entre os trabalhadores portugueses e EU14 pareciam ser mais influenciados por diferenças socioeconómicas entre países do que por fatores de risco individuais. No entanto, ao analisar os determinantes da dor músculo-esquelética em trabalhadores portugueses, verificou-se que a prevalência da dor músculo-esquelética é principalmente atribuível à exposição a fatores de risco físicos no local de trabalho.

Abstract

Abstract

Objectives: To analyse musculoskeletal disorders among workers in Portugal and to identify their determinants, through the following specific objectives: (1) Describe secular trends of the prevalence of self-reported musculoskeletal symptoms in Portuguese workers from 1995 to 2010 and compare these to the remaining European countries; (2) Estimate the associations of occupational and personal-level risk factors with the report of musculoskeletal symptoms among Portuguese workers.

Methods: This thesis uses data from the second to the fifth European Working Conditions Survey (EWCS), a periodic cross-sectional study performed every five years to investigate the working conditions in Europe. In all surveys, the sample within each country was selected to be representative of individuals aged 15 years or over. The analyses are restricted to individuals that were employed at the time of the survey and whose place of residence was one of the European Union countries that participated in all EWCS (Belgium, Denmark, Germany, Greece, Spain, France, Ireland, Italy, Luxembourg, Netherlands, Austria, Portugal, Finland, Sweden and United Kingdom). Characteristics of participants were described using proportions. Prevalence of musculoskeletal symptoms were estimated according to sex. Predictors of musculoskeletal symptoms were identified using Poisson regression and associations were identified as prevalence ratio and 95% confidence intervals.

Results: Objective 1 - Between 1995 and 2010, Portuguese workers presented higher prevalence of all types of musculoskeletal pain in comparison to EU14 workers. Strength of associations between country of residence and musculoskeletal pain increased with age in Portuguese workers. Although there were occasional differences between major occupational groups, no specific job seemed disproportionally affected in Portuguese workers when compared to EU14 workers. Objective 2 - Among Portuguese workers, exposure to work-related physical risk factors were strongly associated with self-reported musculoskeletal pain: tiring or painful positions was associated with all musculoskeletal complaints. Additionally, patterns of increased physical demands such as vibrations, standing and lifting or moving people showed an association with pain in the lower limbs. Repetitive hand or arm movements were associated with neck/shoulders/upper limbs pain. Work-

related psychosocial and personal risk factors did not show any association with musculoskeletal complaints.

Conclusion: The evidence in this thesis illustrates that musculoskeletal pain is a common phenomenon among Portuguese workers. In fact, with the increase in age, Portuguese were more likely to report musculoskeletal pain. Although there were occasional differences between major occupational groups, no specific job seemed disproportionally affected. Over the years, the differences of self-reported musculoskeletal pain between Portuguese and EU14 workers seemed to be more influenced by macro-level socioeconomic differences between countries than by individual risk factors, however, when analysing the determinants of musculoskeletal pain in Portuguese workforce, the prevalence of self-reported musculoskeletal pain was mainly attributable to exposure to physical risk factors at workplace.

1. Introduction

Introduction

1.1. Occupational Health

The right to health and safety at work is one of the basic human rights (1).

Workers represent half of the world´s population and besides being the most dynamic element of society, they are the major contributors to economic and social development (2–4). In fact, the sustained development of modern societies depends on their workers, so the value of their health, safety and well-being is directly correlated with it (4). The importance of workforce health has already been recognised as crucial by the European Union (EU) trough the adoption of a new *Strategic Framework on Health and Safety at Work 2014-2020*. The present strategy aims to improve implementation of existing health and safety rules, to improve the prevention of work-related diseases and to take account of the ageing of the EU's workforce(5).

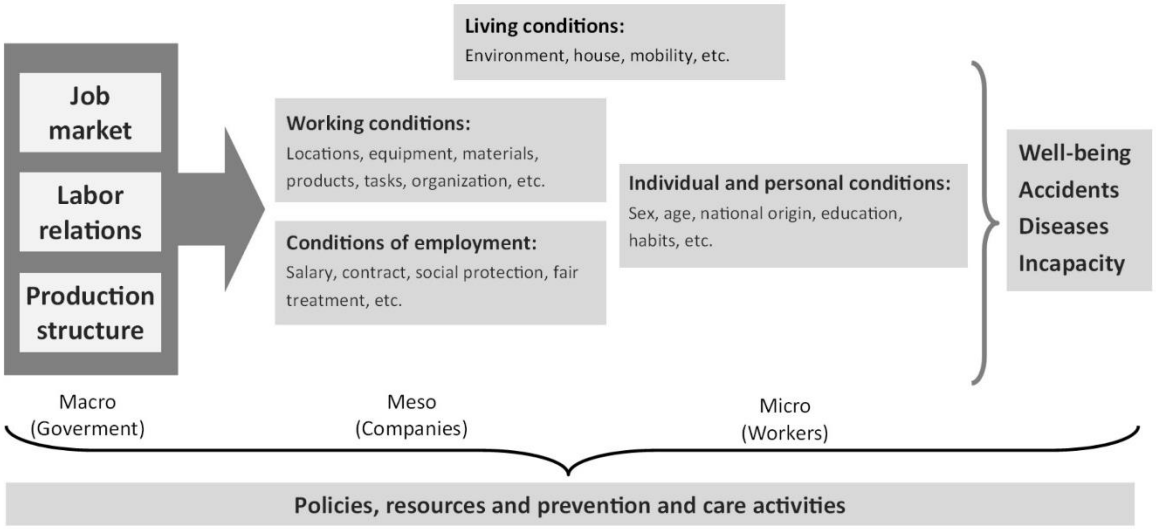


Figure 1: Conceptual model of causality in Occupational Health

Adapted from FG Benavides, P Boix, F Rodrigo and JM Gil (Coordinadores). Informe de salud laboral, España 2001-2010. Barcelona: CISAL-UPF, 2013.

Workers´ health is determined not only by risk factors that they may be exposed to at the workplace but also by individual, cultural, environmental and socio-economic factors (4,6). As presented in the above causal model of occupational health, the effect that the job has on the individual´s health is the result of different influences that act at several levels. The country´s socio-economic context influences the macro level of employment and working conditions such as wages, type of contract, adequate infrastructure, supportive management, and career progression. At a more proximal level, health can be determined by the interaction between working and living conditions and individual characteristics. In this model, it is also possible to identify the sectors capable of intervention, namely workers, companies and governments (Figure 1) (7,8).

Acknowledgement of the relationship between work and health has always been important but not always sufficient. It is necessary that society and its political structures take occupational health as a priority objective.

Occupational Health aims to identify, evaluate and control hazards arising in the workplace that could impair the health and safety of workers; to enhance the physical, mental and social well-being of workers and support the development and maintenance of their work capacity and to enable workers to conduct socially and economically productive lives (9,10). Occupational Health interventions at the workplace present extensive benefits for employees, companies and society: they decrease absenteeism due to illness or work accidents, make safer workplaces and contribute to sustainable development, which is the key to poverty reduction; promote quality of employment and increase productivity not only because workers are healthier but also more motivated. In this prospective, workplace health promotion should be systematically part of the culture of institutions (4,9,11).

In the European Union, the adoption of the *EU Occupational Safety and Health (OSH) Strategy* in all Member States led to a reduction by 27.9% in the incidence rate of accidents leading to absences of more than three days between 2007 and 2013. Additionally, 85% of workers express satisfaction with workplace health and safety in their current job and over three quarters (77%) say that OSH information and/or training is available in their workplace (5). Despite the significant reduction in work accidents and better prevention, the health and

safety of workers in the EU still needs improvements. In 2012, more than 3 000 workers died due to work accidents and more than 2.5 million workers were victims of a serious work-accident that resulted in at least four calendar days of absence from work (12). In addition, a quarter of European workers declared that work has a mainly negative effect on their health (5). Over 44 million workers of the EU now have a long-standing health problem or disability that affects their ability to work, and MSDs account for a higher proportion of sickness absence from work than any other health condition (2).

1.2. Occupational Health in Portugal

The current state of organization and provision of Occupational Health in Portugal is the result of a complex process which involved political, social, economic and scientific factors.

The beginning of the Industrial Revolution in Portugal, that occurred between 1870 and 1913, was characterized by population and economic growth but also by the degradation of the working conditions, resulting in high numbers of work accidents and occupational diseases (13,14). Such conditions led to the creation of Health and Safety services as well as laws that would protect the worker in case of accident (15). However, workers´ health and safety was not a real priority and as a result, the occurrence of accidents and diseases remained elevated (13).

Portugal joining the European Economic Community in 1986 exposed the flaws that the organizational model of Occupational Health services at the time presented. European Directives were incorporated into Portuguese legislation by way of health and safety regulations (11,15). However, there was still a lot of margin for improvements in the safety and health of workers. It was only in July 1991 that the Government and all social partners signed the first *Agreement on Safety, Hygiene and Health in Labour*. This agreement aimed at contributing to the modernization of the national economy, to assure the competitiveness of the companies and, in a sustainable way, to improve the working and living conditions of workers (11,15,16).

Since 1991, significant advances have been made in health and safety of workers in Portugal. However, a considerable portion of the overall morbidity of the Portuguese workforce remained related to work and despite the evolution of the working conditions and the greater availability of effective interventions for Occupational Health, many workers remained exposed to unacceptable levels of occupational risk factors, being victims of occupational diseases and accidents at work (11). This is compatible with the fact that only 35 to 60% of Portuguese workers are covered by occupational health services (data from 2014) (17).

As a result, in 2013, using data reported by insurance companies, an estimated 503 work-related accidents occurred per day. Of all workers who had work-related accidents, 125 died due to the resulting injuries. Among those with non-fatal injuries, one fifth needed a work absence of over a month. Regarding occupational diseases, musculoskeletal conditions were clearly the most certified group in Portugal in 2014 (8). Moreover, MSDs were the main reason why 31.3% of Portuguese workers had to, at least once, ask for sick leave (18).

1.3. Musculoskeletal disorders

MSDs[1] are the most common cause of work incapacity and impaired functional ability (19–21). MSDs encompass a spectrum of problems of the musculoskeletal system and connective tissue, such as regional pain syndromes, carpal tunnel syndrome, osteoarthritis and rheumatoid arthritis (22,23).

MSDs affects practically every adult at one point in their life. Various studies revealed that back pain is the most frequently MSD reported. In second place comes disorders in the neck, shoulders and upper limb. Disorders in the lower limb are less frequent (24,25).

[1] The term disorders can be used for a clinically recognizable set of symptoms or behaviours.

MSDs are a topic of major concern among the European Commission and social partners due to the prevalence and impact they impose on workers, organizations, welfare systems and society. Work-related MSDs affect more than 4 million workers in the EU and are responsible for about half of all work-related disorders in EU countries (2). However, these numbers underestimate the reality due to underreporting resulting from workers' lack of information, discouragement in the face of the complex administrative procedures, and fear of losing their jobs (26). The European Commission estimates that MSDs are the main cause for 49.9% of all absences from work lasting 3 days or longer and for 60% of permanent work incapacity (2). Moreover, it is estimated that the total costs of work-related MSDs in European countries is €240 billion annually or up to 2% of Gross domestic product (GDP) (27).

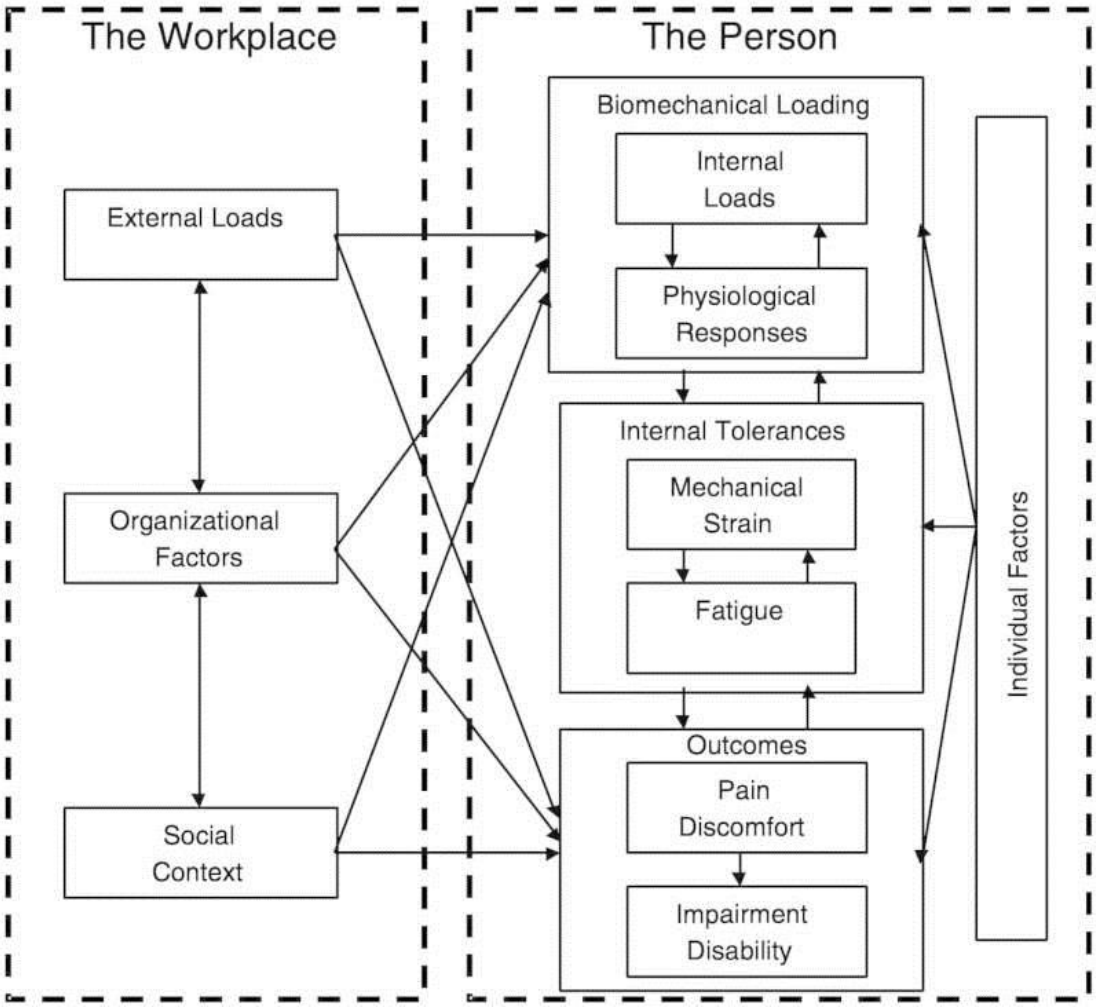


Figure 2: A conceptual model of the possible roles and influences that various factors may play in the development of musculoskeletal disorders (28)

According to Figure 2, development of MSDs is the result of complex interactions that includes not only occupational exposures that are related to each other, but also a wide number of interdependent individual characteristics. This model identifies the person as the central biological subject exposed to external factors with various physical, psychological, and social features that may influence the biological and clinical response. These individual factors include age, sex, educational level, smoking habits, comorbidities, and perhaps genetic influences, as well as participation in leisure activities (28).

Although MSDs are multifactorial in origin, a strong body of evidence has shown that work-related factors are strongly associated with musculoskeletal complaints among active workers (29). Physical exposures (external loads) resulting from work are transmitted through biomechanical forces to create internal loads on the tissues and anatomical structures. Physical factors such as repetitive movements, heavy manual lifting, poor posture, and partial or whole-body vibration have been associated with musculoskeletal complaints in previous studies (22,30–32). When the load exceeds the mechanical tolerance, tissue damage occurs (28).

In addition to physical factors, several organizational and social context factors, such as highly demanding tasks, low social support and low control at the workplace, have also been demonstrated as additional contributing factors for MSDs (31,33). To evaluate organizational and social context of the workplace, Karasek's job demands-control model is one of the most influential models (34). The job demands-control model explains how levels of job demands and control can influence strain and job satisfaction. First, job demands are measured as quantitative workload or role conflict, job decision-making authority is the amount of control in the job and skill discretion consists in the level of skill required to complete the work (35).

