THE NUMBER OF PAIN SITES IN INDIVIDUALS SEEKING PHYSIOTHERAPY AND THE ASSOCIATION WITH BIOPSYCOSOCIAL PAIN CHARACTERISTICS: A CROSS-SECTIONAL STUDY.

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PREFACE

This master's thesis is the last part of a full - time master's program. When I started on the master's degree in “aktivitet og bevegelse”, I did the mandatory practice to become a certified physical therapist. After mandatory practice, I was offered a job at the bachelor's program in physiotherapy at NTNU. Using the knowledge acquired from the master's program in both workplaces have been convenient and valuable.

The topic for this master's thesis is of personal interest, and it is also a field of research that has received increased attention in recent years. Pain in general is a central part of the work as a physical therapist, and I am grateful for the opportunity to immerse myself in this field because I will benefit from the knowledge acquired in later work and practice.

Completing the master’s degree alongside the jobs has been an educational, motivating, and challenging process filled with emotions. It is strange to see how the final product has turned out to be after all the reading, writing, deleting, and rewriting. Now, I am proud to have completed the master’s degree and to deliver the final thesis one year after certification. This could not have been possible without the support and the cooperation that I have had with the people around me. Consequently, there are many who deserves a thank.

First of all, I would like to thank FYSIOPRIM who has given me access to the raw data used in this thesis. I am very grateful for the quick and decisive supervision and feedback received from my co-supervisor Ingebrigt Meisingset both during and outside the working hours. The quality of this thesis would not have been as it is without him. I would also like to thank my employer NTNU who has made it possible to combine work and study, my colleagues who have simulated to reflection, and significant others who have supported me during the process. Finally, a big thanks to my main supervisor Håvard Østerås for facilitating the master's thesis, good feedback, useful discussions, and the ability to motivate me throughout the whole master's course.

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ABSTRACT

Musculoskeletal pain is common and several variables have shown to be prognostic regardless of primary pain site. In recent years, epidemiological studies have reported multisite pain to be common in the general population. However, few studies have investigated the number of pain sites and the association with prognostic variables in a clinical sample. The **objective** of this study was to describe the number of musculoskeletal pain sites in patients seeking physiotherapy and investigate the association between the number of pain sites and prognostic variables. The **study sample** consisted of 742 individuals with either neck, shoulder, or back complaint as well as individuals with osteoarthritis of the hip or knee. A multisite pain / complex condition was also included. This study used a cross-sectional **design** with self-report questionnaires. The Standardised Nordic Questionnaire was used to measure the number of pain sites. The **results** showed multisite pain to be prevalent in the study sample. Individuals with osteoarthritis of the hip or knee and individuals with complaints in the shoulder and the back showed similarities in the number of pain sites. These complaint groups reported fewer pain sites than individuals with neck complaints. The multisite pain / complex group had the highest prevalence of multisite pain. Lower age, female gender, higher BMI, and a more severe / worsen level on all included prognostic variables were associated with a higher number of pain sites. Results from the stepwise backward regression analysis showed that lower age, higher BMI, female gender, and a more severe /worsen level of pain intensity, pain duration, work ability, and mental distress, demonstrated the strongest association with an increasing number of pain sites, accounting for 30% of the variance. In the **discussion**, the number of pain sites is compared to previous research and important variables are discussed. The need for a holistic treatment regime and more attention on the number of pain sites in clinical samples is addressed.

Keywords: Multisite pain; Single site pain; Biopsychosocial patient characteristics; Physical therapy; Primary care; Activity restrictions; Fear-avoidance; Self-efficacy, Sleeping quality; Disability.

CONTENT

LIST OF ABBERVIATIONS

BMI	Body mass index.
ICPC	The International Classification of Primary Care.
NPS	Number of pain sites.
VIF	Variance inflation factor
WHO	Worlds health organization.
ÖMPSQ	The Örebro Musculoskeletal Pain Screening Questionnaire.

INTRODUCTION

Musculoskeletal pain is common in the general population (Christensen, Johansen & Knardahl, 2017; Ihlebæk, Brage, Natvig & Bruusgaard, 2010; Picavet & Schouten, 2003; Vos et al., 2017), with a global prevalence estimated to be 30% (Cimmino, Ferrone, & Cutolo, 2011). Nearly 1 in 12 have musculoskeletal complaints that have lasted for at least 15 days (Hagen, Svebak & Zwart, 2006), 51% have complaints that have lasted for more than three months (Holth, Kine, Werpen, Zwart & Hagen, 2008) and 91% have experienced musculoskeletal pain during the past 12 months (Kamaleri, Natvig, Ihlebaek, Benth & Bruusgaard, 2008).

Musculoskeletal pain is an important reason for individuals seeking medical care (Kinge, Knudsen, Skirbekk & Vollset, 2015; Mose, Christiansen, Jensen & Andersen, 2016; Steinsbekk, Adams, Sibbritt, Jacobsen & Johnsen, 2007). It is the leading course of pain-related disability, and next to mental health conditions, the largest contributor to global disability in general (Vos et al., 2017).

Studies have reported a relationship between musculoskeletal pain and lack of physical activity, reduced health-related quality of life, loss of independence, and depressive symptoms (Ang, Kroenke & McHorney, 2006; Klinedinst, Resnick, Yerges-Armstrong & Dorsey, 2015; Kovacs, Abraira, Zamora, & Fernández 2005; Martinez et al., 2001; Tüzün, Albayrak, Eker, Sözay & Daşkapan, 2004). It is also a major cause of work loss, early retirement and decreased national production (Schofield et al., 2015; Schofield et al., 2012). As a consequence, musculoskeletal pain places burdens on those individuals experiencing it, as well as the society more broadly (Briggs et al., 2016; Hoy et al., 2014; Murray et al., 2012)

Estimating the global burden of musculoskeletal pain is complex due to its health-related and financial impact on different levels of society (Blyth, Briggs, Schneider, Hoy & March, 2019). Despite the difficulties, it is estimated that the total socio-economic expenditure and social service expenses were somewhere in between 69-73 billion NOK in Norway in 2009 (Lærum et al., 2013, p.19). Due to the extensive burden, literature discuss interventions addressing musculoskeletal pain to be a priority (Briggs et al., 2018; Woolf, Erwin & March, 2012)

Health care providers seek to provide the best possible care to the patient. To do so, provide the right treatment to the right patient at the right time is crucial (Haldorsen, 2003). This process includes evaluation and use of best available evidence (Cleland, Noteboom, Whitman

& Allison, 2008; Manske & Lehecka, 2012) In musculoskeletal care, this process has traditionally been based on pathoanatomic diagnostic labels (Ludewig et al., 2017). A method widely used is "The International Classification of Primary Care" (ICPC) which is a valid and reliable tool for classifying musculoskeletal disorders (Nielsen, Aaen-Larsen, Vedsted, Nielsen & Hjøllund, 2008). Also, other methods exists (Botsis, Bassøe, & Hartvigsen, 2010). The most common musculoskeletal pain site is the low back followed by the neck, and the shoulder, respectively (Coggon et al., 2013; de Vos Andersen, Kent, Hjort & Christiansen, 2017). The most common "rheumatic" disorder is osteoarthritis, which most often affects the knee or the hip joint (Arden & Nevitt, 2006; Newman et al., 2003), and fibromyalgia (Clauw, 2014).