In addition to occupational and individual–level risk factors, there is evidence to support that MSDs appears to be driven by socio-economic factors operating at a population level, such as financial support for health-related incapacity for work, local unemployment rates and systems of compensation for work-related illness and injuries (28,36).

1.4. Musculoskeletal disorders in Portugal

In the most recent National Health Survey (2014), chronic back pain was the most frequently reported chronic disorder, by 32.9% of respondents (37). In the study *Pain in the Portuguese population - some epidemiological aspects (2003),* prevalence of low back pain in the seven days preceding the interview was 51.3% (95% CI: 48.7 to 53.9) (38). Also, a study conducted among adults residents in Porto found that chronic low back pain was frequently reported by respondents, corresponding to 12.3% (95% CI: 10.5 to 14.3) of the participants (39). A different study conducted in primary care units in Porto showed that the prevalence of low back pain in the six months prior to evaluation was 49.0% (95% CI: 43.3 to 54.7) (39).

In recent years, several studies have addressed MSDs in specific occupations.
One study conducted in 822 large companies that aimed to estimate the prevalence of work-related musculoskeletal disorders (WRMSDs) showed that the prevalence of clinically relevant WRMSD was of 5.9%. The most prevalent WRMSD was low back pain with a prevalence of 2.27% (40). A different study showed high symptoms prevalence (last 12 months) in the lower back (60.6%), the upper back (44.5%), and the neck (48.6%) among healthcare workers (41).

Although there have been several attempts to quantify MSDs, it remains difficult to quantify precisely the extent of such conditions among the working population. Most data about MSDs in Portuguese workers come from individual studies, not national level epidemiological studies. Improving data collection across Portugal and conducting cohort studies would provide valuable information to policymakers, health practitioners and to society in general. Good epidemiological data is important for a number of reasons: (1) It is impossible to be accurate about the economic consequences of MSDs, their impact or their social costs to workers, their family and to society; (2) poor data make it difficult to make a persuasive case for action to Portuguese employers or to Portuguese policy-makers. (3) interventions plans are more difficult to apply if there are no reliable or comprehensive data on the extent or impact of MSDs in the Portuguese workforce.

2. Aims

Aims

The aim of this thesis is to analyse musculoskeletal disorders among workers in Portugal and to identify their determinants. This will be achieved through the following two scientific papers:

Paper I: "Musculoskeletal pain in Portuguese and EU14 workers: a comparison study based on the European Working Conditions Survey, 1995-2010" which aimed:

- To describe secular trends of the prevalence of self-reported musculoskeletal symptoms in Portuguese workers from 1995 to 2010;
- To compare the prevalence of self-reported musculoskeletal symptoms in Portuguese workers with the remaining fourteen European countries.

Paper II: "Musculoskeletal disorders in Portuguese workers: is it the job or the person?", which aimed:

- To estimate the associations between musculoskeletal outcomes and occupational and personal-level risk factors.

3. Chapter I

Musculoskeletal disorders in Portuguese and EU14 Workers: a comparison study based on the European Working Conditions Survey, 1995-2010

Abstract

Introduction: Musculoskeletal disorders affects millions of European workers causing pain, impaired functional ability and work incapacity. In Europe, periods of economic recession in Europe have led to a deterioration of working conditions, and consequently, the impact of musculoskeletal disorders on workforce health is likely to increase and to be even higher in countries most adversely affected by economic crisis. The main objective of this study was to describe secular trends of the prevalence of self-reported musculoskeletal symptoms in Portuguese workers from 1995 to 2010 and to compare these to the remaining European countries.

Methods: Using data from second to fifth European Working Condition Surveys, one-year (fifth survey) and point prevalence (second to fourth surveys) of musculoskeletal pain were estimated in Portugal and in the remaining 14 member states from the European Union-15 (EU14) in each year of survey and stratified by sex. Associations between country of residence and self-reported musculoskeletal symptoms were quantified by crude and age- and occupation-adjusted prevalence ratios and 95% confidence intervals, using Poisson regression models.

Results: Compared to the EU14 workers, Portuguese workers presented in all four surveys, higher prevalence of all types of musculoskeletal pain. Strength of associations between country of residence and musculoskeletal pain increased with age in Portuguese workers. Although there were occasional differences between major occupational groups, no specific job seemed disproportionally affected in Portuguese workers when compared to EU14 workers.

Conclusion: Our analysis indicates substantial differences between Portuguese and EU14 workers in prevalence of musculoskeletal pain. This variation did not seem to be explained by individual risk factors and may be attributable in part to macro-level socioeconomic differences between countries.

Introduction

Musculoskeletal disorders (MSDs) affect more than 40 million European workers (1) causing pain, impaired functional ability and work incapacity (2–4). They encompass a spectrum of problems, from undiagnosed musculoskeletal pain to chronic conditions such as osteoarthritis and rheumatoid arthritis (5,6). According to the literature, chronic exposure to physical risk factors such as repetitive movements, heavy manual lifting, poor posture, and partial or whole-body vibration may cause work-related musculoskeletal disorders such as rotator cuff syndrome, carpal tunnel syndrome or spondylosis (5,7–9). In addition to biomechanical exposures, psychosocial factors, such as highly-demanding tasks and low control, have also been identified as additional risk factors (8,10). Moreover, at a wider societal level, results from the CUPID (Cultural and Psychosocial Influences on Disability) study have shown that MSDs appears to be driven by socio-economic factors operating at a population level, such as financial support for health-related incapacity for work and systems of compensation for work-related illness and injuries (11).

The prevalence of MSDs in working populations varies widely. Depending on the body region considered, the method used for the assessment of symptoms and the sample under study, prevalence estimates superior to 40% have been reported (1,3,12,13). The lack of comparable tools makes it difficult to quantify precisely and consistently the extent of musculoskeletal disorders (3). Nonetheless, a recent study conducted in 18 countries (Brazil, Ecuador, Colombia, Costa Rica, Nicaragua, United Kingdom, Spain, Italy, Greece, Estonia, Lebanon, Iran, Pakistan, Sri Lanka, Japan, South Africa, Australia and New Zealand) used standardized methods to collect information on musculoskeletal pain and found more than 30-fold differences in the 12-month prevalence of musculoskeletal sickness absence (14).

The burden of MSDs on workers leads to considerable costs for the public health system and to the society, namely losses in productivity and wages (6). Due to the importance that a healthy workforce has in productivity and improvement, and consequently in economic growth and competitiveness (15), a series of directives (Directive 90/270/EEC, Directive 89/656/EEC and Directive 90/269/EEC) were introduced to promote the safety and health of workers and to obligate employers to take appropriate preventive measures to make the

workplace safer and healthier (16–19). However, over the years, European Union (EU) countries were differently affected by several economic recessions which led to deep changes in their economy and labor market. In the most recent recession, that began in 2008, the combined real gross domestic product (GDP) of the 18 Eurozone countries fell by 5.8 cumulative percentage points (20) and unemployment rates increased all over the Eurozone: by 2010, over 16 million workers were jobless (21) and income poverty rates increased by 1.8% (20). One of the countries most deeply affected by the most recent economic recession is Portugal. Since 2000 that Portugal´s productivity decreased significantly, and competitiveness deteriorated (22). With the financial crisis in 2008, Portugal has had one of the fastest and highest increase in the unemployment rate, after Greece and Spain (23). From 2007 to 2009, the rate of job destruction by closing firms was, on average, 36.4% and by 2009, the share of job destruction by the turnover of firms was 40.6%, 5.0 percentage points above its pre-recession level (year 2006). Mean unemployment duration increased significantly - from a minimum of less than 14 months in 2003 to above 20 months in 2010 (24,25).

In periods of economic recession, less attention and resources are dedicated to the monitoring and enforcement of minimum health and safety standards of workers (26). There is evidence that workers who remain in the labor market during economic recession periods are exposed to greater work intensity, deterioration of work–life balance, increasing stress at work and greater risk of harassment/bullying, contributing to poor physical and mental health and addiction problems (27,28). Though several studies have addressed the impact of economic changes on several health problems (27–31), very little is known regarding their effect on musculoskeletal pain.

Using the European Working Conditions Survey (EWCS) as a comparable tool across different countries, our main objective was to describe secular trends of the prevalence of self-reported musculoskeletal symptoms in Portuguese workers from 1995 to 2010 and to compare these to the remaining European countries at each point in time.

Methods

Participants

We used data from the EWCS, a periodic cross-sectional study performed by the European Foundation for the Improvement of Living and Working Conditions (Eurofound) every five years, to investigate the working conditions in Europe. To date, Eurofound has carried out six surveys – 1991, 1995, 2000, 2005, 2010 and 2015. The survey covered the 12 EU countries in 1991, the EU15 in 1995 and 16 countries in 2000 (the EU15 and Norway). The survey carried in 2000 was extended in 2001 to cover the 10 EU membership candidate countries. The fourth survey included the participation of all 27 EU Member States plus Croatia, Turkey, Switzerland and Norway, while the fifth survey covered the same countries, apart from Switzerland, but with the addition of Albania, the Former Yugoslav Republic of Macedonia, Kosovo and Bosnia and Herzegovina - a total of 34 countries. The most recent survey, the sixth, included the 28 EU Member States, the five EU candidate countries, as well as Switzerland and Norway (32–35).

In all surveys, the sample within each country was selected to be representative of individuals aged 15 years or over. A multi-stage, stratified random sampling design was used in each country and each stratum was defined by NUTS (Nomenclature of Territorial Units for Statistics) regions levels II/III and by degree of urbanization. The survey consisted of a standardized questionnaire and was conducted by face-to-face interviews at peoples' homes (32–35).

The analyses in this paper are restricted to individuals that participated in one of the surveys where musculoskeletal symptoms were inquired, that were employed at the time of the survey and whose place of residence was one of the European Union countries that participated in all EWCS (Belgium, Denmark, Germany, Greece, Spain, France, Ireland, Italy, Luxembourg, Netherlands, Austria, Portugal, Finland, Sweden and UK). Since this study overlapped with the embargo of data from the sixth EWCS by Eurofound, no information on the latest survey (2015) is presented. From the sample of 122 236 individuals inquired in one of the EWCS included in our analysis (second to fifth survey), we excluded 48 961 individuals for not meeting the requirements above. A further 371 individuals with missing information

on age or occupation were excluded from the analyses. Armed Forces workers were not included in our analysis due to their own peculiarities and heterogeneity. Thus, our sample is composed by a total 72 491 individuals. A flow diagram with the participants for this study is presented in Figure 1. For analysis purpose, all EU15 countries with the exception of Portugal were pooled into one single category designated EU14.

Musculoskeletal pain assessment

Up to 2005, self-reported musculoskeletal pain was assessed with the question: "Does your work affect your health, or not? How does it affect your health?". In 2010, the question was modified to "Over the last 12 months, did you suffer from any of the following health problems?". Within the answer options, "backache", "muscular pain in the neck/shoulders/upper limb" and "muscular pain in lower limb" were presented. In the second (1995) and fourth (2005) surveys, "muscular pain in the neck/shoulders/upper limb and lower limb" were grouped into one single option.

Covariates

Age was classified in 15-years category (<30 years, 30-44 years, 45-59 years, ≥60 years), and occupation was labelled according to the 10 major groups from the 1988 version of the International Standard Classification of Occupations (ISCO-88). For further analyses purposes and adopting common methods to Eurostat, workers were assigned to one of four major occupational groups according to the level of skill and physical effort of their job. *Legislators, senior officials and managers*, *Professionals*, and *Technicians and associate professionals* were grouped in "high-skilled non-manual occupations"; "skilled non-manual occupations" included *Clerks* and *Service workers and shop and market sales workers*; *Skilled agricultural and fishery workers*, *Craft and related trades workers* and *Plant and machine operators and assemblers* were grouped in "skilled manual occupations" and "*elementary occupations*" included only workers from *Elementary occupations*.

Statistical analysis

Statistical analysis was carried out using Stata 11.2 (Stata Corp, College Station, TX, USA).

Descriptive statistics at the national and European level were estimated in the EWCS waves 1995, 2000, 2005, and 2010 by using the *svyset* command in STATA and presented as proportions. One-year (fifth survey) and point prevalence (second to fourth surveys) of each musculoskeletal symptom was estimated according to country and year of survey stratified by sex. Associations between country of residence and self-reported musculoskeletal symptoms were quantified by crude and age- and occupation-adjusted prevalence ratios (PR) and 95% confidence intervals (CI), using Poisson regression models without sampling weights. Models with country of residence as the independent variable were estimated, with the reference group being EU14. In the first model, all estimates were adjusted for age and occupation and stratified by sex. The second model was stratified by sex and major occupational group and all estimates were adjusted to age. In the third model, all estimates were adjusted for occupation and stratified by sex and age group.

Results

In Portugal and EU14, men composed the majority of the workforce. However, between the years of 1995 and 2010, the proportion of female workers increased by 3.2% in both groups. In all four surveys, about two-thirds of the EU14 and Portuguese workforce had less than 45 years of age. When compared to the remaining countries of the EU, Portugal presented higher proportion of working individuals over 60 years old. Regarding the proportion of the employed population by occupation, we observed that over the years, in Portugal, the *Craft and related trades workers* prevailed (1995: 21.0%; 2000: 22.1%; 2005: 18.9%; 2010: 19.1%). In the remaining 14 EU countries, in 1995, the occupation with the highest proportion of workers was *Craft and related trades workers (*15.0%), in 2000 it was *Technicians and associate professionals (*14.4%), and in 2005 as well as in 2010 it was *Professionals* (2005: 16.7%; 2010: 17.5%) (Table 1).

Figures 2 and 3 summarize the comparison of self-reported musculoskeletal symptoms, namely, back, neck/shoulders/upper limb and lower limb pain, in Portugal and EU14 workers, between the years of 1995 and 2010, by sex. Between 1995 and 2005, 34.9% to 48.5% Portuguese workers and 28.4% to 33.3% EU14 workers reported having musculoskeletal pain related to their work in, at least, one of the three anatomical sites, and in 2010, 59.6% of EU14 workers and 72.9% of Portuguese workers reported having musculoskeletal pain over the last 12 months (p-value<0.001).

A comparison of Portugal with the remaining 14 countries revealed that the differences in self-reported musculoskeletal symptoms remained over time: Portuguese workers reported more frequently all types of musculoskeletal pain in comparison to EU14 workers. For all anatomical sites, the prevalence of self-reported musculoskeletal symptoms was higher in men between the years of 1995 and 2005 in comparison to women. However, in 2010, the prevalence of self-reported musculoskeletal pain was higher among women.

Among male and female Portuguese workers, prevalence of back pain decreased from 38.3% in 1995 to 32.1% in 2005 and from 42.6% to 29.8%, respectively. In the remaining EU14

workers, there was a slight increase in the proportion of workers reporting back pain in 2000 followed by a decrease in 2005. Nonetheless, when comparing the EU14 to the Portuguese workforce, the latter reported more frequently back pain in all four surveys and this association was significant in 1995, 2005 and 2010. Adjustment for age and occupation slightly reduced the strength of the observed associations [Male workers: PR_{1995}=1.23 (1.06-1.43); PR_{2005}=1.17 (0.98-1.39); PR_{2010}=1.32(1.17-1.49); Female workers: PR_{1995}=1.33 (1.14-1.54); PR_{2005}=1.21(1.02-1.44); PR_{2010}=1.41(1.26-1.58)].

Male and female workers presented similarly increasing prevalence of pain in neck/ shoulders/upper limb and pain in lower limb from 2005 to 2010, both in EU14 and in Portugal. Prevalence of pain in neck/shoulders/upper/lower limb in EU14 and Portuguese male workers increased from 1995 to 2005.

Tables 2 and 3 show the association estimates for musculoskeletal pain by major occupational group, stratified by sex. Compared to EU14 workers, the highest PRs for back and lower limb pain were observed among Portuguese high-skilled non-manual workers. Associations between country and neck/shoulders/upper limb pain behaved similarly across major occupational groups, and no specific type of job seemed disproportionally affected. Most significant associations between country and musculoskeletal symptoms according to major occupational group were found in 1995 and 2010.

Tables 4 and 5 summarise the association between country of residence and musculoskeletal pain according to age group, in male and female workers. With increasing age, Portuguese workers were more likely to report musculoskeletal pain in comparison to European workers. In fact, the highest adjusted PRs for back pain and lower limb were observed among Portuguese workers over 60 years old [Back pain in male: PR_{2005}= 2.09 (1.16-3.78); Lower limb in male PR_{2010}= 1.76 (1.17-2.66); Back pain in female: PR_{2005}= 2.42 (1.19-4.90); Lower limb in female PR_{2010}= 1.54 (1.02-2.35)]. Significant associations between pain in neck/shoulders/upper limb and country of residence were only observed among male Portuguese workers aged between 30 and 59 in 2010 [PR_{30-44}= 1.27 (1.03-1.56); PR_{45-59}= 1.24 (1.01-1.51)]. Portuguese female workers, across all age groups, reported more frequently pain in neck/shoulder/upper and lower limb in 1995 in comparison to the remaining

European workers (prevalence ratios between 1.45 and 1.96). As for Portuguese male workers, a significant association was observed only among those with less than 44 years of age [$PR_{<30}$= 1.82 (1.32-2.52); PR_{30-44}= 1.37 (1.03-1.82)].

Discussion

From 1995 to 2010, Portuguese workers presented higher prevalence of all types of musculoskeletal pain in comparison to EU14 workers. Strength of associations between country of residence and musculoskeletal pain increased with age in Portuguese workers. Although there were occasional differences between major occupational groups, no specific job seemed disproportionally affected in Portuguese workers when compared to EU14 workers.

To interpret these findings, both real and artefactual explanations should be considered. Age is one of the most common predictors for MSDs, as shown by several previous studies (36–38). Degenerative processes probably explain the observed increase in reporting musculoskeletal pain in older workers. Ageing causes loss of muscle mass and an increase in the amount of time that takes the muscle to contract in response to nerve stimulation. Additionally, bones become more fragile, cartilage loses resilience and ligaments become less elastic. Not only do connective tissues become generally more prone to dysfunction but there are also distinctive tissue changes that are regarded as diseases (eg.: osteoarthritis) (39,40). On the other hand, the increase in pain reporting can be a result of an accumulation of musculoskeletal pain causes that persist over time (40).

Perception of pain is different for males and females, with a growing number of papers demonstrating that gender is a fundamental predictor in modulating the experience to pain; therefore, our analysis was stratified by sex (41,42). Men presented higher prevalence of musculoskeletal symptoms when questioned on how their work affected their health (years 1995-2005); on the other hand, women presented higher prevalence of musculoskeletal symptoms when questioned about health problems over the previous 12 months. A marked gender difference in the prevalence of non-work-related musculoskeletal pain – women tend to report more frequently – may be explained by non-occupational factors. Women spend nearly twice as much time on unpaid work then men, which may result in greater overall exposure to physically demanding activities and psychological strain (43–46). In contrast, men tend to report work-related musculoskeletal pain more frequently due to the

fact that even within the same job, men are more exposed to physical risk factors associated to musculoskeletal pain (43,47).

Besides age and gender, occupation is also major determinant of musculoskeletal pain. Many MSDs are work-related in the sense that the tasks that individuals carry out in their normal work activities can contribute significantly, but in varying magnitude, to the causation of the disorder (1,3,48). Since we were interested in estimating the effect that country of residence may have on the report of musculoskeletal pain independently of individual factors – and there were potentially relevant differences in the distributions of age and occupation between Portugal and EU14 – adjustments were made to age and occupation to reduce confounding by these variables.

Another of the possible explanations for a higher pain frequency in Portugal is the exposure to physical risk factors. Many papers have supported the relationship between musculoskeletal pain and work-related physical factors (13,49,50), including a critical review that found strong evidence of an association between MSDs and certain work-related physical risk factors when there are high levels of exposure (e.g., rapid rates or prolonged durations of work tasks and awkward, repetitive, or prolonged postures) and especially in combination with exposure to more than one physical factor (e.g., repetitive lifting of heavy objects in extreme or awkward postures) (51). Over the years, Portuguese workers reported to be more exposed in comparison to the EU14 workers. However, no clear relationship between time trends of exposure to physical risk factors and musculoskeletal pain was observed (Appendix 1). These results indicate that exposure to physical risk factors cannot fully explain country differences in pain report.

Our finding that individual background factors and exposure to physical risk factors cannot fully explain differences in pain reporting between Portuguese and EU14 workers suggests that these may also be the reflection of different social and contextual specificities. A similiar comparison between two Central American countries (Costa Rita and Nicaragua) and Spain found that upper extremity musculoskeletal pain was only partially explained by the covariates analysed and that other aspects of work and cultural attributes may explain the residual differences between these countries (52). In fact, several studies have indicated that

pain perception and reporting is different according to individuals´ cultures (53,54). Alternatively, poorer economic circumstances as a result of economic recession have also been associated with many public health issues (30,31). Musculoskeletal pain report – as a complex biopsychosocial experience – may also respond to those macro-level socioeconomic changes and psychosocial influences.

Beyond real causal influences, there are a number of artefactual factors that should be considered while interpreting the results of this paper. The EWCS questionnaire was developed in English and afterwards translated into 32 languages with all versions of the questionnaires being revised by experts. However, it is possible that certain terms are perceived differently in different languages and cultures. Self-reported musculoskeletal pain in Neck/shoulder/upper/lower limbs was presented as a single dichotomous variable in the 1995 and 2005 EWCS, therefore, it is impossible to perceive the true dimension of reporting symptoms in each anatomical region. Time-trends analysis was not possible to perform in all four surveys since in the 2010 EWCS, the wording of the question was altered to include any (rather than only work-related) pain. In addition, the high proportion of refuses may introduce some degree of selection bias which may limit the generalisability of the results in the countries examined.

Nevertheless, this paper presents several strengths. Our study was based on a large sample size, which provides more statistical power than most studies. Also, in all countries, data were collected using standardized methods. To our knowledge, this is the first study that evaluates the prevalence of musculoskeletal pain among Portuguese workers and compare these same results to the remaining European countries, a group with partly shared political environment and policy directives.

In conclusion, our analysis indicates substantial differences in prevalence of musculoskeletal pain between Portuguese and EU14 workers. The differences between Portugal and the remaining EU14 countries highlight the need for additional occupational health surveillance in Portugal, a country where political and entrepreneurial concern about the health of workers has been limited. The variation between both groups did not seem to be explained by individual risk factors, and it may be in part attributable to macro-level socioeconomic

differences between countries. Future studies are needed in order to explore the role that macro-level socioeconomic differences may play in prevalence of musculoskeletal pain, perhaps by comparing trends over time in countries where socio-economic context have changed.

Acknowledgments

The authors would like to thank the European Foundation for the Improvement of Living and Working Conditions for collecting the data for the EWCS and the UK Data Archive for supplying the database.

Bibliography

1. Bevan S, Quadrello T, McGee R, Mahdon M, Vavrovsky A, Barham L. Fit for work? Musculoskeletal disorders in the European workforce. London; 2009.
2. Dieppe PA, Lohmander LS. Pathogenesis and management of pain in osteoarthritis. Lancet. Elsevier; 2005;365(9463):965–73.
3. McBeth J, Jones K. Epidemiology of chronic musculoskeletal pain. Best Pract Res Clin Rheumatol. Elsevier; 2007;21(3):403–25.
4. World Health Organization. International Classification of Functioning, Disability and Health: ICF. Geneva: World Health Organisation; 2001. 299 p.
5. Punnett L, Wegman DH. Work-related musculoskeletal disorders: the epidemiologic evidence and the debate. J Electromyogr Kinesiol. Elsevier; 2004;14(1):13–23.
6. Woolf AD, Pfleger B. Burden of major musculoskeletal conditions. Bull World Health Organ. SciELO Public Health; 2003;81(9):646–56.
7. Telaprolu N, Anne SD. Physical and psychological work demands as potential risk factors for musculoskeletal disorders among workers in weaving operations. Indian J Occup Environ Med. Medknow Publications; 2014;18(3):129.
8. Widanarko B, Legg S, Devereux J, Stevenson M. Interaction between physical and psychosocial risk factors on the presence of neck/shoulder symptoms and its consequences. Ergonomics. Taylor & Francis; 2015;58(9):1507–18.
9. Palmer KT, Harris EC, Coggon D. Carpal tunnel syndrome and its relation to occupation: a systematic literature review. Occup Med (Chic Ill). Soc Occupational Med; 2007;57(1):57–66.
10. Rasmussen-Barr E, Grooten WJA, Hallqvist J, Holm LW, Skillgate E. Are job strain and sleep disturbances prognostic factors for neck/shoulder/arm pain? A cohort study of a general population of working age in Sweden. BMJ Open. British Medical Journal Publishing Group; 2014;4(7):e005103.
11. Coggon D, Ntani G, Palmer KT, Felli VE, Harari R, Barrero LH, et al. Disabling musculoskeletal pain in working populations: is it the job, the person, or the culture? PAIN®. Elsevier; 2013;154(6):856–63.
12. Walker BF. The prevalence of low back pain: a systematic review of the literature from 1966 to 1998. J Spinal Disord Tech. LWW; 2000;13(3):205–17.
13. Pelissier C, Fontana L, Emmanuel F, Agard JP, Couprie F, Delaygue B, et al. Occupational Risk Factors for Upper-limb and Neck Musculoskeletal Disorder among Health-care Staff in Nursing Homes for the Elderly in France. Ind Health. National Institute of Occupational Safety and Health, Japan; 2014;52(4):334.
14. Coggon D, Ntani G, Vargas-Prada S, Martinez JM, Serra C, Benavides FG, et al. International variation in absence from work attributed to musculoskeletal illness: findings from the CUPID study. Occup Environ Med. BMJ Publishing Group Ltd; 2013;70(8):575–84.

15. McGee R, Bevan S, Quadrello T. Fit For Work? Musculoskeletal Disorders and the Canadian Labour Market. London; 2009.

16. Santos S. Programa Nacional de Saúde Ocupacional: 2º Ciclo. 2013.

17. Council Directive. of 30 November 1989 on the minimum health and safety requirements for the use by workers of personal protective equipment at the workplace (third individual directive within the meaning of Article 16 (1) of Directive 89/391/EEC) (89/656/EEC). 1989 p. L 393/18.

18. Council Directive. of 29 May 1990 on the minimum health and safety requirements for the manual handling of loads where there is a risk particularly of back injury to workers (fourth individual Directive within the meaning of Article 16 (1) of Directive 89/391/EEC). 1990 p. L 165/ 21.

19. Directive C. of 29 May 1990 on the minimum safety and health requirements for work with display screen equipment (fifth individual Directive within the meaning of Article 16 (1) of Directive 89/391/EEC). Official Journal L 1990 p. L 156/21.

20. Storm STH, Naastepad CWM. Myths, Mix-ups and Mishandlings: What Caused the Eurozone Crisis? Annual Conference Institute for New Economic Thinking "Liberté, Égalité, Fragilité", Paris, France, 11 April 2015. 2015.

21. Kiiver H, Hijman RH. Impact of the crisis on unemployment so far less pronounced in the EU than in the US. Luxembourg; 2010.

22. Organisation for Economic Co-operation and Development. Portugal: Reforming the state to promote growth. Paris; 2013.

23. International Labour Organization. Portugal - Tackling the job crisis in Portugal. Switzerland; 2014.

24. Carneiro A, Portugal P, Varejao J. Catastrophic job destruction during the Portuguese economic crisis. J Macroecon. Elsevier; 2014;39:444–57.

25. Torres S. Os jovens no mercado de trabalho: indicadores de medida em confronto. Lisboa; 2013.

26. Ségol B, Jepsen M, Pochet P, Degryse C, Myant M, Piasna A, et al. Benchmarking Working Europe 2014 [Internet]. Brussels: ETUI aisbl; 2014. 132 p. Available from: https://books.google.pt/books?id=n3UmCwAAQBAJ

27. World Health Organization. Impact of economic crises on mental health. Copenhagen: World Health Organization. Regional Office for Europe; 2011.

28. Gyes G, Szekér L. Impact of the crisis on working conditions in Europe [Internet]. Dublin; 2013. Available from: http://www.eurofound.europa.eu/observatories/eurwork/comparative-information/impact-of-the-crisis-on-working-conditions-in-europe

29. Karanikolos M, Mladovsky P, Cylus J, Thomson S, Basu S, Stuckler D, et al. Financial crisis, austerity, and health in Europe. Lancet. Elsevier; 2013;381(9874):1323–31.

30. Stuckler D, Basu S, Suhrcke M, Coutts A, McKee M. Effects of the 2008 recession on health: a first look at European data. Lancet. Elsevier; 2011;378(9786):124–5.

31. Stuckler D, McKee M. There is an alternative: public health professionals must not remain silent at a time of financial crisis. Eur J Public Health. Oxford Univ Press; 2012;22(1):2–3.

32. Paoli P. Second European Survey on Working Conditions in the European Union. Dublin; 1997.

33. Paoli P, Merllié D. Third European Survey on Working Conditions 2000. Dublin; 2001.

34. Parent-Thirion A, Fernández Macías E, Hurley J, Vermeylen G. Fourth European Working Conditions Survey. Dublin; 2007.

35. Gallup Europe. 5th European Working Conditions Survey - Techinal Report. UK Data Archive. Dublin; 2012.

36. Ahacic K, Kåreholt I. Prevalence of musculoskeletal pain in the general Swedish population from 1968 to 2002: age, period, and cohort patterns. Pain. Elsevier; 2010;151(1):206–14.

37. Bergman S, Herrström P, Högström K, Petersson IF, Svensson B, Jacobsson LT. Chronic musculoskeletal pain, prevalence rates, and sociodemographic associations in a Swedish population study. J Rheumatol. The Journal of Rheumatology; 2001;28(6):1369–77.

38. Cimmino MA, Ferrone C, Cutolo M. Epidemiology of chronic musculoskeletal pain. Best Pract Res Clin Rheumatol. Elsevier; 2011;25(2):173–83.

39. Freemont AJ, Hoyland JA. Morphology, mechanisms and pathology of musculoskeletal ageing. J Pathol. Wiley Online Library; 2007;211(2):252–9.

40. Buckwalter JA, Woo SL, Goldberg VM, Hadley EC, Booth F, Oegema TR, et al. Soft-tissue aging and musculoskeletal function. J Bone Jt Surg Am. The American Orthopedic Association; 1993;75(10):1533–48.

41. Fillingim RB, King CD, Ribeiro-Dasilva MC, Rahim-Williams B, Riley JL. Sex, gender, and pain: a review of recent clinical and experimental findings. J pain. Elsevier; 2009;10(5):447–85.

42. Paller CJ, Campbell CM, Edwards RR, Dobs AS. Sex-based differences in pain perception and treatment. Pain Med. Wiley Online Library; 2009;10(2):289–99.

43. Messing K, Ostlin P. Gender equality, work and health: a review of the evidence. Geneva Switzerland World Health Organization [WHO] Department of Gender Women and Health 2006.; 2006.

44. Strazdins L, Bammer G. Women, work and musculoskeletal health. Soc Sci Med. Elsevier; 2004;58(6):997–1005.

45. Dahlberg R, Karlqvist L, Bildt C, Nykvist K. Do work technique and musculoskeletal symptoms differ between men and women performing the same type of work tasks? Appl Ergon [Internet]. 2004;35(6):521–9. Available from: http://www.sciencedirect.com/science/article/pii/S0003687004001061

46. Goldman MB, Hatch M. Women and Health [Internet]. Califórnia: Academic Press; 2000. 1276 p. Available from: https://books.google.es/books?id=zSCgj8LXFHAC

47. Eng A, Mannetje A, McLean D, Ellison-Loschmann L, Cheng S, Pearce N. Gender differences in occupational exposure patterns. Occup Environ Med. BMJ Publishing Group Ltd; 2011;68(12):888–94.