Several biopsychosocial patient characteristics have shown to be prognostic regardless of anatomical pain site. Among identified prognostic variables are the number of pain sites (Artus, Campbell, Mallen, Dunn, & van der Windt, 2017; Green et al., 2018), pain intensity (Artus et al., 2017; Valentin et al., 2016), pain duration (Artus, van der Windt, Jordan, & Croft, 2014; de Vos Andersen et al., 2017; Valentin et al., 2016) work-ability (Lagersted-Olsen, Bay, Jørgensen, Holtermann, & Søgaard, 2016), activity restriction (Artus et al., 2017; Valentin et al., 2016), sleep quality (Mundal, Gråwe, Bjørngaard, Linaker, & Fors, 2014), mental distress (Artus et al., 2014; de Vos Andersen et al., 2017), fear-avoidance (de Vos Andersen et al., 2017) and pain self-efficacy (Artus et al., 2014; Denison, Asenlöf, & Lindberg, 2004). These findings are interesting as future prognosis seems to be more influenced by psychological, physiological, and social factors than the specific site of pain or the assumed cause of pain.

In recent years, there has been increased attention regarding the number of musculoskeletal pain sites in the general population (e.g. Coggon et al., 2013; Kamaleri, Natvig, Ihlebaek & Bruusgaard, 2008; Natvig, Ihlebæk, Grotle, Brage & Bruusgaard, 2010). Studies have reported multisite pain to be more common the single-site pain and prevalent in 40-75% of the study sample (Carnes et al., 2007; Kamaleri et al., 2008a; Mundal et al., 2016; Pan et al., 2017; Thapa, Shmerling, Bean, Cai & Leveille, 2018). A relation has been reported between the number of pain sites and disability (Bruusgaard, Tschudi-Madsen, Ihlebæk, Kamaleri & Natvig, 2012), sick leave (Andersen, Frydenberg, & Mæland, 2009; Mose et al., 2016; de Fernandes & Burdorf, 2016) and disability pensioning (Kamaleri et al., 2009). Furthermore, multisite pain is more severe and disabling than single-site pain (Kamaleri et al., 2008b; Leveille, Bean, Ngo, McMullen & Guralnik, 2007; Peat, Thomas, Wilkie & Croft, 2006).

Studies have also reported poorer prognosis (Nordstoga, Nilsen, Vasseljen, Unsgaard-Tøndel & Mork, 2017; Vasseljen, Woodhouse, Bjørngaard & Leivseth, 2013) and less effective treatment (Dunn, Jordan & Croft, 2011; Moradi et al., 2010) in individuals experiencing multisite pain. As a result, it has been suggested that counting the number of pain sites may serve as a method for identifying individuals with risk for disability (Natvig, Ihlebæk, Kamaleri & Bruusgaard, 2011; Neupane, Miranda, Virtanen, Siukola & Nygård, 2011).

Despite the consequences of multisite pain, most studies on musculoskeletal pain have focused on site-specific pain site or regional distribution (Huisstede et al., 2008; Walker-Bone, Palmer, Reading, Coggon, & Cooper, 2004) which may give a fragmented picture (Gummesson, Atroshi, & Ekdahl, 2004) and may explain why some therapy interventions fail to show an effect.

Few studies have investigated the number of pain sites in a clinical sample and the prevalence of this pain characteristic is therefore limited. A better understanding of the number of pain sites and its relationship to prognostic patient characteristics will increase the current understanding of this pain characteristic, help identify individuals who might benefit from a more holistic treatment approach, influence the financial burden of musculoskeletal pain and help future research in improvement and development of treatment approaches.

The objective of this study is therefore twofold. First, to describe the number of musculoskeletal pain sites in patients seeking physiotherapy in primary care due to complaint in common musculoskeletal pain sites, and second, investigate the association between the number of musculoskeletal pain sites and biopsychosocial patient characteristics known to be important prognostic variables regardless of primary pain site.

METHOD

STUDY DESIGN

This cross-sectional study is part of a larger ongoing project. For more details about the project see Evensen et al. (2018).

SETTING

Individuals seeking physical therapy between June 2015 to June 2019 in nine municipalities of Norway (Oslo, Drammen, Ski, Kongsberg, Stavanger, Trondheim, Orkanger, Rindal, and Alta) were on their first encounter asked to participate in the project. All five health regions of Norway are represented.

During the consultation, the physiotherapists categorized the patients in one of the five following complaint groups: neck, shoulder, back, hip, or knee. A sixth category, multisite / complex pain, was based on the patient-reported history, the number of pain sites, the overall severity of the patient's symptoms, and clinical examination. The categorization of patients was decided entirely by the treating physiotherapist. Other variables specifying the reason for the encounter could also be filled out. Available variables were myalgia, tendinopathy, arthrosis, rheumatism disease, heart disease, asthma and lung disease, asthma and stroke, central neurological disease, peripheral neurological disease, cancer, headache/ migraine, dizziness, trauma ligament, trauma fracture, trauma muscle, operation-postoperative rehabilitation, pain more than six months, psychological health, lymph disease, elderly with reduced function, dementia or reduces cognitive function and other. Multiple markings were possible. A free text variable made it possible for the physiotherapist to note with own words information regarding symptoms, complaints, diagnosis, pathology, thoughts, functional level, etc. If the patient had consulted a doctor in advance and been diagnosed with an ICPC-code this code was also noted.

After categorization by the physiotherapist, the patient received a package of self-report questionnaires based on physiotherapy evaluation and reason for the encounter. The package of self-report questionnaires included general and disease-specific questionnaires and was completed either by using an e-tablet or through a web-link sent by e-mail. The data from all patients were copied from the Infopad-server to a secure server with in-memory encryption for research data at the University of Oslo (Services for Sensitive Data, TSD). Data management is done according to the quality assurance system of the University of Oslo. The software for data collection is provided by Infopad AS (www.infopad.no).

ETHICS

Project information and consent forms were available in both Norwegian and English.

The FYSIOPRIM project was approved by the Regional Committees for Medical and Health Research Ethics in Norway (REC no. 2013/2030) and registered in ClinicalTrails.gov on August 13th, 2018 (retrospectively registered). Identifier: NCT03626389. Anonymous data can be provided on request.

PARTICIPANTS AND CATEGORIZATION OF PARTICIPANTS

The research sample in the present study is patients seeking physical therapy because of common musculoskeletal pain. Two different strategies were used for inclusion because: i) a large number of available individuals were not diagnosed with an ICPC-code, ii) reviewing individuals with an ICPC-code contributed to the development of inclusion and exclusion guidelines for individuals in both strategies, iii) frequency analysis of individuals with ICPC-codes was necessary to determine the most common anatomical pain sites, and iv) inclusion of individuals entirely based on the physiotherapist categorization in the complaint groups would increase the probability of inclusion bias (Russell et al., 2019).

In both strategies, both genders were included, and the following exclusion criteria applied: i) Individuals younger than 20 years, ii) individuals with BMI lower than 18.49 because of uncertainty regarding unknown other pathology, iii) individuals reporting zero pain sites, iv) individuals with missing data on 4≤ included variables, and v) extreme values like BMI>100 and age> 120.

Inclusion method one

Inclusion method one was based on the ICPC-code set by the general practitioner. Individuals diagnosed with an ICPC-code from the following ICPC-chapters were automatically excluded: A, B, D, F, H, K, N, P, R, S, T, U, W, X, Y, and Z. Individuals diagnosed with an ICPC-code from the L-chapter which represents musculoskeletal pain were included in further analysis. A frequency analysis was performed to determine the most common pain site according to ICPC-code. Different ICPC-codes referring to the same anatomical pain site were investigated for between-group differences on all descriptive variables. If the groups showed general similarities and did not differ completely, these were collapsed to represent a complaint group.