48. Bernard BP, Putz-Anderson V, Burt SE. A critical review of epidemiologic evidence for work-related musculoskeletal disorders of the neck, upper extremity, and low back. Cincinnati Centers Dis Control Prev Natl Inst Occup Saf Heal Publ. 1997;97–141.

49. Mayer J, Kraus T, Ochsmann E. Longitudinal evidence for the association between work-related physical exposures and neck and/or shoulder complaints: a systematic review. Int Arch Occup Environ Health. Springer; 2012;85(6):587–603.

50. Hoogendoorn WE, Bongers PM, de Vet HCW, Douwes M, Koes BW, Miedema MC, et al. Flexion and rotation of the trunk and lifting at work are risk factors for low back pain: results of a prospective cohort study. Spine (Phila Pa 1976). LWW; 2000;25(23):3087–92.

51. Putz-Anderson V, Bernard BP, Burt SE, Cole LL, Fairfield-Estill C, Fine LJ, et al. Musculoskeletal disorders and workplace factors. Natl Inst Occup Saf Heal. 1997;

52. Campos-Fumero A, Delclos GL, Douphrate DI, Felknor SA, Vargas-Prada S, Serra C, et al. Upper extremity musculoskeletal pain among office workers in three Spanish-speaking countries: findings from the CUPID study. Occup Environ Med. BMJ Publishing Group Ltd; 2016;73(6):394–400.

53. Callister LC. Cultural influences on pain perceptions and behaviors. Home Health Care Manag Pract. SAGE Publications; 2003;15(3):207–11.

54. Campbell CM, Edwards RR. Ethnic differences in pain and pain management. Pain. Future Medicine; 2012;2(3):219–30.

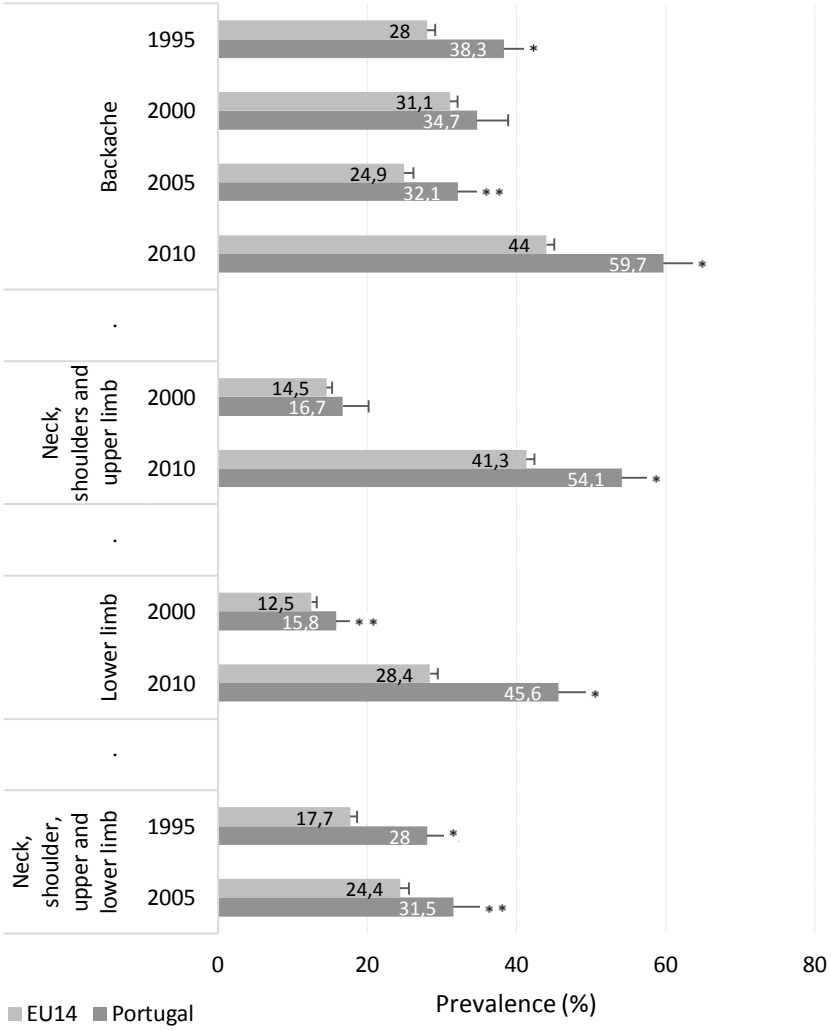
Figure 1: Flow diagram of the participants

Table 1: Distribution (%) of participants by age, sex and occupation according to country of residence and year of survey (weighted estimates)

		Portugal				EU14			
		1995	2000	2005	2010	1995	2000	2005	2010
Sex	Male	55.6	54.6	53.5	52.4	58.1	57.1	56.2	54.9
	Female	44.4	45.4	46.5	47.6	41.9	42.9	43.8	45.1
Age	<30	23.5	25.3	22.7	17.2	25.1	24.3	21.3	19.0
	30-44	38.1	35.5	42.9	41.1	42.0	41.2	41.2	40.6
	45-59	28.9	33.3	29.3	34.4	29.2	31.0	33.1	35.8
	≥60	9.6	5.9	5.1	7.3	3.7	3.5	4.4	4.6
Occupation	Legislators, senior officials and managers	8.7	6.9	9.0	6.1	8.5	9.2	10.3	9.7
	Professionals	7.0	6.8	8.8	10.6	13.2	14.1	16.7	17.5
	Technicians and associate professionals	10.5	7.8	8.4	9.7	14.1	14.4	14.2	16.9
	Clerks	11.3	9.9	10.6	10.1	13.2	12.7	12.4	12.1
	Service workers and shop and market sales workers	13.5	12.7	12.9	17.8	13.5	14.1	13.8	13.6
	Skilled agricultural and fishery workers	7.9	6.8	1.2	5.4	5.0	4.1	2.6	2.2
	Craft and related trades workers	21.0	22.1	18.9	19.1	15.0	14.0	12.6	11.5
	Plant and machine operators and assemblers	9.9	13.1	17.7	9.0	8.6	8.6	7.3	7.6
	Elementary occupations	10.1	14.0	12.5	12.3	8.9	8.9	10.2	8.9

Figure 2: Prevalence of self-reported musculoskeletal pain and association with country of residence in male Portuguese and EU14 workers

Male



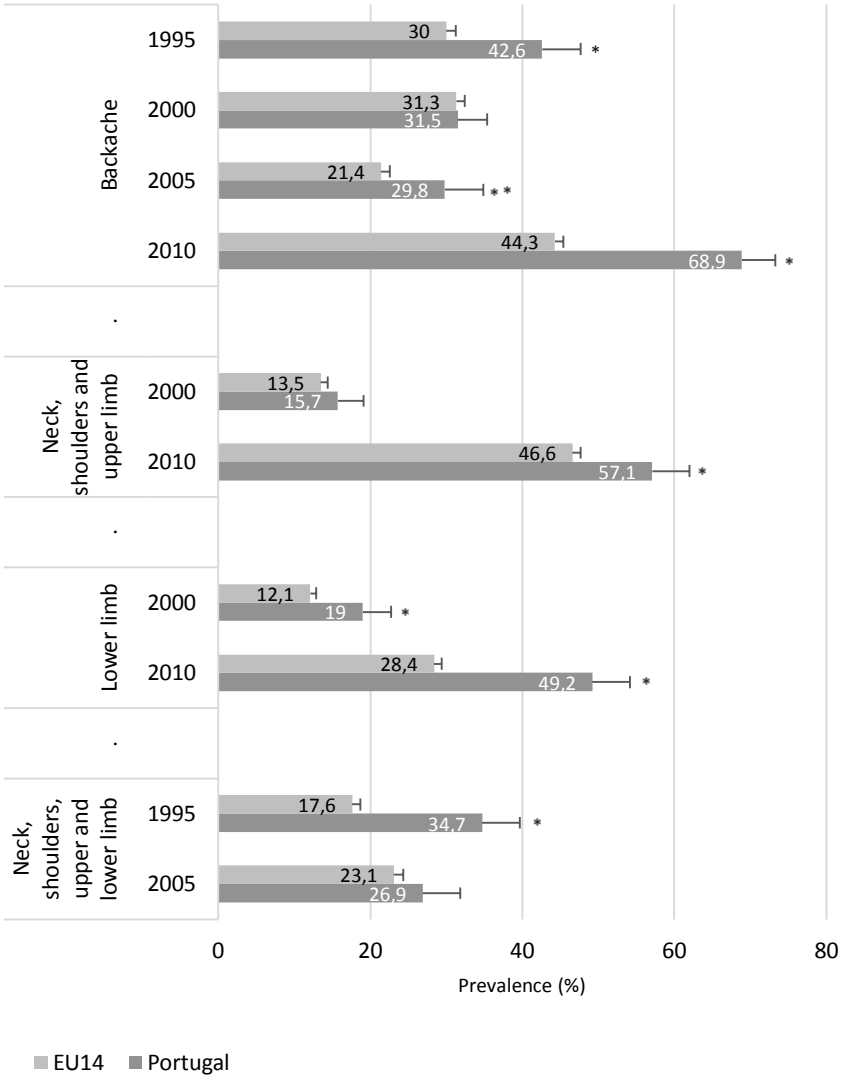
	Crude PR (95% CI)	Adjusted PR[(a)] (95% CI)
Backache		
1995	1.00	1.00
	1.28 (1.10-1.48)	1.23 (1.06-1.43)
2000	1.00	1.00
	1.03 (0.90-1.18)	0.94 (0.82-1.08)
2005	1.00	1.00
	1.25 (1.05-1.48)	1.17 (0.98-1.39)
2010	1.00	1.00
	1.43 (1.26-1.62)	1.32 (1.17-1.49)
Neck, shoulders and upper limb		
2000	1.00	1.00
	1.03 (0.85-1.25)	0.91 (0.75-1.11)
2010	1.00	1.00
	1.36 (1.19-1.55)	1.25 (1.10-1.43)
Lower limb		
2000	1.00	1.00
	1.20 (0.99-1.46)	1.06 (0.87-1.29)
2010	1.00	1.00
	1.64 (1.42-1.88)	1.42 (1.23-1.64)
Neck, shoulder, upper and lower limb		
1995	1.00	1.00
	1.58 (1.33-1.87)	1.48 (1.25-1.76)
2005	1.00	1.00
	1.19 (1.00-1.42)	1.14 (0.95-1.36)

[(a)] Adjusted for age and occupation

* p-value <0.001
**p-value<0.05

Figure 3: Prevalence of self-reported musculoskeletal pain and association with country of residence in female Portuguese and EU14 workers

Female



	Crude PR (95% CI)	Adjusted PR* (95% CI)
Backache 1995	1.00	1.00
Backache 1995	1.42 (1.23-1.65)	1.33 (1.14-1.54)
Backache 2000	1.00	1.00
Backache 2000	1.00 (0.88-1.15)	0.91 (0.80-1.05)
Backache 2005	1.00	1.00
Backache 2005	1.24 (1.04-1.47)	1.21 (1.02-1.44)
Backache 2010	1.00	1.00
Backache 2010	1.53 (1.37-1.71)	1.41 (1.26-1.58)
Neck, shoulders and upper limb 2000	1.00	1.00
Neck, shoulders and upper limb 2000	1.08 (0.89-1.31)	0.91 (0.75-1.11)
Neck, shoulders and upper limb 2010	1.00	1.00
Neck, shoulders and upper limb 2010	1.23 (1.09-1.38)	1.15 (1.02-1.30)
Lower limb 2000	1.00	1.00
Lower limb 2000	1.48 (1.23-1.77)	1.19 (0.99-1.42)
Lower limb 2010	1.00	1.00
Lower limb 2010	1.67(1.46-1.90)	1.43(1235-1.63)
Neck, shoulders, upper and lower limb 1995	1.00	1.00
Neck, shoulders, upper and lower limb 1995	1.89 (1.60-2.24)	1.60 (1.35-1.90)
Neck, shoulders, upper and lower limb 2005	1.00	1.00
Neck, shoulders, upper and lower limb 2005	1.08 (0.91-1.29)	1.07 (0.90-1.28)

* Adjusted for age and occupation

* p-value <0.001
**p-value<0.05

Table 2: Prevalence ratio and 95% Confidence Interval of self-reported musculoskeletal pain in male workers by major occupational group (statistical significant PRs are painted bold)

		Male							
		High-skilled non-manual		Skilled non-manual		Manual skilled		Elementary	
	Year	**PR**	**95% CI**	**PR**	**95% CI**	**PR**	**95% CI**	**PR**	**95% CI**
Back pain	1995	1.32	0.93–1.87	**1.65**	**1.15-2.35**	1.13	0.93-1.37	1.13	0.67-1.92
	2000	1.14	0.80-1.60	0.72	0.48-1.09	0.92	0.78-1.09	1.34	0.88-2.04
	2005	**2.16**	**1.54-3.04**	1.43	0.84-2.41	0.90	0.69-1.16	1.05	0.71-1.55
	2010	**1.52**	**1.17-2.01**	1.04	0.74-1.45	**1.35**	**1.15-1.60**	1.28	0.89-1.85
Neck/shoulders/upper limb	2000	1.22	0.71-2.08	**0.32**	**0.12-0.87**	0.92	0.73-1.16	1.34	0.76-2.36
	2010	1.34	0.99-1.80	1.06	0.75-1.51	**1.29**	**1.08-1.53**	1.25	0.85-1.83
Lower limb	2000	**2.16**	**1.46-3.41**	0.85	0.46-1.57	0.96	0.75-1.23	1.23	0.67-2.28
	2010	**1.68**	**1.19-2.38**	0.95	0.63-1.45	**1.44**	**1.20-1.75**	**1.84**	**1.28-2.66**
Neck/shoulders/upper and lower limb	1995	1.40	0.86-2.27	**1.99**	**1.28-3.10**	**1.41**	**1.14-1.74**	1.55	0.91-2.66
	2005	**1.98**	**1.40-2.81**	1.34	0.76-2.35	0.92	0.71-1.19	0.94	0.61-1.43

Table 3: Prevalence ratio and 95% Confidence Interval of self-reported musculoskeletal pain in female workers by major occupational group (statistical significant PRs are painted bold)

		Female							
		High-skilled non-manual		Skilled non-manual		Manual skilled		Elementary	
Back pain	1995	**1.35**	**1.01-1.80**	1.22	0.86-1.72	1.22	0.94-1.60	**1.37**	**1.01-1.88**
	2000	0.71	0.48-1.05	0.86	0.68-1.09	0.81	0.62-1.05	1.20	0.93-1.54
	2005	**1.64**	**1.24-2.16**	0.96	0.62-1.48	1.09	0.71-1.68	0.89	0.65-1.22
	2010	**1.50**	**1.18-1.90**	**1.46**	**1.23-1.74**	**1.61**	**1.19-2.17**	1.19	0.95-1.51
Neck/shoulders/ upper limb	2000	0.71	0.39-1.29	**0.64**	**0.42-0.98**	1.16	0.84-1.61	1.03	0.72-1.49
	2010	1.08	0.84-1.40	1.17	0.97-1.41	1.35	0.98-1.86	1.11	0.86-1.42
Lower limb	2000	1.38	0.85-2.26	1.09	0.77-1.53	1.04	0.74-1.46	**1.56**	**1.11-2.21**
	2010	**1.51**	**1.12-2.04**	**1.53**	**1.24-1.87**	**1.50**	**1.05-2.15**	**1.30**	**1.01-1.67**
Neck/shoulders/upper and lower limbs	1995	**2.38**	**1.73-3.27**	**1.60**	**1.05-2.45**	1.15	0.85-1.57	**1.44**	**1.02-2.03**
	2005	**1.43**	**1.08-1.90**	0.68	0.41-1.12	0.90	0.57-1.44	0.95	0.69-1.29

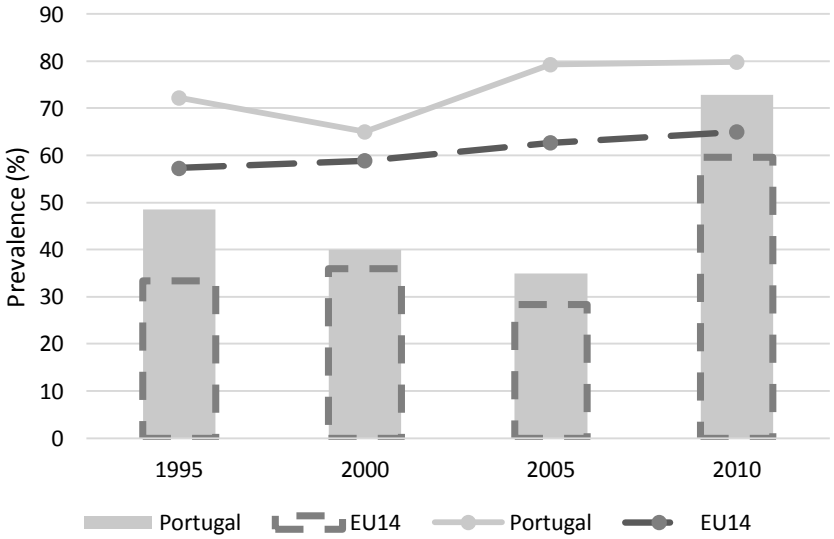
Table 4: Prevalence ratio and 95% Confidence Interval of self-reported musculoskeletal pain in male workers by age group (statistical significant PRs are painted bold)

		Male							
		<30		30-44		45-59		≥60	
Back pain	1995	1.29	0.95-1.76	1.07	0.83-1.37	**1.42**	**1.09-1.84**	1.14	0.68-1.91
	2000	0.66	0.49-0.90	0.94	0.75-1.16	1.15	0.92-1.45	1.39	0.88-2.22
	2005	1.13	0.79-1.63	1.00	0.76-1.30	1.29	0.93-1.79	**2.09**	**1.16-3.78**
	2010	1.02	0.65-1.60	**1.37**	**1.13-1.67**	**1.27**	**1.06-1.54**	**1.69**	**1.15-2.48**
Neck/shoulders/upper limb	2000	0.79	0.52-1.21	0.96	0.70-1.31	1.02	0.73-1.42	0.78	0.36-1.69
	2010	1.15	0.76-1.77	**1.27**	**1.03-1.56**	**1.24**	**1.01-1.51**	1.40	0.92-2.13
Lower limb	2000	0.98	0.64-1.49	1.02	0.73-1.41	1.23	0.89-1.70	1.15	0.57-2.31
	2010	1.18	0.72-1.95	**1.34**	**1.05-1.71**	**1.52**	**1.23-1.87**	**1.76**	**1.17-2.66**
Neck/shoulders/upper and lower limbs	1995	**1.82**	**1.32-2.52**	**1.37**	**1.03-1.82**	1.37	0.99-1.90	1.49	0.87-2.54
	2005	1.16	0.80-1.68	0.90	0.67-1.20	1.29	0.93-1.79	**2.11**	**1.17-3.82**

Table 5: Prevalence ratio and 95% Confidence Interval of self-reported musculoskeletal pain in male workers by age group (statistical significant PRs are painted bold)

		Female							
		<30		30-44		45-59		≥60	
Back pain	1995	1.23	0.90-1.68	**1.32**	**1.05-1.67**	**1.35**	**1.03-1.77**	1.01	0.54-1.86
	2000	0.76	0.57-1.01	0.96	0.78-1.17	0.93	0.73-1.18	1.07	0.51-2.23
	2005	1.15	0.78-1.70	1.09	0.84-1.43	1.08	0.79-1.48	**2.42**	**1.19-4.90**
	2010	1.25	0.87-1.79	**1.44**	**1.21-1.72**	**1.39**	**1.17-1.65**	**1.70**	**1.17-2.47**
Neck/shoulders/upper limb	2000	0.80	0.49-1.29	0.97	0.72-1.31	0.93	0.67-1.29	0.67	0.24-1.86
	2010	1.26	0.87-1.81	1.13	0.93-1.39	1.16	0.97-1.39	1.10	0.72-1.67
Lower limb	2000	1.25	0.85-1.86	**1.41**	**1.06-1.86**	1.06	0.77-1.47	0.72	0.26-1.99
	2010	1.29	0.82-2.02	**1.48**	**1.18-1.85**	**1.45**	**1.19-1.75**	**1.54**	**1.02-2.35**
Neck/shoulders/upper and lower limbs	1995	**1.48**	**1.01-2.17**	**1.56**	**1.19-2.06**	**1.45**	**1.07-1.97**	**1.96**	**1.10-3.49**
	2005	1.12	0.74-1.68	0.91	0.69-1.21	0.99	0.73-1.36	**2.82**	**1.39-5.71**

Appendix 1: Prevalence of exposure to at least one ergonomic risk factor for at least half of the time (line) – tiring and painful positions, carrying or moving heavy loads, repetitive hand and arm movements and vibrations - and prevalence of reporting at least one musculoskeletal symptom in the last 12 months (bars) – back, neck/shoulders/upper and lower limb pain by - year of survey in Portuguese and EU14 workers



4. Chapter II

Musculoskeletal disorders in Portuguese workers: is it the job or the person?

Abstract

Objective: Estimate the associations of occupational and personal-level risk factors with the report of musculoskeletal symptoms among Portuguese workers.

Methods: Using data from the Fifth European Working Conditions Survey, 931 Portuguese workers were interviewed. One-year prevalence of musculoskeletal symptoms were estimated according to sex. Personal-level risk factors studied included: sex, age, educational level, housework or cooking, taking care of relatives, gardening or repairs and work-family conflict. Occupational-level risk factors studied included: occupational group, employment status, employment contract, number of hours worked per week, having a second job, eight ergonomic exposures, no manager or colleagues support and job demands-control model. Associations between occupational-level and personal-level risk factors and musculoskeletal symptoms were quantified by crude and age- and occupation-adjusted prevalence ratios and 95% confidence intervals, using Poisson regression models.

Results: This study shows that musculoskeletal pain is a common phenomenon among Portuguese workers. An important finding is the relationship between physical exposures at workplace and musculoskeletal pain: tiring or painful positions was associated with all musculoskeletal complaints. Additionally, patterns of increased physical demands such as vibrations, standing and lifting or moving people showed an association with pain in the lower limb. Repetitive hand or arm movements were strongly associated with neck/shoulders/upper limb pain. Work-related psychosocial and personal risk factors did not show any association with musculoskeletal complaints-

Conclusion: Our evidence suggests that musculoskeletal pain among Portuguese workers is mainly associated with work-related physical factors, therefore it is important that additional efforts are targeted at identifying these situations so that prevention interventions can be applied in order to reduce the incidence and severity of MSDs.

Introduction

Musculoskeletal disorders (MSDs) are a major cause of long-term pain and physical incapacity (1), representing 11% of the total years lived with disability among individuals in high-income countries (2). Although these conditions are multifactorial in origin, a strong body of evidence has shown that work-related factors are strongly associated with musculoskeletal complaints among active workers (3). MSDs are highly prevalent in the working population (4,5) and impose considerable burden on workers, organizations, welfare systems and the society in general due to individual suffering, health care costs and loss of productivity (1,4,6) .

With regard to work-related risk factors, many studies have shown that physical exposures such as repetitive movements, heavy manual lifting, poor posture, low temperatures, and partial or whole-body vibration are associated with MSDs (5,7–9). In fact, a systematic review revealed that manual material handling, vibration, trunk flexion or rotation and working with hands above shoulder level were associated with shoulder complaints (10). A critical review of work-related MSDs provided evidence regarding the relationship between low back pain and lifting and forceful movements, tiring or painful postures, whole-body vibration and static work postures (3). In addition to physical risk factors, several psychosocial factors, such as highly demanding tasks, low social support and low control at the workplace, have also been demonstrated as additional contributing factors for MSDs (9,11).

Besides strictly occupational exposures, several studies have suggested that certain personal risk factors could interact with workplace circumstances and be detrimental to workers´ health outcomes (3,12–14). For instance, Kim and colleagues found a consistent association between work-family conflict and self-reported musculoskeletal pain among hospital patient care workers (12). Also, a prospective study established that intense low back pain was predicted by being highly engaged in taking care of relatives during leisure time (14).

Most research has focused on work-related determinants of health and disease, but these should be seen at the light of macro-level circumstances. Portugal was one the countries most deeply affected by the most recent economic recession (15). With the financial crisis in 2008, Portugal had one of the fastest and highest increases in unemployment rate, after Greece and Spain (16). From

2007 to 2009, the rate of job destruction by closing firms was, on average, 36.4% and mean unemployment duration increased from a minimum of 14 months in 2003 to above 20 months in 2010 (17,18). Such economical context has a negative impact on workers' health and well-being, not only by an exposure to greater work intensity and increasing stress at work but also due to the limited time that workers have to rest and dedicate to their personal lives (19).

The European Working Conditions Survey (EWCS) provides a unique opportunity to periodically monitor the health of workers in settings such as Portugal, where there is little tradition of occupational health surveillance, as well as comparatively low coverage of risk prevention policies at the workplace. The fifth survey, which took place in 2010, provides particularly interesting evidence to assess the impact of the economic downturn that began in 2008 and thereby support the adoption of appropriate and relevant technical guidelines as well as to review and improve some of the legislation.

We therefore sought to estimate the associations of occupational and personal-level risk factors with the report of musculoskeletal symptoms among Portuguese workers, using data collected as part of the fifth EWCS.

Methods

Participants

The EWCS is a periodic cross-sectional study performed by the European Foundation for the Improvement of Living and Working Conditions (Eurofound) every five years, to investigate the working conditions of employers and employees in Europe. The fifth EWCS covered the participation of all 27 EU Member States plus Croatia, Turkey, Albania, Norway, the Former Yugoslav Republic of Macedonia, Kosovo and Bosnia and Herzegovina - a total of 34 countries (20).

The samples within each country were selected to be representative of individuals aged 15 years or over (16 in Spain, UK and Norway) and who were employed the week that preceded the beginning of the interview. A multi-stage, stratified random sampling design was used in each country and each stratum was defined by NUTS (Nomenclature of Territorial Units for Statistics) regions levels II/III and by degree of urbanization. The survey consisted of a standardized questionnaire and was conducted by face-to-face interviews at participants' homes (20).

The analyses in this paper were restricted to employed and self-employed individuals in Portugal. Armed Forces were not included in our analysis due to a relatively small sample size together with relevant heterogeneity and other specificities.

Musculoskeletal pain assessment

Musculoskeletal symptoms were assessed through the following question: "Over the last 12 months, did you suffer from any of the following health problems?". Within the answer options, backache, pain in the neck/shoulder/upper limbs and pain in the lower limbs were presented.

Personal-level risk factors

Age was classified in 15-years categories (<30 years, 30-44 years, 45-59 years, ≥60 years), and occupation was labelled according to the 1988 version of the International Standard Classification of Occupations (ISCO-88). Education was categorized as primary, secondary or tertiary.

Time spent caring for and educating children and grandchildren, as well as time spent caring for elderly/disabled relatives was aggregated into one single variable designated T*ime spent caring for relatives*. Time spent caring for relatives, time spent with cooking and housework and time spent gardening and repairs were dichotomized. An individual was considered exposed if he/she was involved in such activity every day or every second day for at least one hour.

Work-family conflict was measured by the question "In general, do your working hours fit in with your family or social commitments outside work?" This question presented a Likert scale with four possible options – very well, well, not very well and not at all well, which were transformed in a dichotomous variable: work-family conflict (including not very well and not at all well) and no work-family conflict (including very well and well).

Occupational-level risk factors

Based on previous studies, the following variables were selected to study occupational risk factors: employment status, type of employment contract, number of hours at wor per weekk, having night shift work, having a second job, job demands and control, social support from manager and colleagues and frequency of nine physical exposures.

Individuals were assigned to one of four possible employment status: self-employed without employees, self-employed with employees, employee and others.

Type of employment contract was collapsed into three categories: indefinite contract, fixed-term contract and other type of contracts (including temporary contract, apprenticeship, no contract and additional types of contracts).

Number of hours worked per week was included as five-category variable: ≤35 hours, 36-40 hours, 35-39 hours, 41-54 hours, and ≥55 hours.

Night shift work was dichotomized; individuals that worked less than 10 days after 10 pm were compared to those who worked 11 or more days after 10 pm.

Job demands and control were measured on the basis of three factors of the Job demands-control model by Karasek. The analysis of exposure to this group of factors was adapted from the methodology presented by Farioli *et al*., in which three scales were created using variables of the EWCS: job demands, job skill discretion, and job decision-making authority (21).

Work-related physical exposures included were: vibrations, low temperatures, tiring or painful positions, lifting or moving people, carrying or moving loads, standing, repetitive hand or arm movements, sitting and working with a computer. The questionnaire presented a Likert scale with seven possible answers that were collapsed into two categories: Non-exposed (including "almost never", "around 1/4 of the time" or "around half of the time") and Exposed (including "around 3/4 of the time", "almost all of the time" or "all of the time").

Statistical analysis

Statistical analysis was carried out using Stata 11.2 (Stata Corp, College Station, TX, USA).

Characteristics of participants were estimated by using the *svyset* command in STATA and presented as proportions. Comparison between male and female workers was performed using the chi-square test or Fisher's exact test.

One-year prevalence of each musculoskeletal symptom was estimated according to sex. Crude and adjusted prevalence ratio (PR) with 95% confidence intervals (95%CI) were estimated by Poisson regression, without sampling weights, to quantify the associations of personal and occupational-level risk factors with each musculoskeletal symptom – back pain, neck/shoulders/upper limb pain and lower limb pain. In each model, all estimates were stratified by sex and adjusted for age as a continuous variable and education and occupation as categorical variables.

Results

In the Fifth EWCS a total of 996 Portuguese workers were interviewed, excluding Armed Forces. We excluded 63 individuals that during the previous week to the interview had not worked as an employee or employer. A further two individuals with missing information on age, education or occupation were excluded from the analyses. Thus, our sample is composed by a total 931 individuals.

Description of the sample

Table 1 provides descriptive statistics of Portuguese workers stratified by sex. Fifty-two percent of participants were men and almost two-thirds had less than 45 years of age. More than 60% of both men and women had primary education. However, nearly twice the percentage of women had higher education in comparison to men (9.5% of men and 18.6% of women). Regarding the proportion of the employed population by occupation, we observed that men were mainly working as *Craft and related trades workers* (30.1%) while women as *Service workers and shop and market sales workers* (27.4%). The vast majority of workers were employees (83.8% and 82.2% of men and women respectively) and worked between 36 and 40 hours per week (50.9% of men and 46.7% of women). In both sexes, standing was the occupational exposure most frequently reported, followed by repetitive hand and arm movements and maintaining tiring or painful positions (66.3%, 59.9% and 36.5% for men and 64.2%, 56.2% and 34.8% for women respectively). Nearly 40% of men perceived their job as highly strained but with low control in comparison 30% of women. For 25.8% of men and 25.4% of women, their job is low strained and has little autonomy (Passive job).

The prevalence of self-reported musculoskeletal symptoms was higher among women: almost seventy percent of Portuguese women reported back pain in comparison to 59.7% of men. Prevalence of pain in neck, shoulders and upper limb was 57.2% in women and 54.1% in men, while 49.3% of women reported pain in the lower limb in comparison to 45.6% of men (Figure 1).

Personal-level risk factors and musculoskeletal pain

Older men and women were more likely to report back pain as well as lower limb pain. The highest PRs for back pain and lower limb pain were observed among workers over 60 years old [Back pain in men: PR= 2.17 (1.23-3.82); Back pain in women: PR= 1.69 (1.03-2.76); Lower limb pain in men: PR=2.35 (1.26-4.38); Lower limb pain in women: PR=2.06 (1.15-3.69)].