Inclusion method two

First, criteria and characteristics for all ICPC-codes from the L-chapter were reviewed to detect possible codes for inclusion in method two (WHO, 2005, p.83-91). That is, ICPC-codes not referring to a specific anatomical site that still could contain individuals with pain in a common anatomical site. Second, all variables specifying the reason for encounter for all included and excluded individuals with an ICPC-code were investigated. Frequent combinations of marking variables and descriptions in the free text variable were noted and used site-specific inclusion and exclusion guidelines. ICPC-codes detected in the first step were not used in the second step. Third, all variables specifying the reason for encounter were reviewed systematically and in detail. If the variables satisfied the site-specific guidelines, the individual was included in the present study.

The combinations of variables are nearly endless. Therefore, only the general exclusion criteria are presented. Individuals were excluded from the present study if: i) there was insufficient evidence regarding the pain site or symptoms, ii) if one of the following variables were filled out: rheumatism, central neurological disease, peripheral neurological disease, stroke, asthma or cancer, iii) indications of rheumatism, central neurological disease, peripheral neurological disease, stroke, asthma or cancer in the free text variable, and iv) indication of post-operative treatment after arthroscopy because of hip or knee osteoarthritis. A detailed presentation of both inclusion and exclusion guidelines can be found in appendix 1.

VARIABLES

All outcome variables were self-reported using questionnaires and measured at first encounter. Only general questionnaires have been used in the present study, enabling a between-group comparison between patients with different complaints.

Descriptive variables

Participants self-reported their age. Gender was categorized as either male or female. Data on height (cm) and weight (kg) were reported, and body mass index (BMI) was calculated and categorized into one of the four categories recommended by the WHO: ‘‘underweight (BMI < 18.49 kg/m2)”, ‘‘normal (BMI 18.5–24.9 kg/m2)”, ‘‘overweight (BMI 25.0–29.9 kg/m2)”, and ‘‘obese (BMI > 30.0 kg/m2)” (WHO, 2000, p.9). The following response categories applied for education level: “primary school or lower”, “high school”, “up to 4 years of college/university” and “more than 4 years of college/university”. If two alternatives were selected, the response representing the highest level of education was used. The variable assessing education level was dichotomized into “high school or less” (primary school or lower and high school) and “higher education” (Up to 4 years of college/university and more than 4 years of college/university) according to previous research (Suri et al., 2010). For material status, the following four categories applied: “married/cohabiting,” “divorced,” “widow/widower,” and “single.” Smoking behaviour and use of analgesics was assessed by answering a yes-no question, “do you smoke daily?” and “have you used pain medication the last week?”, respectively. Physical activity level was estimated by using an index considering physical activity frequency, intensity, and duration (Kurtze, Rangul, Hustvedt, & Flanders, 2008). The frequency was assessed by answering the question “How often do you exercise during a week?”. Responses include: “never”, “once”, less than once”, “2-3 times” and “approximately every day”. The intensity was assessed by answering the question “How hard do you exercise?”. Responses include: “easy without sweating and getting breathless”, “getting breathless and sweating” and “almost completely to exhaustion”. The duration was assessed by answering the question “For how long do you exercise each time?”. Responses include “Less than 15 min”, “15-29 min”, “30 min -1h” and “>1 h”. The index and self-reported physical activity questionnaire is a valid and reliable tool for measuring leisure-time physical activity (Kurtze et al., 2008).

Outcome variable

The number of pain sites was evaluated using the body map from the Standardised Nordic questionnaires. The questionnaire asks participants to mark regions on the body with complaints during the last week on a body figure. The number of body regions ranges from 0 to 10 and includes the head, neck, shoulders, upper back, low back, elbows, wrists/hands, hips/thighs, knees, and ankles/feets. Multiple answers were possible. The Standardised Nordic questionnaires is a valid and reliable questionnaire measuring the number of pain sites and is applicable for cross-sectional studies (Kuorinka et al., 1987). The present study categorized the sample into the following number of pain sites groups: “1 pain site”, “2-3 pain sites”, “4-5 pain sites”, and “6≤ pain sites”, a categorization used in previous research (Nordstoga et al., 2017)

Patient characteristics

Pain duration was assessed using item 1 from the Örebro Musculoskeletal Pain Screening Questionnaire short form (ÖMPSQ-short): “How long have you had your current pain problem?". The item contains ten responses: "0-1 week", "1-2 weeks", "3-4 weeks", "4-5 weeks", "6-8 weeks", "9-11 weeks", "3-6 months", "6-9 months", "9-12 months" and ">1 year". The ÖMPSQ-short has a good predictive ability in primary care settings and is appropriate for screening long term work disability (Linton, Nicholas & Macdonald, 2011). Pain duration was grouped in the following three categories: "<3 months", "3≤12 months" and ">1 year" according to previous research (Meisingset et al., 2020).

Pain intensity last week was assessed using item 2 from the ÖMPSQ-short: "How would you rate the pain that you have had during the past week?". Individuals rates their pain on an 11-point numerical rating scale ranging from 0 (no pain) to 10 (pain as bad as it could be). The numerical ranting scale is a valid tool measuring pain (Ferreira-Valente, Pais-Ribeiro & Jensen, 2011)

Work ability was assessed by using the Work Ability score (El Fassi et al., 2013). The Work Ability score consists of a single question: "What is your current work ability compared with the lifetime best?". Individuals respond on an 11-point numerical scale ranging from 0 (cannot work, risk) to 10 (working at best). The Work Ability score is a useful tool for assessing work ability and it has shown a strong correlation with the seven-item work ability index (Ahlstrom, Grimby-Ekman & Dellve, 2010; El Fassi et al., 2013)

Daily activity restriction was assessed by answering the question "Due to pain or complaints, how much reduced is your activities of daily life?". Response options include: "very much reduced", "quite reduced", "slightly reduced" and "not reduced". A graded classification of pain-related disability has shown acceptable reliability and validity, and the method is supported for use in primary care (Von Korff, Ormel, Keefe & Dworkin, 1992). Activity restrictions were dichotomized by collapsing "very much reduced" and "quite reduced" to "activity restrictions" and by collapsing "slightly reduced" and "not reduced" to "normal activity functioning".

Fear-avoidance was measured using item 10 from ÖMPSQ-short. Individuals were asked to respond to the statement: "I should not do my normal activities or work with my present pain?" on an 11-point numerical scale ranging from 0 (disagree) to 10 (completely agree). A higher score indicates a higher level of fear-avoidance.

Pain self-efficacy was measured using the 2-item version of the Pain Self-Efficacy Questionnaire. The questionnaire consists of two statements: "I can do some form of work, despite pain”, and “I can live a normal lifestyle, despite pain”. Response options range from 0 (not at all) to 6 (completely confident) on both questions. Both answers were collapsed resulting in a score ranging from 0-12. A higher score indicates higher levels of pain self-efficacy. The 2-item version of the Pain Self-Efficacy Questionnaire is a valid and robust measure of pain self-efficacy (Nicholas, McGuire & Asghari, 2015)

Sleep quality was assessed using the sleep item from the 15D questionnaire. The sleep item has five response options: “I am able to sleep normally”, “I have slight problems with sleeping”, “I have moderate problems with sleeping”, “I have great problems with sleeping”, and “I suffer severe sleeplessness”. The 15D is a valid, reliable, and sensitive tool for assessing the quality of life (Sintonen, 2001). Sleep quality was dichotomized by collapsing “I am able to sleep normally” and “I have slight problems with sleeping” to “adequate sleep”, and by collapsing “I have moderate problems with sleeping”, “I have great problems with sleeping” and “I suffer severe sleeplessness” to “sleeping problems”. Similar groupings have been used in previous research (Meisingset et al., 2020; Mundal et al., 2014)

Mental distress was measured using the 10-item version of the Hopkins Symptom Check List (Derogatis, Lipman, Rickels, Uhlenhuth & Covi, 1974), a valid tool in a primary care setting (Haavet, Sirpal, Haugen, & Christensen, 2011). Items are scored on a scale ranging from 1 (not at all) to 4 (very much/ extremely).