Regarding educational level, men and women with tertiary level of education were less likely to report neck/shoulder/upper limb pain [PR_{men}= 0.45 (0.25-0.81); PR_{women}= 0.70(0.46-1.00]. Women with tertiary education were less likely to report back pain [PR= 0.69 (0.49-0.99]. As for pain in the lower limb, men with secondary and tertiary education as well as women with tertiary education tended to carry a lower risk of pain [Secondary education in men: PR= 0.61 (0.39-0.97); Tertiary education in men: PR= 0.28 (0.12-0.63); Tertiary education in women: PR= 0.42 (0.25-0.7)]. Back pain and women with tertiary education were negatively associated [PR=0.89(0.49-1.00].

No occupation seemed significantly associated with any of the musculoskeletal symptoms with the exception of women working as Craft and related trades on reporting pain in the neck/shoulders and upper limbs [PR= 1.90 (1.01-3.22)].

Some personal-level risk factors such as taking care of relatives, housework or cooking and gardening or repairs were not significantly associated with prevalence of musculoskeletal symptoms.

Occupational-level risk factors and musculoskeletal pain

Among men, back pain was significantly associated with exposure to tiring or painful positions and repetitive hand and arm movements, while among women, back pain was associated with exposure to tiring or painful positions. Adjusted PR for age, education and occupation reduced the strength of the observed associations and only exposure to tiring or painful positions remained significantly associated with back pain [Male workers: PR= 1.54 (1.20-1.98); Female workers: PR= 1.35 (1.08-1.70)].

Workers exposed to repetitive hand or arm movements, vibrations and tiring or painful positions were significantly more likely to report pain in the neck/shoulders or upper limb. After adjustment to age, education and occupation, exposure to vibrations was no longer associated with neck/shoulders or upper limb pain, however, exposure to repetitive hand or arm movements in male workers [Male workers: PR= 1.46 (1.08-1.98)] and exposure to tiring or painful positions in female and male workers remained significant [Male workers: PR= 1.71 (1.31-2.22); Female workers: PR= 1.55 (1.21-1.99)].

In men, musculoskeletal pain in the lower limb was associated with exposure to vibrations, low temperatures, tiring or painful positions, carrying or moving heavy objects, standing and repetitive hand and arm movements. In women, musculoskeletal pain in the lower limb was associated with exposure to tiring or painful positions, lifting and moving people and standing. When adjusted personal risk factors, musculoskeletal pain in the lower limb among male workers remained significantly associated with exposure to vibrations, tiring or painful positions and standing [PR= 1.56 (1.13-2.14); PR= 1.48 (1.10-1.96); PR= 1.55 (1.05-2.30), respectively] while in female workers, musculoskeletal pain in the lower limb remained significantly associated with exposure to tiring or painful positions and standing [PR= 1.33 (1.02-1.73); PR= 1.47 (1.01-2.11), respectively]. Lifting or moving people became a significant predictor of pain in the lower limb among male workers after adjusting for personal risk factors [PR= 2.80 (1.10-7.10)].

Frequent work with computers was inversely associated with all musculoskeletal symptoms. [Back pain in men: PR= 0.59 (0.42-0.83); back pain in women: PR= 0.73 (0.56-0.95); neck/shoulders/upper limb pain in men: PR= 0.54 (0.37-0.79); neck/shoulders/upper limb pain in women: PR= 0.67 (0.50-0.90); lower limb pain in men: PR= 0.47 (0.31-0.72); lower limb pain in women: PR= 0.59 (0.42-0.83)].

No significant associations were found between musculoskeletal symptoms and employment status, employment contract, number of hours worked per week, having night shifts and having a second job. Additionally, none of the job types included in the job demands-control model were significantly associated with prevalence of musculoskeletal pain.

Discussion

This study reinforces musculoskeletal pain as a common manifestation among Portuguese workers. An important finding is the relationship between physical exposures at the workplace and musculoskeletal pain: tiring or painful positions were associated with all musculoskeletal complaints. Additionally, patterns of increased physical demands such as vibrations, standing and lifting or moving people showed an association with pain in the lower limbs. Repetitive hand or arm movements were strongly associated with neck/shoulders/upper limb pain. Work-related psychosocial and personal risk factors did not show significant associations with musculoskeletal complaints.

High prevalence of musculoskeletal pain is commonly found in population-based studies. In the Dutch population-based Musculoskeletal Complaints and Consequences Cohort Study (DMC_3-study), the prevalence of low back pain was 26.9%, shoulder pain was 20.9% and neck pain was 20.6% among those aged 25 years and over (22). Similarly, in the most recent Portuguese National Health Survey, back pain was the most frequently reported chronic disease (32.9%) (23). The prevalence of musculoskeletal pain presented in our study was slightly higher in comparison to other studies and may be the result of the wording of the question or of the response categories presented, but it might also represent higher risk among worker-only samples.

Musculoskeletal pain was more prevalent among women. Such differences may be the result of differential exposure to risks in the workplace, differences in muscle strength and endurance or the result of workstations designed according to male norms (24–26). Moreover, women spend twice as much time on household activities and parenting than men which may result in greater overall exposure to physically demanding tasks and psychosocial strain, as well as a reduction in opportunities for recovery (27–29). Older workers were more likely to report back pain and lower limb pain. This may be explained by an age-related decrease in functional capacity but also by the accumulation of musculoskeletal pain causes that persist over time (30).

In this cross-sectional study, physical risk factors were associated to musculoskeletal complaints. Such findings are in accordance with observations made in other studies (3,5,10,31). Keeping the

standing position for long periods was consistently associated with all musculoskeletal complaints. A recent study found evidence that long-term fatigue develops after five hours of standing work even with regular rest breaks and persists for at least 30 minutes after a seated recovery period. Such results suggest that occupational activities requiring prolonged standing are likely to contribute to lower-extremity and back disorders (32). Consequently, this study lends to support the idea that exposure to physical factors in the workplace may increase the risk for MSDs.

In order to study the relationship between work-related psychosocial risk factors and musculoskeletal pain, we used a model developed by Farioli which in turn was based on Karasek´s model (21). This model explains how levels of job demands, control in the work and skill required to complete the work can influence strain and job satisfaction. Additionally to these dimensions, this model suggests that social support from manager and colleagues may have a positive impact on health outcomes (33). Nevertheless, in Portuguese workers, no significant associations were observed when musculoskeletal pain was the outcome. It is possible that high-strain jobs are engaged by healthier workers – who are less likely to report MSDs - since they are more likely to re-interpret their jobs positively over time as they are able to maintain involved in their work.

Surprisingly, other occupational-level risk factors such as employment status, employment contract, number of hours worked per week, having night shifts or having a second job did not influence the risk of reporting musculoskeletal pain. These findings may have been influenced by other occupational or personal-level risk factors that we were not able to analyze, such as family support or monetary compensation. These factors could influence the perceptions for musculoskeletal pain.

There is sparse knowledge of how engaging certain tasks during leisure time such as caring for relatives or cooking is related to MSDs. Still, some studies have shown positive associations between these personal-level risk factors and MSDs (3,12–14). In the present study, spending time caring for relatives, cooking and housework and gardening or repairs was not associated with musculoskeletal pain.

While interpreting the results of this paper some limitations should be taken into account. [1] The EWCS questionnaire was developed in English and afterwards translated into 32 languages with all versions of the questionnaires being revised by experts. However, it is possible that certain terms are perceived differently in different languages and cultures. [2] Data for the EWCS was collected by self-report. Such methodological approach might bias the prevalence estimates and inflate or dilute real associations. [3] It is possible that workers with serious health conditions were not included in our analysis because they have left the labour market or were with long-term absence from work. This might have cause underestimation of the effects of certain risk factors on musculoskeletal pain.

Among the strength of the study, it is important to highlight that, as far as we know, this is the first study conducted in the general Portuguese workforce that evaluates the association between risk factors and musculoskeletal pain. Additionally, all data were collected in 34 countries using standardized methods, therefore the results obtained in our study are comparable to other studies that also used the EWCS.

Our evidence suggests that musculoskeletal pain among Portuguese workers is mainly associated with work-related physical factors. Physical risk factors are modifiable or preventable; therefore, efforts must be targeted at improving their surveillance and management in order to reduce the incidence and severity of MSDs.

Acknowledgments

The authors would like to thank the European Foundation for the Improvement of Living and Working Conditions for collecting the data for the EWCS and the UK Data Archive for supplying the database.

Bibliography

1. European League Against Rheumatism. Musculoskeletal Health in Europe: Report v5.0. 2012.
2. Murray CJL, Barber RM, Foreman KJ, Ozgoren AA, Abd-Allah F, Abera SF, et al. Global, regional, and national disability-adjusted life years (DALYs) for 306 diseases and injuries and healthy life expectancy (HALE) for 188 countries, 1990–2013: quantifying the epidemiological transition. Lancet. Elsevier; 2015;386(10009):2145–91.
3. Bernard BP, Putz-Anderson V, Burt SE. A critical review of epidemiologic evidence for work-related musculoskeletal disorders of the neck, upper extremity, and low back. Cincinnati Centers Dis Control Prev Natl Inst Occup Saf Heal Publ. 1997;97–141.
4. Bevan S, Quadrello T, McGee R, Mahdon M, Vavrovsky A, Barham L. Fit for work? Musculoskeletal disorders in the European workforce. London; 2009.
5. McBeth J, Jones K. Epidemiology of chronic musculoskeletal pain. Best Pract Res Clin Rheumatol. Elsevier; 2007;21(3):403–25.
6. Ahlberg I. The economic costs of musculoskeletal disorders-A cost-of-illness study in Sweden for 2012. 2014;
7. Coenen P, Kingma I, Boot CRL, Twisk JWR, Bongers PM, van Dieën JH. Cumulative low back load at work as a risk factor of low back pain: a prospective cohort study. J Occup Rehabil. Springer; 2013;23(1):11–8.
8. Fonseca N da R, Fernandes R de CP. Factors related to musculoskeletal disorders in nursing workers. Rev Lat Am Enfermagem. SciELO Brasil; 2010;18(6):1076–83.
9. Widanarko B, Legg S, Devereux J, Stevenson M. Interaction between physical and psychosocial risk factors on the presence of neck/shoulder symptoms and its consequences. Ergonomics. Taylor & Francis; 2015;58(9):1507–18.
10. Mayer J, Kraus T, Ochsmann E. Longitudinal evidence for the association between work-related physical exposures and neck and/or shoulder complaints: a systematic review. Int Arch Occup Environ Health. Springer; 2012;85(6):587–603.
11. Rasmussen-Barr E, Grooten WJA, Hallqvist J, Holm LW, Skillgate E. Are job strain and sleep disturbances prognostic factors for neck/shoulder/arm pain? A cohort study of a general population of working age in Sweden. BMJ Open. British Medical Journal Publishing Group; 2014;4(7):e005103.
12. Kim S, Okechukwu CA, Buxton OM, Dennerlein JT, Boden LI, Hashimoto DM, et al. Association between work–family conflict and musculoskeletal pain among hospital patient care workers. Am J Ind Med. Wiley Online Library; 2013;56(4):488–95.
13. Bergqvist U, Wolgast E, Nilsson B, Voss M. Musculoskeletal disorders among visual display terminal workers: individual, ergonomic, and work organizational factors. Ergonomics. Taylor & Francis; 1995;38(4):763–76.
14. Eriksen W, Bruusgaard D, Knardahl S. Work factors as predictors of intense or disabling low back pain; a prospective study of nurses' aides. Occup Environ Med. BMJ Publishing Group Ltd; 2004;61(5):398–404.

15. Organisation for Economic Co-operation and Development. Portugal: Reforming the state to promote growth. Paris; 2013.

16. International Labour Organization. Portugal - Tackling the job crisis in Portugal. Switzerland; 2014.

17. Carneiro A, Portugal P, Varejao J. Catastrophic job destruction during the Portuguese economic crisis. J Macroecon. Elsevier; 2014;39:444–57.

18. Torres S. Os jovens no mercado de trabalho: indicadores de medida em confronto. Lisboa; 2013.

19. World Health Organization. Impact of economic crises on mental health. Copenhagen: World Health Organization. Regional Office for Europe; 2011.

20. Gallup Europe. 5th European Working Conditions Survey - Techinal Report. UK Data Archive. Dublin; 2012.

21. Farioli A, Mattioli S, Quaglieri A, Curti S, Violante FS, Coggon D. Musculoskeletal pain in Europe: role of personal, occupational and social risk factors. Scand J Work Environ Health. Europe PMC Funders; 2014;40(1):36.

22. Picavet HSJ, Schouten J. Musculoskeletal pain in the Netherlands: prevalences, consequences and risk groups, the DMC 3-study. Pain. Elsevier; 2003;102(1):167–78.

23. Instituto Nacional de Estatística IP. Inquérito Nacional de Saúde 2014. Lisboa; 2016.

24. Goldman MB, Hatch M. Women and Health [Internet]. Califórnia: Academic Press; 2000. 1276 p. Available from: https://books.google.es/books?id=zSCgj8LXFHAC

25. Rollman GB, Lautenbacher S. Sex differences in musculoskeletal pain. Clin J Pain. 2001;17(1):20–4.

26. Côté JN. A critical review on physical factors and functional characteristics that may explain a sex/gender difference in work-related neck/shoulder disorders. Ergonomics. Taylor & Francis; 2012;55(2):173–82.

27. Messing K, Ostlin P. Gender equality, work and health: a review of the evidence. Geneva Switzerland World Health Organization [WHO] Department of Gender Women and Health 2006.; 2006.

28. Strazdins L, Bammer G. Women, work and musculoskeletal health. Soc Sci Med. Elsevier; 2004;58(6):997–1005.

29. Dahlberg R, Karlqvist L, Bildt C, Nykvist K. Do work technique and musculoskeletal symptoms differ between men and women performing the same type of work tasks? Appl Ergon [Internet]. 2004;35(6):521–9. Available from: http://www.sciencedirect.com/science/article/pii/S0003687004001061

30. Buckwalter JA, Woo SL, Goldberg VM, Hadley EC, Booth F, Oegema TR, et al. Soft-tissue aging and musculoskeletal function. J Bone Jt Surg Am. The American Orthopedic Association; 1993;75(10):1533–48.

31. Luime JJ, Kuiper JI, Koes BW, Verhaar JAN, Miedema HS, Burdorf A. Work-related risk factors

for the incidence and recurrence of shoulder and neck complaints among nursing-home and elderly-care workers. Scand J Work Environ Health. JSTOR; 2004;279–86.

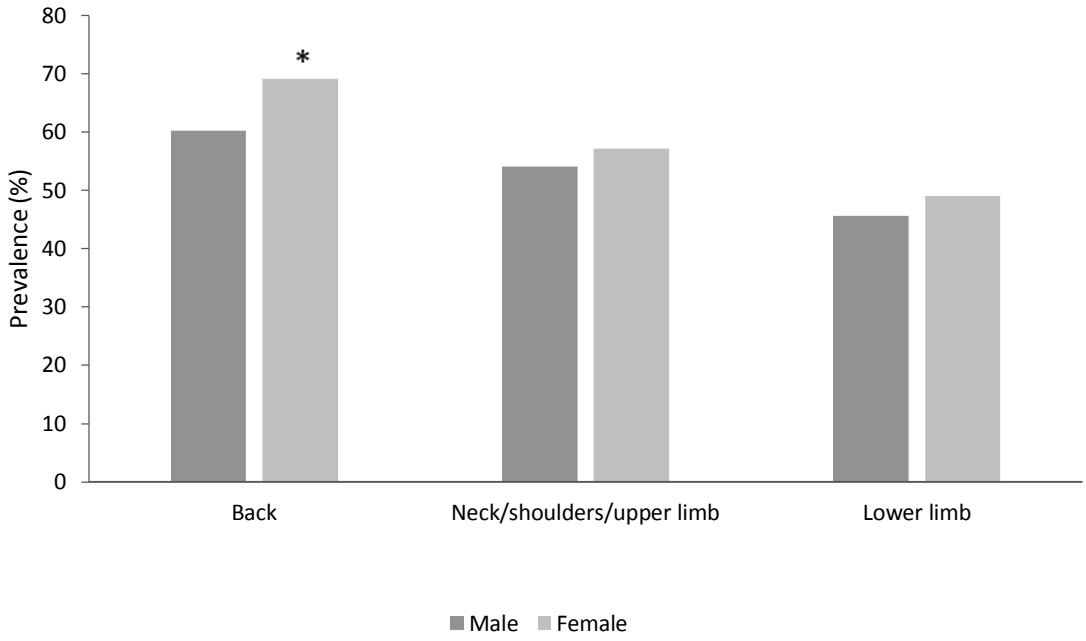
32. Garcia M-G, Läubli T, Martin BJ. Long-term muscle fatigue after standing work. Hum Factors J Hum Factors Ergon Soc. SAGE Publications; 2015;0018720815590293.