STUDY SIZE

Power analysis has not been conducted.

STATISTICAL ANALYSIS

Frequency analysis, histograms, scatterplot, and cross tables were conducted to become familiar with the raw data.

Descriptive statistics and frequency analysis were conducted to describe the characteristics of the study sample and other variables. Normally distributed variables were presented as mean and standard deviation (SD), non-normally distributed variables were presented with a median and inter quartile range [IQR], and frequencies were presented with percentages. The number of individuals responding and the percentage of the total study sample were presented. This results in an indirect presentation of missing data. The number of individuals responding in each response category and valid percent was presented.

Between-group differences were analysed using Chi-square test for on variables of nominal scale, Kruskal–Wallis test for skewed or not normally distributed variables, and one-way analyses of variance (ANOVA) for normally distributed variables. A post hoc test (Bonferroni) was used to confirm differences.

This study completed a simple linear regression, an adjusted multivariable regression, and a stepwise backward regression analysis. In the simple linear regression analysis, all biopsychosocial patient characteristics were analysed individually for the association with the number of pain sites. In the adjusted multivariable regression analysis, all biopsychosocial patient characteristics were included together for the effect of biopsychosocial patient characteristics on the number of pain sites. The adjusted model contains all variables under consideration and may include irrelevant variables with no significant association with the number of pain sites leading to a needlessly complex model. Therefore, a stepwise backward regression analysis was conducted to get a simple and easily interpretable model consisting of important variables for the number of pain sites. The stepwise backward regression analysis was conducted by removing the variable with the highest p-value in the full model (same as the adjusted model) until the stopping rule was satisfied. The stopping rule was set at $p<0.05$, meaning that all variables showing a $p\geq0.05$ were excluded. This results in a model with the highest determination coefficient while at the same time maintaining variables with a significant association with the number of pain sites (Watroba, 2011).

Before the analysis was conducted several assumptions were tested, and variables not satisfying the assumptions were removed from the analysis. First, a scatterplot was used to investigate the assumption of a linear relationship between the outcome variable and independent variables. Second, residuals of the regression were checked by looking at a histogram. Third, multicollinearity in the data was checked in two ways. 1): By computing a matrix of Pearson's bivariate correlations among all independent variables, and 2): by investigating the variance inflation factor (VIF). The VIF assesses how much the variance of an estimated regression coefficient increases when independent variables are correlated (Akinwande, Dikko, & Samson, 2015). If the VIF value is equal to 1 there is a no multicollinearity, and, as a rule of thumb, if the VIF value exceeds 5 or 10, there is a problematic amount of multicollinearity (James, Witten, Hastie & Tibshirani, 2000, p.101&102). In the present study, a VIF value higher than 3 and an $r>0.7$ were set as an indication of problems with multicollinearity. Finally, homoscedasticity, which describes a situation in which the variance of errors is the same across all values of the independent variables, was checked using a scatterplot of residuals versus predicted values (Goldfeld & Quandt, 1965; Hedayat & Robson, 1970).

All variables on ordinal scale were copied and transformed into dummy variables. Crossable analysis was performed to ensure a successful transformation. A reference value was set for each of these variables. After sensitivity analysis (see below), the following reference values were used: “higher education”, “0 week – 3 months”, “normal activity function” and “adequate sleep”. “Female” was used as a reference value for the gender variable. In addition to all biopsychosocial patient characteristics satisfying the assumptions, age, BMI, gender, and education level were included in the adjusted regression analysis and stepwise backward regression analysis because of potential confounding effects.

Sensitivity analysis was conducted for all regression analysis by entering variables on ordinal scale in the models with different categorizations of the response categories. That is, entrance of a variable with all the original response categories, entrance of the variables after dichotomizing the response categories, and entrance of the variable with other categorizations of the response categories. An example of the latter is inclusion of the variable measuring sleep quality with three categories: adequate sleep (I am able to sleep normally and I have slight problems with sleeping) moderate sleep and sleeping problems (I have great problems with sleeping and I suffer severe sleeplessness). In the stepwise backward regression analysis, sensitivity analysis was also conducted by removing different variables showing equal or approximately equal p-value in different order. In short, simple linear regression analysis and adjusted regression analysis was conducted several times by include of variables on ordinal scale with different categorizations of response categories. The stepwise backward regression analysis was conducted several times by include of variables on ordinal scale with different categorizations of response categories, and by eliminating non-significant variables in a different order.

A significant level was set at a p-value <0.05. Results from the regression analysis were presented with the coefficient of determination (R^2), 95% confidence intervals (95% CI), and the beta coefficients (β).

All data were analyzed using SPSS version 14 for Windows on the secure server. Because of ethics, all results have been manually transferred from SPSS to Microsoft Excel. After transfer, an external individual with statistical experience double-checked all data and results. All graphs, tables, and figures presented have been made in Microsoft Excel.

RESULTS

PARTICIPANTS

In the present study, 742 individuals satisfied the inclusion criteria and were included. Figure 1 presents the inclusion process. Data from 1589 individuals were available. A total number of 114 individuals were excluded initially, 41 individuals because of age <20 years, 15 because of BMI <18.5, 6 because of BMI >120, and 52 individuals due to missing data regarding the number of pain sites. 1475 individuals were included in further analysis.

Inclusion method one

ICPC-codes were registered on 920 individuals and 807 were diagnosed with an ICPC-code from L- chapter. 805 were reviewed and included in the frequency analysis. After reviewing, 32 individuals were considered potential participants and included in method two. The most site of pain or complaint was in the shoulder, back, and neck, osteoarthritis of the hips and knees, and muscle pain. The between-group analysis conducted between ICPC-codes referring to the same anatomical site and between individuals diagnosed with osteoarthritis of the hips and knees showed great similarities (data not shown), and the subgroups were collapsed in different complaint groups. In total, 447 individuals were included using inclusion method one. A schematic presentation of the collapsing process is presented in table 1.

Inclusion method two

In inclusion method two, 589 individuals were reviewed. Of these, 557 individuals were not diagnosed with an ICPC-code whereas 32 were diagnosed with an ICPC-code. The review process resulted in inclusion of 295 individuals which were distributed in the complaint groups.

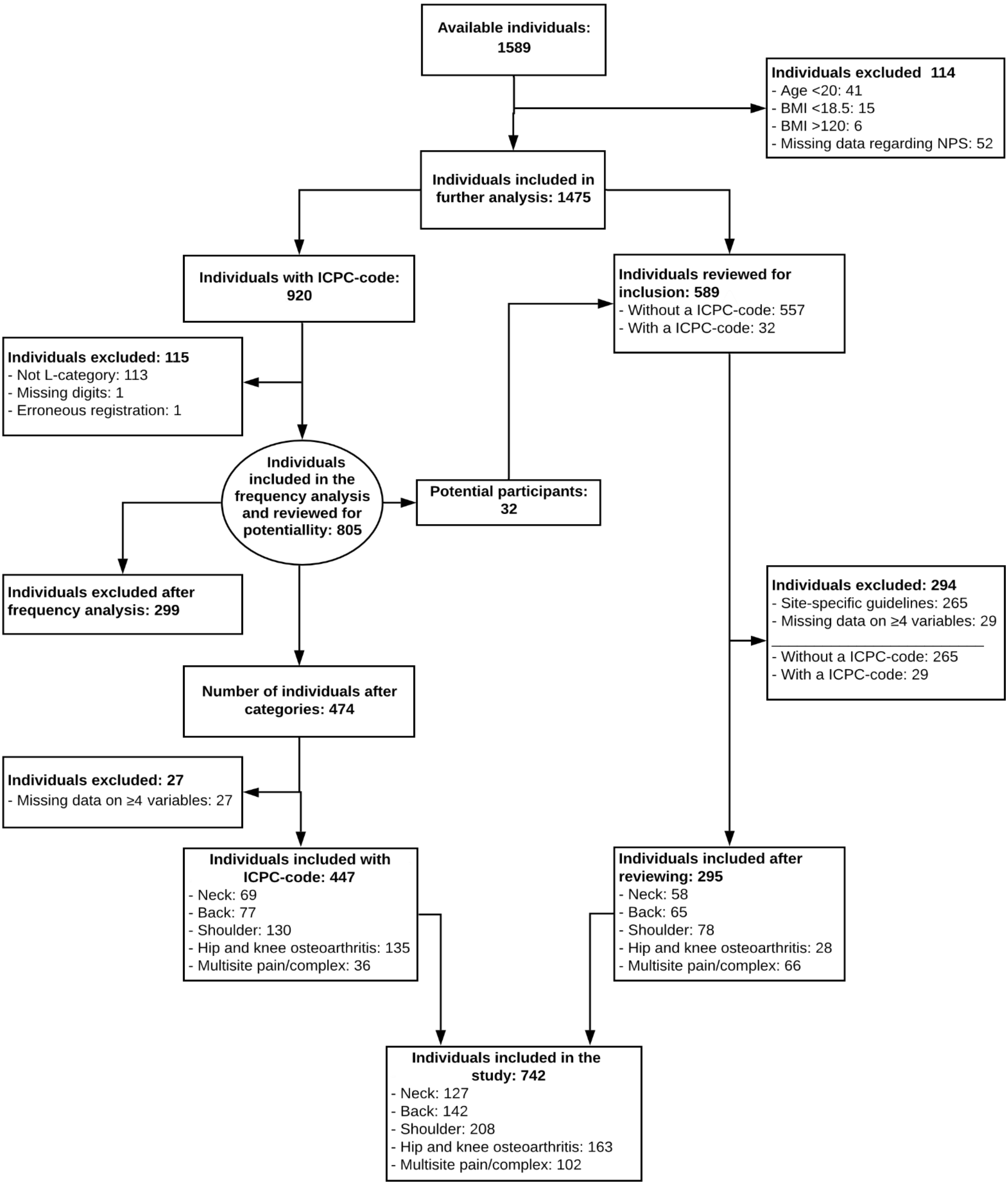

Figure 1: Flow chart presenting the inclusion process of individuals in the cross-sectional study**.** NPS: number of pain sites. ICPC: international Classification of Primary Care

Table 1: Schematic presentation of the collapsing of different ICPC-codes into complaint groups and the number of individuals in the complaint groups

ICPC code		Complaint groups	n
L01 - Neck symptoms/complain L83 - Neck syndrome	→	Neck	69
L02 - Back symptoms/complain L03 - Low back symptoms/complain L84 - Back syndrome without radiation pain L86 - Back syndrome with radiation pain	→	Back	77
L08 - Shoulder symptoms/complain L92 - Shoulder syndrome	→	Shoulder	130
L89 - Osteoarthritis of hip L90 - Osteoarthritis of knee	→	Hip or knee osteoarthritis	135
L18 - Muscle pain	→	multisite pain / complex	36

DESCRIPTIVE DATA

Descriptive statistics of participants are presented in table 2.

All descriptive variables had a response rate of over 90%. Following physical activity level with the lowest rate of 91.5%, were BMI and smoking status with a rate of 94.9% and 98.8%, respectively.

The mean age was 50 years (SD = 16.1), 507 (68.3%) individuals were female, the median BMI was 25.6 [IQR = 23.3; 29.1] and 142 (20.2%) were obese. The majority, 462 (62.6 %) individuals, had higher education, 542 (73.7%) were married or in cohabitate, 664 (90.6%) were non-smokers and 377 (51.1%) used pain medication during the last week. Inactivity was prevalent in 265 (39.9 %) individuals and 107 (15.8%) individuals were highly active.

The common site of pain was in the shoulder group with 208 (28%) individuals, followed by the 163 (21.9%) individuals having hip or knee osteoarthritis. Experiencing pain in the back were intermediate and reported by 142 (19.1%) individuals. The least common sites of pain were the neck and multisite pain/ complex category with 127 (17.1%) and 102 (13.7 %) individuals, respectively.

The number of individuals reporting 1 pain site was 167 (22.5%), 314 (42.3%) reported 2-3 pain sites, 152 (20.5%) reported 4-5 pain sites and 109 (14.7%) reported 6≤ pain sites. The median number of pain sites were 3 [IQR =2; 4].

Table 2: Descriptive statistics of the study sample categorized according to the number of pain sites.

Variables	Groups				
	Study sample	**1 pain site**	**2-3 pain sites**	**4-5 pain sites**	**6≤ pain sites**
	n (%)	n (%)	n (%)	n (%)	n (%)
Total	742 (100)	167 (22.5)	314 (42.3)	152 (20.5)	109 (14,7)
Age	742 (100)				
20-29	98 (13.2)	12 (7.2)	39 (12.4)	33 (21.7)	14 (12.8)
30-39	121 (16.3)	19 (11.4)	46 (14.6)	28 (18.4)	28 (25.7)
40-49	134 (18.1)	26 (15.6	50 (15.9)	27 (17.8)	31 (28.4)
50-59	151 (20,4)	42 (25.1)	59 (18.8)	28 (18.4)	22 (20.2)
60-69	144 (19.4)	41 (24.6)	72 (22.9)	20 (13.2)	11 (10.1)
>70	94 (12.6)	27 (16.2)	48 (15.3)	16 (10.5)	3 (2.8)
Mean (SD)	50 (16.1)	54 (15.2)	51.8 (16.2)	46.3 (17.0)	43.7 (12.8)
Gender	742 (100)				
Female	507 (68,3)	100 (59.9)	204 (65)	112 (73.7)	91 (83.5)
BMI	704 (94,9)	154 (92.2)	301 (95.9)	148 (97.4)	101 (92.7)
Normal	298 (42.3)	57 (37)	140 (46-5)	67 (45.3)	34 (33.7)
Overweight	264 (37.5)	74 (48.1)	103 (34.2)	52 (35.1)	35 (34.7)
Obese	142 (20.2)	23 (14.9)	58 (193)	29 (19.6)	32 (31.7)
Median	25.6	26.2	25.3	25.3	26.9
[IQR]	[23.3;29.1]	[23.7;28.0]	[23.1;28.4]	[23.2;29.5]	[23.1;30.85]
Complaint groups	742 (100)				
Neck	127 (17.1)	11 (6.6)	58 (18.5)	41 (27.0)	17 (15.6)
Shoulder	208 (28.0)	61 (36.5)	93 (29.6)	42 (27.6)	12 (11.0)
Back	142 (19.1)	36 (21.6)	61 (19.4)	28 (18.4)	17 (15.6)
Hip & knee arthrosis	163 (21.9)	56 (33.5)	83 (26.4)	13 (8.6)	11 (10.1)
Widespread	102 (13.7)	3 (1.8)	19 (6.1)	28 (18.4)	52 (47.7)
Median [IQR]	3 [2;4]				
Education level	736 (99.2)	166 (99.4)	312 (99.4)	151 (99.3)	107 (98.2)
High school or less	275 (37.4)	60 (36.1)	110 (35.3)	64 (42.4)	41 (38.3)
Higher education	461 (62.6)	106 (63.9)	202 (64.7)	87 (57.6)	66 (61.7)
Material status	735 (99.1)	163 (97.6)	313 (99.7)	150 (98.7)	109 (100)
Married or cohabitant	542 (73.7)	123 (75.5)	241 (77.0)	98 (65.3)	80 (73.4)
Divorced	41 (5.6)	8 (4.9)	18 (5.8)	9 (6.0)	6 (5.5)
Widow/widower	29 (3.9)	12 (7.4)	11 (3.5)	5 (3.3)	1 (0.9)
Single	123 (16.7)	20 (12.3)	43 (13.7)	38 (25.3)	22 (20.2)
Smoking status	733 (98.8)	164 (98.2)	310 (98.7)	151 (99.3)	108 (99.1)
Non-smoker	664 (90.6)	154 (93.9)	279 (90)	136 (90.1)	95 (88.0)
Pain medication	738 (99.5)	166 (99.4)	312 (99.4)	151 (99.3)	109 (100)
Use last week	377 (51.1)	68 (41)	148 (47.4)	85 (56.3)	76 (69.7)