33. Karasek Jr RA. Job demands, job decision latitude, and mental strain: Implications for job redesign. Adm Sci Q. JSTOR; 1979;285–308.

Table 1: General description of the sample population

		Male	Female	p-value
Age	15-29	18.4	16.0	0.792
	30-44	39.8	42.4	
	45-59	34.9	33.9	
	≤60	7.0	7.7	
Highest level of education	Primary	68.0	63.0	0.002
	Secondary	22.6	18.4	
	Tertiary	9.5	18.6	
Occupation	Legislators, senior officials and managers	6.0	6.3	<0.001
	Professionals	7.8	13.7	
	Technicians and associate professionals	11.3	7.9	
	Clerks	7.5	13.0	
	Service workers and shop and market sales workers	9.0	27.4	
	Skilled agricultural and fishery workers	7.8	2.7	
	Craft and related trades workers	30.1	6.9	
	Plant and machine operators and assemblers	12.9	4.7	
	Elementary occupations	7.5	17.4	
Work-family conflict		19.2	19.7	0.775
Taking care of relatives		40.9	59.1	<0.001
Housework or Cooking		36.6	93.3	<0.001
Repairs or Gardening		2.4	1.3	0.436
Employment status	Self-employed with employees	11.2	12.8	0.745
	Self-employed with employees	3.4	2.7	
	Employee	83.8	82.2	
	Other	1.6	2.0	
Employment contract	Indefinite contract	62.1	55.0	0.306
	Fixed-term contract	11.9	14.3	
	Other	9.5	12.4	
Number of hours per week	≤35	15.8	32.8	<0.001
	36-40	50.9	46.7	
	41-54	19.0	13.3	
	≥55	10.1	4.2	
Having a second job		5.2	6.2	0.550
Physical exposures	Vibrations	21.7	11.7	<0.001
	Low temperatures	6.1	3.7	0.173
	Tiring or painful positions	36.5	34.8	0.527
	Lifting or moving people	1.5	5.3	0.007
	Carrying or moving heavy loads	9.5	3.4	0.002
	Standing	66.3	64.2	0.466
	Repetitive hand or arm movements	59.9	56.2	0.231
	Working with computers	24.4	27.5	0.361
Night shift		9.0	4.3	
No manager support		5.6	9.1	0.057
No colleagues support		3.0	4.1	0.317
Job-control model	Low strain	19.7	29.4	0.004
	Passive	25.8	25.4	
	Active	14.9	17.3	
	High strain	39.7	27.9	

Figure 2: Prevalence (%) of musculoskeletal pain of back, neck/shoulders/upper limb and lower limb in the previous 12 months among Portuguese workers



*p-value<0.02

Table 2: Associations between back pain and individual risk factors

	Male				Female			
	PR	95% CI	aPR	95% cI	PR	95% CI	aPR	95% CI
Age								
15-29	1.00	Ref			1.00	Ref		
30-44	1.70	1.05-2.74			1.44	0.98-2.13		
45-59	1.90	1.18-3.06			1.57	1.06-2.31		
≥60	2.17	1.23-3.82			1.69	1.03-2.76		
Highest level of education								
Primary	1.00	Ref	1.00	Ref	1.00	Ref	1.00	Ref
Secondary	0.73	0.53-1.02	0.82	0.58-1.16	0.75	0-55-1.01	0.80	0.59-1.10
Tertiary	0.75	0.48-1.16	0.82	0.53-1.29	0.65	0.46-0.92	0.69	0.49-0.99
Occupation								
Legislators, senior officials and managers	1.00	Ref	1.00	Ref	1.00	Ref	1.00	Ref
Professionals	0.63	0.32-1.22	0.64	0.31-1.32	0.86	0.51-1.45	1.11	0.62-1.99
Technicians and associate professionals	0.89	0.47-1.67	1.00	0.53-1.91	1.19	0.62-2.28	1.28	0.67-2.46
Clerks	0.50	0.25-1.01	0.54	0.27-1.11	0.96	0.59-1.57	1.06	0.64-1.75
Service workers and shop and market sales workers	0.75	0.44-1.31	0.83	0.47-1.44	1.14	0.74-1.76	1.21	0.77-1.89
Skilled agricultural and fishery workers	1.24	0.68-2.30	1.16	0.61-2.18	1.62	0.66-3.92	1.23	0.50-3.06
Craft and related trades workers	1.10	0.72-1.70	1.21	0.77-1.91	1.44	0.86-2.41	1.45	0.85-2.47
Plant and machine operators and assemblers	1.20	0.72-1.98	1.32	0.78-2.25	1.29	0.65-2.56	1.32	0.65-2.66
Elementary occupations	1.06	0.63-1.78	1.13	0.66-1.93	1.21	0.78-1.88	1.16	0.74-1.83
Work-family conflict	1.18	0.89-1.58	1.31	0.97-1.77	1.21	0.94-1.56	1.21	0.93-1.57
Taking care of relatives	1.17	0.92-1.49	1.19	0.94-1.53	1.09	0.87-1.35	1.07	0.86-1.34
Housework or Cooking	1.24	0.98-1.57	1.27	0.99-1.62	1.46	0.82-2.61	1.23	0.68-2.21
Repairs or gardening	1.28	0.63-2.59	1.11	0.54-2.29	1.45	0.65-3.25	1.29	0.56-2.96
Employment status								
Self-employed with employees	1	Ref	1	Ref	1	Ref	1	Ref
Self-employed with employees	0.92	0.48-1.74	0.90	0.46-1.76	1.06	0.58-1.96	1.27	0.66-2.45
Employee	0.89	0.64-1.25	1.03	0.70-1.51	0.89	0.65-1.20	0.85	0.59-1.22
Other	1.45	0.57-3.67	1.19	0.45-3.10	0.90	0.44-1.84	0.76	0.36-1.60
Employment contract								
Indefinite contract	1	Ref	1	Ref	1	Ref	1	Ref
Fixed-term contract	1.02	0.68-1.54	1.21	0.78-1.85	0.98	0.69-1.37	1.03	0.72-1.47
Other	1.17	0.77-1.77	1.12	0.72-1.72	1.27	0.94-1.71	1.20	0.86-1.68
Number of hours per week								
≤35	1	Ref	1	Ref	1	Ref	1	Ref
36-40	1.06	0.73-1.54	1.08	0.72-1.62	1.02	0.80-1.29	1.01	0.78-1.31
41-54	1.41	0.93-2.14	1.32	0.85-2.06	0.93	0.66-1.32	0.95	0.66-1.38
≥55	1.25	0.77-2.02	1.23	0.74-2.04	1.09	0.67-1.78	1.06	0.63-1.78
Having a second job	1.13	0.69-1.85	1.38	0.83-2.28	0.93	0.59-1.46	0.99	0.63-1.57
Physical exposures								
Vibrations	1.27	0.97-1.66	1.19	0.89-1.59	1.27	0.93-1.73	1.14	0.77-1.70
Low temperatures	1.36	0.90-2.05	1.26	0.81-1.96	1.18	0.68-2.05	1.18	0.67-2.07
Tiring or painful positions	1.68	1.33-2.13	1.54	1.20-1.98	1.42	1.15-1.76	1.35	1.08-1.70
Lifting or moving people	1.06	0.39-2.84	1.44	0.52-3.97	1.27	0.85-1.89	1.19	0.78-1.83
Carrying or moving heavy loads	1.33	0.92-1.94	1.23	0.84-1.80	1.28	0.77-2.15	1.20	0.71-2.04

Standing	1.21	0.93-1.57	1.09	0.79-1.48	1.14	0.91-1.44	1.06	0.79-1.41
Repetitive hand or arm movements	1.37	1.06-1.76	1.26	0.95-1.66	1.15	0.92-1.42	1.04	0.82-1.33
Working with computers	0.59	0.42-0.83	0.69	0.43-1.09	0.73	0.56-0.95	0.89	0.62-1.27
Night shift	0.88	0.54-1.42	0.99	0.61-1.62	0.78	0.43-1.43	0.85	0.46-1.57
No manager support	1.32	0.85-2.05	1.10	0.69-1.74	1.01	0.70-1.47	0.95	0.64-1.40
No colleagues support	1.19	0.63-2.24	0.99	0.52-1.90	1.04	0.62-1.75	0.97	0.57-1.68
Job control model								
Low strain	1.00	Ref	1.00	Ref	1.00	Ref	1.00	Ref
Passive	0.86	0.60-1.24	0.93	0.63-1.37	0.93	0.69-1.25	0.97	0.70-1.34
Active	1.01	0.67-1.52	1.15	0.75-1.76	1.05	0.76-1.47	1.20	0.85-1.72
High strain	1.03	0.75-1.41	1.12	0.79-1.57	1.06	0.80-1.41	1.12	0.80-1.55

95% CI: 95% confidence interval

aPR: adjusted prevalence ratio for age, education and occupation. Education was adjusted for age and occupation was adjusted for age and education

Table 3: Associations between neck/shoulders and upper limb pain and individual risk factors

	Male				Female			
	PR	95% CI	aPR	95%	PR	95% CI	aPR	95% CI
Age								
15-29	1.00	Ref			1.00	Ref		
30-44	1.36	0.85-2.16			1.15	0.77-1.73		
45-59	1.52	0.96-2.41			1.45	0.98-2.16		
≥60	1.58	0.86-2.82			1.27	0.74-2.17		
Highest level of education								
Primary	1.00	Ref	1.00	Ref	1.00	Ref	1.00	Ref
Secondary	0.77	0.55-1.08	0.82	0.57-1.17	0.83	0.61-1.14	0.89	0.64-1.24
Tertiary	0.45	0.25-0.81	0.47	0.26-0.85	0.64	0.44-0.94	0.70	0.46-1.00
Occupation								
Legislators, senior officials and managers	1.00	Ref	1.00	Ref	1.00	Ref	1.00	Ref
Professionals	0.71	0.35-1.45	0.99	0.46-2.14	0.94	0.53-1.69	1.21	0.63-2.32
Technicians and associate professionals	0.88	0.43-1.79	0.96	0.47-1.99	1.44	0.71-2.89	1.52	0.75-3.06
Clerks	0.62	0.30-1.28	0.66	0.32-1.38	1.03	0.60-1.80	1.09	0.62-1.93
Service workers and shop and market sales workers	0.82	0.45-1.49	0.80	0.44-1.46	1.19	0.73-1.94	1.26	0.76-2.09
Skilled agricultural and fishery workers	1.27	0.65-2.50	1.07	0.54-2.14	1.05	0.31-3.53	0.81	0.23-2.77
Craft and related trades workers	1.22	0.76-1.96	1.15	0.70-1.88	1.76	1.00-3.09	1.80	1.01-3.22
Plant and machine operators and assemblers	1.40	0.81-2.41	1.32	0.75-2.32	1.26	0.57-2.77	1.31	0.59-2.95
Elementary occupations	1.19	0.67-2.09	1.09	0.61-1.94	1.39	0.85-2.29	1.36	0.82-2.27
Having a second job	0.97	0.55-1.69	1.17	0.66-2.07	1.12	0.71-1.77	1.20	0.75-1.90
Taking care of relatives	1.12	0.87-1.44	1.11	0.85-1.43	1.10	0.87-1.40	1.07	0.84-1.37
Housework or Cooking	1.16	0.90-1.49	1.21	0.93-1.57	1.64	0.85-3.19	1.36	0.69-2.68
Repairs or gardening	1.45	0.72-2.93	1.32	0.64-2.70	1.44	0.60-3.49	1.34	0.54-3.35
Employment status								
Self-employed with employees	1.00	Ref	1.00	Ref	1.00	Ref	1.00	Ref
Self-employed with employees	0.90	0.44-1.82	0.90	0.43-1.88	0.78	0.37-1.66	0.90	0.41-2.01
Employee	0.95	0.66-1.37	1.10	0.73-1.66	0.90	0.65-1.26	0.80	0.54-1.18
Other	0.68	0.16-2.84	0.55	0.13-1.56	0.84	0.38-1.87	0.67	0.29-1.53
Employment contract								
Indefinite contract	1.00	Ref	1.00	Ref	1.00	Ref	1.00	Ref
Fixed-term contract	0.96	0.62-1.49	1.10	0.69-1.74	0.87	0.60-1.28	0.92	0.61-1.38
Other	1.17	0.81-1.90	1.19	0.76-1.85	1.33	0.97-1.83	1.20	0.84-1.71
Number of hours per week								
≤35	1.00	Ref	1.00	Ref	1.00	Ref	1.00	Ref
36-40	1.09	0.73-1.61	0.99	0.65-1.52	1.01	0.78-1.32	1.01	0.76-1.34
41-54	1.28	0.82-2.00	1.09	0.68-1.75	0.89	0.60-1.31	0.95	0.63-1.42
≥55	1.03	0.60-1.75	0.98	0.56-1.71	1.17	0.70-1.97	1.29	0.74-2.24
Work-family conflict	1.14	0.84-1.56	1.26	0.91-1.73	1.19	0.90-1.58	1.20	0.90-1.59
Physical exposures								
Vibrations	1.48	1.12-1.94	1.33	0.99-1.79	1.48	1.08-2.04	1.36	0.90-2.06
Low temperatures	1.41	0.92-2.16	1.31	0.83-2.07	1.30	0.73-2.32	1.28	0.71-2.31
Tiring or painful positions	1.86	1.45-2.40	1.71	1.31-2.22	1.65	1.31-2.08	1.55	1.21-1.99
Lifting or moving people	1.50	0.62-3.64	1.85	0.74-4.65	1.41	0.93-2.14	1.40	0.90-2.19
Carrying or moving heavy loads	1.47	1.00-2.15	1.33	0.90-1.96	1.12	0.61-2.04	1.07	0.58-1.97
Standing	1.29	0.97-1.70	1.11	0.80-1.54	1.10	0.86-1.40	1.03	0.75-1.41

Repetitive hand or arm movements	1.61	1.23-2.13	1.46	1.08-1.98	1.33	1.04-1.69	1.18	0.91-1.54
Working with computers	0.54	0.37-0.79	0.72	0.45-1.17	0.67	0.50-0.90	0.74	0.50-1.11
Night shift	1.01	0.62-1.63	1.09	0.66-1.79	0.95	0.52-1.74	1.09	0.59-2.02
No manager support	1.16	0.71-1.88	0.98	0.59-1.62	0.97	0.65-1.47	0.91	0.59-1.39
No colleagues support	1.18	0.60-2.30	0.97	0.49-1.93	1.07	0.61-1.87	1.00	0.56-1.80
Job control model								
Low strain	1.00	Ref	1.00	Ref	1.00	Ref	1.00	Ref
Passive	0.91	0.61-1.37	0.95	0.63-1.45	0.92	0.66-1.28	0.97	0.68-1.38
Active	1.06	0.67-1.65	1.23	0.77-1.96	1.05	0.73-1.52	1.19	0.80-1.75
High strain	1.23	0.87-1.74	1.32	0.91-1.92	1.19	0.87-1.62	1.26	0.88-1.80

95% CI: 95% confidence interval

aPR: adjusted prevalence ratio for age, education and occupation. Education was adjusted for age and occupation was adjusted for age and education