Physical activity level	679 (91.5)	148 (88.6)	286 (91.1)	146 (96.1)	99 (90.8)
Inactive	265 (39.9)	49 (33.1)	111 (38.8)	63 (43.2)	42 (42.4)
Medium	307 (45.2)	67 (45.3)	135 (47.2)	60 (41.1)	45 (45.5)
High	107 (15.8)	32 (21.6)	40 (14.0)	23 (15.8)	12 (12.1)

Values are shown as n (%), unless otherwise stated. The total number of observations for each variable is also presented.

MAIN RESULTS

NUMBER OF PAIN SITES FOR THE MAIN COMPLAINT GROUPS

The number of pain sites for the diagnostic groups is presented in table 3. Figure 2 gives a visual presentation. The diagnostic groups' shoulder, back, and hip and/or knee osteoarthritis had a similar ranking of the number of pain sites. The majority reported 2-3 pain sites with a prevalence of between 44.7% in the back group and 50.9% in the hip or knee osteoarthritis group. Reporting 1 pain site was the second most prevalent, ranging from 25.4% in the back group and 34.4 in the hip or knee osteoarthritis group. In the hip or knee osteoarthritis group, 8.0% reported 4-5 pain sites, whereas 20.2% and 19.7% reported 4-5 pain sites in the shoulder and back group, respectively. The prevalence of 6 ≤ pain sites was 6.7% and 5.8% in the hip or knee osteoarthritis group and the shoulder group, respectively. In the back group, 12.0% reported 6 ≤ pain sites. In the neck group, the most common number of pain sites were 2-3, making up 45.7%. The prevalence of 4-5 and 6 ≤ pain sites where 32.3% and 13.4% respectively. The least prevalent number of pain sites were 1 and reported by 8.7%. In the multisite / complex group, 51% reported 6 ≤ pain sites, 27.5% reported 4-5 pain sites, 18.6% reported 2-3 pain sites and 2.9% reported 1 pain site. In the total study sample, 42.3% reported 2-3 pain sites, 22.5% reported localized pain, 20.5% and 14.7% reported 4-5 and 6 ≤ pain sites, respectively.

Complaint group	**Categorized according to the number of pain sites**			
	1 pain site	**2-3 pain sites**	**4-5 pain sites**	**6 ≤ pain sites**
	n (%)	n (%)	n (%)	n (%)
Neck	11 (8.7)	58 (45.7	41 (32.3)	17 (13.4)
Shoulder	61 (29.3)	93 (44.7)	42 (20.2)	12 (5.8)
Back	36 (25.4)	61 (43.0)	28 (19.7)	17 (12.0)
Knee & Hip OA	56 (34.4)	83 (50.9)	13 (8.0)	11 (6.7)
Multisite pain / complex	3 (2.9)	19 (18.6)	28 (27.5)	52 (51.0)
Overall	(22.5)	(42.3)	(20.5)	(14.7)

Table 3: The distribution of the number of pain sites in main complaint groups.

ASSOCIATION BETWEEN NUMBER OF PAIN SITES AND BIOPSYCHOSOCIAL PATIENT CHARACTERISTICS

All biopsychosocial patient characteristics passed the assumptions. Results from the regression analysis are presented in table 4.

Simple linear regression

In the simple linear regression analysis, lower age (β=-0.03, 95% CI = -0.04;-0.02, p<0.001), female gender (β=-0.76, 95% CI = -1.13;-0.46, p<0.001), higher BMI (β=0.05, 95% CI = 0.02;0.09, p<0.01), pain duration >12 months (β=1.13, 95% CI = 0.72;1.53, p<0.001) and a more severe / worsen level of pain intensity (β=0.30 95% CI = 0.29;0.37, p<0.001), work ability (β=-0.24, 95% CI = -0.30;-0.18, p<0.001), activity restrictions (β=1.17, 95% CI = 0.82;1.47, p<0.001), fear-avoidance (β=0.09, 95% CI = 0.03;0.14, p<0.01), pain self-efficacy (β=-0.14, 95% CI = -0.20;-0.08, p<0.001), sleeping quality (β=1.23, 95% CI = 0.92;1.54, p<0.001), and mental distress (β=1.94, 95% CI = 1.67;2.19, p<0.001) were statistically significant association with a higher number of pain sites. A non-linear relationship was demonstrated between the number of pain sites and pain duration. It was a not a statistically significant difference between the following response categories for pain duration: "0 weeks to 3 months" and "3 – 12 months" (β=0.28, 95%CI = -0.18;0.74, p>0.05), and "3- 12 months" and ">12 months" (95% CI = 0.72;1.53, p>0.05). Education level was not statistically significant associated with the number of pain site (β =0.18 95% CI= -0.15;0.51, p>0.05). In the analysis, mental distress and work ability showed the highest percentage of the variance in number of pain sites, 24% (R^2=0.24) and 10% (R^2=0.10), respectively.

Adjusted multivariable analysis

When all variables entered the adjusted multivariable analysis, the model explained 31% (R^2=0.31) of the variance of the number of pain sites. Lower age (β=-0.03, 95%CI=0.04;0.01, p<0.001), female gender (β=-0.45, 95%CI=-0.87;-0.04, p<0.05), higher BMI (β=0.04, 95%CI=0.00;0.08, p<0.05), pain duration > 12 months (β=0.66, 95%CI=0.17;1.16, p<0.01), and a more severe / worsen level of pain intensity (β=0.14, 95%CI=0.03;0.24, p<0.01), work ability (β=-0.11, 95%CI=0.20;-0.02, p<0.05) and mental distress (β=1.25, 95%CI=0.84;1.66, p<0.001) were statistically significant association with a higher number of pain sites. It was not a statistically significant difference between the following response categories for pain duration: "0 weeks to 3 months" and "3 – 12 months" (95%CI=-0.33;0.75, p>0.05), and "3-12 months" and ">12 months" (95%CI=0.17;1.16, p>0.05). Education level (β=0.07, 95%CI=-1.41;1.58. p>0.05), daily activity restrictions (β=0.39, 95%CI=-0.10;0.88, p>0.05), fear-avoidance (β=0.02, 95%CI=-0.09;0.06, p>0.05), pain self-efficacy (β=0.09, 95%CI=-0.01;0.18, p>0.05) and sleep quality (β=0.25, 95%CI=-0.18;0.67, p>0.05), did not show a statistically significant association with the number of pain sites.

Stepwise backward regression

The stepwise backward regression model explained 30% (R^2=0.30) of the variance of the number of pain sites. Lower age (β=-0.02, 95%CI=-0.03;-0.01, p<0.01), female gender (β=-0.44, 95%CI=-0.80;-0.08, p<0.05), higher BMI (β=0.04, 95%CI=0.01;0.07, p<0.05), pain duration > 12 months (β=0.70, 95%CI=0.27;1.13, p<0.001) and a more severe / worsen level of pain intensity (β=0.10, 95%CI=0.01;0.19, p<0.05), work ability (β=-0.90, 95%CI=-0.15;-0.03, p<0.01) and mental distress (β=1.43, 95%CI=1.1;1.78, p<0.001) satisfied the stopping rule and were statistically significant associated with a higher number of pain sites (p<0.05). It was not a statistically significant difference between the following response categories for pain duration: "0 weeks to 3 months" and "3 – 12 months" (95%CI = -0.23; 0.72, p>0.05), and "3- 12 months" and ">12 months" (95%CI = 0.27; 1.13, p>0.05). Education level, daily activity restrictions, fear-avoidance, pain self-efficacy, and sleep quality did not show a statistically significant association with the number of pain sites (p>0.05) and were eliminated. The last variable eliminated was pain self-efficacy (p=0.051).

Sensitivity analysis

Sensitivity analysis did not influence the outcome of the adjusted regression analysis and the stepwise backward regression analysis. In the adjusted regression analysis age, gender, BMI, pain intensity, pain duration > 1 year, work ability, and mental distress were statistically significant associated with the number of pain sites despite different entrance of the response categories to variables on an ordinal scale. The same variables were statistically significant associated with the number of pain sites in the stepwise backward regression analysis despite conduction the analysis with different entrance of the response categories on variables on an ordinal scale, and despite that the elimination process was performed by removing different variables showing an equal or an almost equal p-value in a different order.

When sleep quality was included with all the original response categories in the simple linear regression, all response categories were statistically significant different from the reference value "normal sleep". "Slight sleeping problems" were statistically significant different from "moderate problem", "great problem" and "severe sleeplessness". The three latter were not statistically significant from each other. When activity restrictions were entered with all original response categories in the simple linear regression, "not reduced" was not statistically significant different from the reference vale "slight reduced". "Quite reduced" and "very reduced" were statistically significant different from the reference value and "not reduced". "Slight reduced" was set as reference value because of few responses in the response category "not reduced".

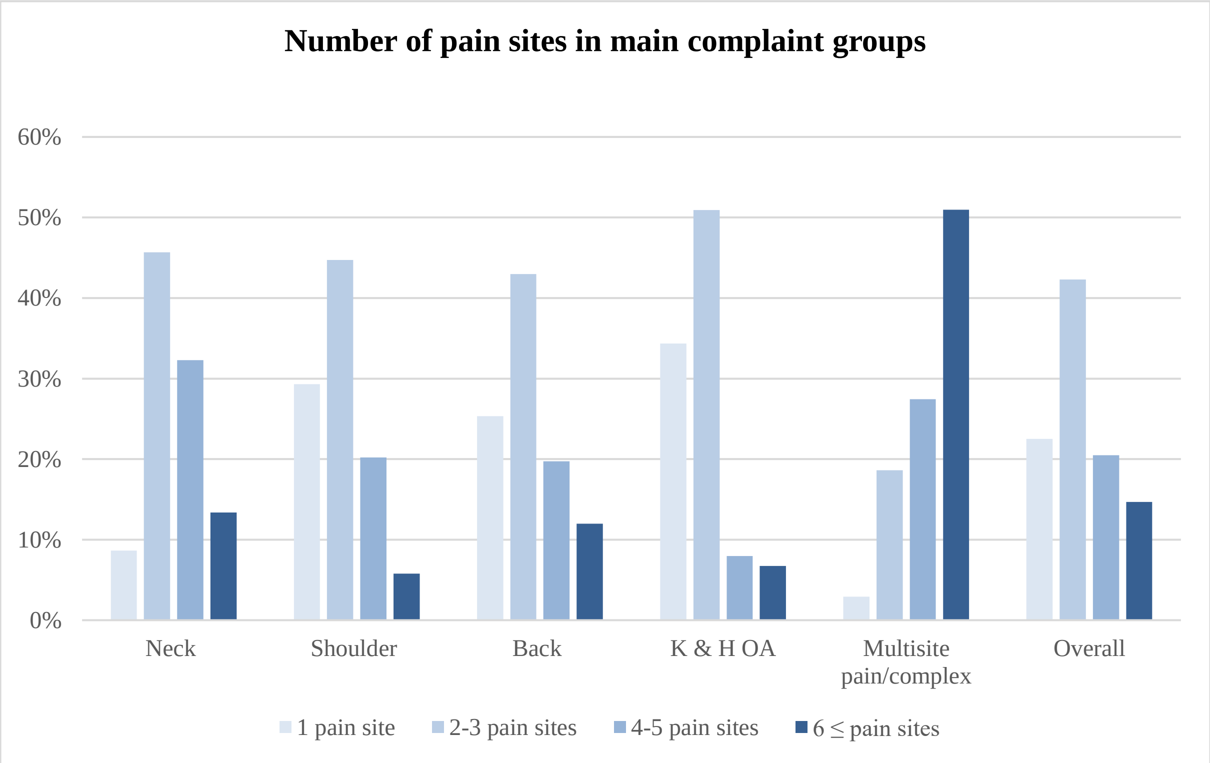

Figure 2: Clustered bar chart presenting the distribution of the number of pain sites in percentages in main complaint groups.

Table 4: Simple linear regression analysis of the association between number of pain sites and biopsychosocial patient characteristics, and multivariable regression analysis of the effect of biopsychosocial patient characteristics on number of pain sites.

	Simple linear regression analysis			**Adjusted**			**Stepwise backward regression**		
Variables	**B**	**(95% CI)**	**R^2**	**B**	**(95% CI)**	**R^2**	**B**	**(95% CI)**	**R^2**
						0.31			0.30
Age	-0.03	(-0.04;-0.02)***	0.05	-0.03	(0.04;0.01)***		-0.02	(-0.03;-0.01)**	
Gender (ref. female)			0.03						
Male	-0.79	(-1.13;-0.46)***		-0.45	(-0.87;-0.04)*		-0.44	(-0.80;-0.08)*	
BMI	0.05	(0.02;0.09)**	0.01	0.04	(0.00;0.08)*		0.04	(0.01;0.07)*	
Education level (ref. higher education)			0.00						
High school or less	0.18	(-0.15;0.51)		0.07	(-1.41;1.58)				
Pain intensity	0.30	(0.29;0.37)***	0.08	0.14	(0.03;0.24)**		0.10	(0.01;0.19)*	
Pain duration (ref. 0 week -3 months)			0.05						
3 - 12 months	0.28	(-0.18;0.74)		0.21	(-0.33;0.75)		0.25	(-0.23;0.72)	
>1 year	1.13	(0.72;1.53)***		0.66	(0.17;1.16)**		0.70	(0.27;1.13)***	
Work ability	-0.24	(-0.30;-0.18)***	0.10	-0.11	(-0.20;-0.02)*		-0.90	(-0.15;-0.03)**	
Daily activity restriction (ref. normal function)			0.07						
Activity restrictions	1.17	(0.82;1.47)***		0.39	(-0.10;0.88)				
Fear-avoidance	0.09	(0.03;0.14)**	0.01	0.02	(-0.09;0.06)				
Pain self-efficacy	-0.14	(-0.20;-0.08)***	0.03	0.09	(-0.01;0.18)				
Sleep quality (ref. adequate sleep)			0.07						
Sleeping problems	1.23	(0.92;1.54)***		0.25	(-0.18;0.67)				
Mental distress	1.94	(1.67;2.19)***	0.24	1.25	(0.84;1.66)***		1.43	(1.01;1.78)***	