Table 4: Associations between lower limb pain and individual risk factors

	Male				Female			
	PR	95% CI	aPR	95%	PR	95% CI	aPR	95% CI
Age								
15-29	1.00	Ref			1.00	Ref		
30-44	1.37	0.80-2.36			1.41	0.87-2.29		
45-59	1.93	1.14-3.28			1.94	1.21-3.12		
≥60	2.35	1.26-4.38			2.06	1.15-3.69		
Highest level of education								
Primary	1.00	Ref	1.00	Ref	1.00	Ref	1.00	Ref
Secondary	0.55	0.36-0.83	0.64	0.42-0.97	0.71	0.50-1.01	0.82	0.57-1.18
Tertiary	0.25	0.11-0.56	0.28	0.12-0.63	0.37	0.22-0.62	0.42	0.25-0.70
Occupation								
Legislators, senior officials and managers	1.00	Ref	1.00	Ref	1.00	Ref	1.00	Ref
Professionals	0.44	0.17-1.12	0.82	0.30-2.24	0.61	0.31-1.19	1.04	0.50-2.18
Technicians and associate professionals	0.90	0.41-1.98	1.14	0.51-2.52	1.16	0.54-2.50	1.29	0.59-2.77
Clerks	0.69	0.32-1.51	0.82	0.37-1.79	0.70	0.38-1.30	0.76	0.40-1.43
Service workers and shop and market sales workers	0.60	0.29-1.23	0.60	0.29-1.24	1.17	0.71-1.94	1.27	0.75-2.13
Skilled agricultural and fishery workers	1.90	0.97-3.73	1.40	0.70-2.78	1.84	0.69-4.93	1.18	0.43-3.25
Craft and related trades workers	1.34	0.79-2.25	1.22	0.71-2.09	1.19	0.64-2.24	1.21	0.64-2.31
Plant and machine operators and assemblers	1.10	0.58-2.08	1.02	0.53-1.95	1.47	0.69-3.17	1.55	0.70-3.40
Elementary occupations	1.67	0.93-3.01	1.46	0.81-2.66	1.43	0.86-2.37	1.35	0.80-2.26
Work-family conflict	1.10	0.79-1.55	1.38	0.97-1.97	1.22	0.90-1.64	1.27	0.94-1.73
Taking care of relatives	1.01	0.76-1.33	1.06	0.80-1.40	1.11	0.86-1.43	1.10	0.85-1.44
Housework or Cooking	1.06	0.81-1.40	1.10	0.83-1.47	1.82	0.86-3.87	1.41	0.66-3.03
Repairs or gardening	1.72	0.85-3.49	1.40	0.68-2.91	1.34	0.50-3.61	1.02	0.37-2.82
Employment status								
Self-employed with employees	1.00	Ref	1.00	Ref	1.00	Ref	1.00	Ref
Self-employed with employees	0.69	0.30-1.57	0.77	0.33-1.81	0.95	0.45-1.96	1.18	0.54-2.59
Employee	0.86	0.59-1.27	1.19	0.77-1.84	0.80	0.57-1.14	0.81	0.53-1.22
Other	1.87	0.73-4.81	1.25	0.47-3.31	1.04	0.48-2.22	0.78	0.35-1.73
Employment contract								
Indefinite contract	1.00	Ref	1.00	Ref	1.00	Ref	1.00	Ref
Fixed-term contract	1.10	0.70-1.73	1.28	0.80-2.06	1.06	0.72-1.56	1.16	0.76-1.77
Other	0.95	0.56-1.60	0.79	0.46-1.37	1.17	0.81-1.69	0.95	0.63-1.42
Number of hours per week								
≤35	1.00	Ref	1.00	Ref	1.00	Ref	1.00	Ref
36-40	1.17	0.75-1.79	1.17	0.73-1.89	0.99	0.74-1.33	1.08	0.79-1.47
41-54	1.31	0.80-2.15	1.25	0.75-2.10	1.06	0.71-1.57	1.16	0.76-1.78
≥55	1.11	0.62-1.99	1.22	0.67-2.24	1.31	0.77-2.24	1.30	0.73-2.31
Having a second job	0.60	0.28-1.28	0.85	0.39-1.83	1.11	0.68-1.81	1.24	0.75-2.05
Physical exposures								
Vibrations	1.66	1.24-2.22	1.56	1.13-2.14	1.32	0.93-1.89	1.33	0.84-2.11
Low temperatures	1.96	1.30-2.95	1.50	0.96-2.34	1.40	0.76-2.56	1.41	0.76-2.61
Tiring or painful positions	1.80	1.37-2.37	1.48	1.10-1.96	1.48	1.15-1.90	1.33	1.02-1.73
Lifting or moving people	1.78	0.73-4.32	2.80	1.10-7.10	1.59	1.04-2.45	1.42	0.90-2.25
Carrying or moving heavy loads	1.58	1.05-2.36	1.31	0.87-1.98	1.44	0.81-2.57	1.28	0.71-2.30

Standing	1.97	1.40-2.77	1.55	1.05-2.30	1.73	1.29-2.32	1.47	1.01-2.11
Repetitive hand or arm movements	1.65	1.22-2.23	1.32	0.95-1.82	1.27	0.98-1.64	1.10	0.83-1.47
Working with computers	0.47	0.31-0.72	0.79	0.46-1.38	0.59	0.42-0.83	1.00	0.63-1.58
Night shift	0.85	0.49-1.50	1.02	0.57-1.81	0.80	0.40-1.62	0.94	0.46-1.93
No supervisor support	1.16	0.68-1.98	0.89	0.51-1.56	1.01	0.65-1.58	0.91	0.57-1.45
No colleagues support	1.41	0.72-2.77	1.16	0.58-2.32	1.38	0.80-2.39	1.20	0.67-2.13
Job control model								
Low strain	1.00	Ref	1.00	Ref	1.00	Ref	1.00	Ref
Passive	0.81	0.53-1.24	0.99	0.63-1.56	0.79	0.55-1.13	0.91	0.62-1.34
Active	0.87	0.54-1.43	1.19	0.72-1.99	0.90	0.61-1.34	1.21	0.79-1.84
High strain	1.07	0.74-1.54	1.36	0.92-2.03	0.92	0.66-1.28	1.14	0.76-1.69

95% CI: 95% confidence interval

aPR: adjusted prevalence ratio for age, education and occupation. Education was adjusted for age and occupation was adjusted for age and education

5. Conclusion

Conclusion

In Portugal there is a disappointing shortage of clinical, epidemiological and economic evidence on the extent and determinants of work-related MSDs. However, the EWCS provided a unique opportunity to monitor the musculoskeletal system health of Portuguese workers.

The evidence in this thesis illustrates that musculoskeletal pain is a common phenomenon among Portuguese workers. In fact, with the increase in age, Portuguese workers were more likely to report musculoskeletal pain. Although there were occasional differences between major occupational groups, no specific job seemed disproportionally affected. Over the years, the differences of self-reported musculoskeletal pain between Portuguese and EU14 workers seemed to be more influenced by macro-level socioeconomic differences between countries than by individual risk factors. However, when analysing the determinants of musculoskeletal pain in the Portuguese workforce, the prevalence of self-reported musculoskeletal pain was mainly associated to exposure physical risk factors at workplace.

As in all scientific studies, our research has its strengths and limitations. The EWCS questionnaire was developed in English and afterwards translated into 32 languages, so it is possible that certain terms were perceived differently in different languages and cultures. The high proportion of refuses may have introduced some degree of selection bias which may limit the generalisability of the results in the countries examined. However, as far as we know, these were the firsts studies conducted in the general Portuguese workforce. Additionally, all data were collected in 34 countries using standardized methods, therefore the results obtained in our studies are comparable to other studies that also used the EWCS.

MSDs affects a person's ability to work, both physically and psychologically and may have a negative impact on the worker, his family, on employers and on society. Strategies focused in improving the surveillance and management of MSDs are fundamental in order to reduce their incidence and severity at a population level.

6. References

References

1. Assembly UNG. Universal declaration of human rights. UN General Assembly. Paris: Taylor & Francis; 1948.

2. Bevan S, Quadrello T, McGee R, Mahdon M, Vavrovsky A, Barham L. Fit for work? Musculoskeletal disorders in the European workforce. London; 2009.

3. World Health Organization. Workers' health: global plan of action. WHA6026. Geneva; 2007.

4. World Health Organization. Global strategy on occupational health for all: the way to health at work - Recommendation of the Second Meeting of the WHO Collaborating Centres in Occupational Health, 11-14 October 1994, Beijing, China. Geneva: World Health Organization; 1995.

5. European Comission. Communication from the Comission to the European Parliament, the Council, the European Economic and Social Committee and the Committe of the regions on an EU Strategic Framework on Health and Safety at Work 2014-2020. 2014.

6. European Commission. Europe 2020: A Strategy for Smart, Sustainable and Inclusive Growth - Communication from the Commission. Brussels: Publications Office of the European Union; 2010.

7. Benavides FG, Amable M, Boix P, Castejón E, Bosch C, García AM, et al. Informe de salud laboral. España, 2006. Barcelona: Observatorio de Salud Laboral; 2007.

8. Monjardino T, Amaro J, Batista A, Norton P, Lucas R, Benavides FG. Trabalho e Saúde em Portugal. Porto: Instituto de Saúde Pública da Universidade do Porto; 2016.

9. Santos C, Moreira S. Programa Nacional de Saúde Ocupacional (PNSOC) – 2º Ciclo 2013/2017. Lisboa; 2013. p. 50.

10. Alli BO. Fundamental principles of occupational health and safety. Second edi. Geneva: International Labour Office; 2001.

11. Santos C. Desenvolvimento da saúde ocupacional em Portugal e a prática profissional dos médicos do trabalho. Universidade Nova de Lisboa; 2004.

12. Kotzeva M. Accidents at work statistics [Internet]. Eurostat. 2015 [cited 2016 Aug 20].

Available from: http://ec.europa.eu/eurostat/statistics-explained/index.php/Accidents_at_work_statistics

13. Castro A. A revolução industrial em Portugal no século XIX [Internet]. 3ª Edição. Porto: Limiar; 1978. Available from: https://books.google.pt/books?id=8bwgAQAAMAAJ

14. Reis J. A industrialização num país de desenvolvimento lento e tardio: Portugal, 1870-1913. Análise Soc. JSTOR; 1987;XXIII(96):207–27.

15. Autoridade para as Condições de Trabalho. Evolução Histórica [Internet]. 2016 [cited 2016 Aug 20]. Available from: http://www.act.gov.pt/(pt-PT)/SobreACT/QuemSomos/EvolucaoHistorica/Paginas/default.aspx

16. Concelho Económico e Social. Acordo de Segurança, Higiene e Saúde no Trabalho. Lisboa: Conselho Económico e Social; 1991.

17. European Trade Union Institute. Occupational health services in need of emergency care. Brussels; 2014.

18. Carneiro P. LME na prestação de cuidados de saúde ao domicílio: avaliação do risco e construção de modelos estatísticos de previsão. Universidade do Minho; 2012.

19. Dieppe PA, Lohmander LS. Pathogenesis and management of pain in osteoarthritis. Lancet. Elsevier; 2005;365(9463):965–73.

20. McBeth J, Jones K. Epidemiology of chronic musculoskeletal pain. Best Pract Res Clin Rheumatol. Elsevier; 2007;21(3):403–25.

21. World Health Organization. International Classification of Functioning, Disability and Health: ICF. Geneva: World Health Organisation; 2001.

22. Punnett L, Wegman DH. Work-related musculoskeletal disorders: the epidemiologic evidence and the debate. J Electromyogr Kinesiol. Elsevier; 2004;14(1):13–23.

23. Woolf AD, Pfleger B. Burden of major musculoskeletal conditions. Bull World Health Organ. SciELO Public Health; 2003;81(9):646–56.

24. Picavet HSJ, Schouten J. Musculoskeletal pain in the Netherlands: prevalences, consequences and risk groups, the DMC 3-study. Pain. Elsevier; 2003;102(1):167–78.

25. Gatchel RJ, Schultz IZ. Handbook of Musculoskeletal Pain and Disability Disorders in the Workplace [Internet]. London: Springer-Verlag New York; 2014. Available from: https://books.google.pt/books?id=T5qKAwAAQBAJ

26. Zheltoukhova K. Musculoskeletal Disorders and Work: Results of a survey of individuals living with Musculoskeletal Disorders in six European countries. London; 2013.

27. Bevan S, Parvanova A, Petersson IF. Fit for Work Europe - The EU Reflection Process on Chronic Diseases: Supporting National Plans on Musculoskeletal Disorders [Internet]. Fit for Work Europe; 2012. Available from: http://www.fitforworkeurope.eu/FfW_Chronic Conditions Position Paper_Circulation_Final_v10.pdf

28. Barondess JA, Cullen MR, de Lateur BJ, Deyo RA, Donaldson KS, Drury CG, et al. Musculoskeletal disorders and the workplace: Low back and upper extremities. Washington, DC: National Academy of Sciences. Washington, D.C.: National Academy of Sciences; 2001. 17-37 p.

29. Bernard BP, Putz-Anderson V, Burt SE. A critical review of epidemiologic evidence for work-related musculoskeletal disorders of the neck, upper extremity, and low back. Cincinnati: Centers for Disease Control and Prevention National Institute for Occupational Safety and Health publication. Cincinnati: National Institute for Occupational Safety and Health; 1997.

30. Telaprolu N, Anne SD. Physical and psychological work demands as potential risk factors for musculoskeletal disorders among workers in weaving operations. Indian J Occup Environ Med. Medknow Publications; 2014;18(3):129.

31. Widanarko B, Legg S, Devereux J, Stevenson M. Interaction between physical and psychosocial risk factors on the presence of neck/shoulder symptoms and its consequences. Ergonomics. Taylor & Francis; 2015;58(9):1507–18.

32. Palmer KT, Harris EC, Coggon D. Carpal tunnel syndrome and its relation to occupation: a systematic literature review. Occup Med (Chic Ill). Soc Occupational Med; 2007;57(1):57–66.

33. Rasmussen-Barr E, Grooten WJA, Hallqvist J, Holm LW, Skillgate E. Are job strain and sleep disturbances prognostic factors for neck/shoulder/arm pain? A cohort study of a general population of working age in Sweden. BMJ Open. British Medical Journal Publishing Group; 2014;4(7):e005103.

34. Van der Doef M, Maes S. The job demand-control (-support) model and psychological well-being: a review of 20 years of empirical research. Work Stress. Taylor & Francis; 1999;13(2):87–114.

35. Karasek Jr RA. Job demands, job decision latitude, and mental strain: Implications for job redesign. Adm Sci Q. JSTOR; 1979;24(2):285–308.

36. Coggon D, Ntani G, Palmer KT, Felli VE, Harari R, Barrero LH, et al. Disabling musculoskeletal pain in working populations: is it the job, the person, or the culture? PAIN®. Elsevier; 2013;154(6):856–63.

37. Instituto Nacional de Estatística I. Inquérito Nacional de Saúde 2014. Lisboa; 2016.

38. Rabiais S, Nogueira PJ, Falcão J. A dor na população portuguesa: alguns aspectos epidemiológicos. ONSA. Instituto Nacional de Saúde Dr. Ricardo Jorge. Lisboa; 2003.

39. Lucas R, Monjardino MT. O estado da reumatologia em Portugal. Observatório Nacional das Doenças Reumáticas. Porto; 2010. 40-91 p.

40. Cunha-Miranda L, Carnide F, Fátima Lopes M. Prevalence of Rheumatic Occupational Diseases - PROUD Study. Acta Reum Port. 2010;35(2):215–26.

41. Serranheira F, Cotrim T, Rodrigues V, Nunes C, Sousa-Uva A. Lesões musculoesqueléticas ligadas ao trabalho em enfermeiros portugueses: «ossos do ofício» ou doenças relacionadas com o trabalho? Rev Port Saúde Pública [Internet]. 2012 Jul [cited 2015 Jul 31];30(2):193–203. Available from: http://www.sciencedirect.com/science/article/pii/S0870902512000314