B= beta coefficients; 95%CI= 95% confidence interval; R^2= coefficient of determination; ref= reference value
*= p<0.05; **= p<0.01; ***= p<0.001

DISCUSSION

The present study found that most individuals with common musculoskeletal complaints seeking physical therapy in primary care have multisite pain. In individuals reporting shoulder complaints, back complaints and osteoarthritis of knee or hip as the primary complaint, experiencing 2-3 pain sites was the most common number of pain sites. Localized pain was second most common followed by 4-5 pain sites. Experiencing 6 ≤ pain sites was least common. The number of pain sites in individuals reporting neck pain as the primary pain site showed similarities with the before mentioned groups. In the neck group, experiencing 2-3 pain sites was also the most common number of pain sites. However, experiencing 4-5 pain sites was the second most common number of pain sites. Localized was least common. The greatest difference was observed between the multisite pain / complex group and the rest of the complaint groups. In the multisite pain / complex group, experiencing 6≤ was the most common followed by 4-5 pain sites and 2-3 pain sites, respectively. Localized pain was least prevalent in this group.

The second objective of this study was to investigate the association between the number of pain sites and biopsychosocial patient characteristics known to be prognostic variables. The simple linear regression analysis showed an statistically significant association between a higher number of pain sites and lower age, female gender, higher BMI, higher pain intensity, pain duration > 12 months, reduced work ability, increased activity restrictions, higher fear-avoidance, lower pain self-efficacy, reduced sleeping quality, and mental distress. In the adjusted regression analysis and the stepwise backward regression analysis, lower age, female gender, higher BMI, higher pain intensity, pain duration > 12 months, reduced work ability, and mental distress showed a statistically significant association with a higher number of pain sites. This means that these variables are the most important once for the number of pain sites. Most interesting is the stepwise backward regression analysis because this model gradually eliminates non-significant variables in order to maintain the model with the highest determination coefficient, and at the same time maintain the variables with an significant association (Watroba, 2011). This model explained 30 % of the variance in the number of pain sites.

Number of pain sites in main complaint groups

Few studies have investigated the number of pain sites in a clinical sample. However, several studies have investigated a sample from the general population. By using the Standardized Nordic Questionnaire, Natvig et al. (2010) investigated the co-occurrence of other pain sites with neck pain in 1144 individuals aged between 24-86 years from the general population. Compared to the present study, Natvig et al. (2010) reported a slightly higher prevalence of multisite pain. There is some possible explanation for this skewness. Because Natvig et al. (2010) is an epidemiologic study investigating a sample from the general population, the included sample has not been selected and categorized on the same manner as the present study. This may result in an inclusion of diagnosis excluded from the present study (e.g.: Zhang & Lee, 2018), or data from individuals categorized in another complaint group in the present study might be reported in Natvig et al. (2010). Another possible explanation is the patient-centered approach often seen in a clinical setting that influences health status positively (Stewart et al., 2000) or the impact of the contexts on individuals' honesty when filling out the measurement (Berthelot, Nizard & Maugars, 2019). This can result in a higher tolerance for symptom reporting in the present study compared to Natvig et al. (2010).

The present study found that in individuals reporting shoulder pain as the primary pain site, 29.3% reported localized pain and 5.8% reported pain from 6≤ sites. This is incongruent with a previous epidemiologic study reporting localized shoulder pain in approximately 5% of the sample and pain from 5≤ sites in approximately 45% of the sample (Kamaleri et al., 2008b). This incongruence may be explained by methodological differences between the two studies. Whilst the present study investigated individuals seeking medical care, Kamaleri et al. (2008b) investigated the general population. Because pain is a central reason for seeking medical care (Bernard & Wright, 2004; Mortimer & Ahlberg, 2003), the two study samples differ. It is, however, surprising that the proportion of individuals experiencing localized pain is greater in the present study. A possible explanation is that Kamaleri et al. (2008b) used data from individuals excluded in the present study (Bilberg, Bremell, Balogh & Mannerkorpi, 2015; Caridi, Pumberger, & Hughes, 2011 Choi, Kim, Lee & Kim, 2017; Silman & Pearson, 2002; Murphy, Hurwitz, Gregory & Clary, 2006; Olofsson, Book, & Jacobsson, 2003; Wepking et al., 2013). Another reason is non-comparable categorization of individuals. Diagnosis categorized in the complex category in the present study might be presented in the shoulder category in Kamaleri et al. (2008b). The most likely explanation is because Kamaleri et al. (2008b) investigated localized pain and multisite pain in general, not in specific groups.

As a result, individuals were categorized in the multisite pain category belonging to the shoulder even though the primary pain site was in another anatomical site. For example, an individual experiencing low back pain, shoulder pain and neck pain, was represented in all these groups, resulting in a negative skewness where multisite pain is overrepresented.

The present study found localized back pain to be prevalent in 25.4% of the pain sample, 43% reported 2-3 pain sites, whereas 19.7% and 12% reported 4-5 pain sites and 6≤ pain sites, respectively. These findings are consistent with a previous cross-sectional epidemiologic study investigating the occurrence of low back pain in combination with pain from four or more sites (Natvig, Bruusgaard & Eriksen, 2001). In Natvig et al. (2001), 25% reported localized low back pain, 44% reported 2-4 pain sites and 31% reported 5≤ pain sites.

In a cross-sectional study investigating co-occurring pain in individuals with hip and/or knee osteoarthritis in a medical setting, 58% of the sample reported symptoms from 2≤ joint (Hoogeboom, den Broeder, Swierstra, de Bie & van den Ende, 2012). Compared to Hoogeboom et al. (2012), the percentage of individuals reporting 2≤ pain sites are higher in the present study; 58% vs 66% respectively. A possible explanation is because the present study used self-marking on a figure to measure the number of pain sites and Hoogeboom et al. (2012) used a direct question related to pain at different joints of the body. Although both methods give valid results, the use of a manikin has shown to result in a higher prevalence of musculoskeletal pain (Hoven, Gorter & Picavet, 2010). In addition, while Hoogeboom et al. (2012) only measured joint pain, the present study measured pain outside the joints, which provided a better opportunity to report pain throughout the body.

The multisite pain / complex group is difficult to define because the group is not based on a primary pain site or complaint and the individuals are included based on two different inclusion strategies. Individuals included from method one was diagnosed with the ICPC-code L18. This ICPC code represents muscle pain and includes fibromyalgia and widespread pain (WHO, 2005, p. 84). The latter is defined as pain lasting 3≤ months, located axially, above and below the waist, and on both sides of the body (Wolfe et al., 1990b) and is a fundamental criterion in fibromyalgia (Ngian, Guymer & Littlejohn, 2011; Wolfe et al., 1990b Wolfe et al., 2010a). According to the definition, an individual with widespread pain will have a minimum of three painful sites. Thus, widespread pain may explain some of the high prevalence of pain in 2≤ sites in this group. Furthermore, over half of the individuals in the multisite pain / complex group reported pain in 6≤ sites. This is similar to Gerhardt, Eich, Treede, & Tesarz (2017) who reported a mean number of pain sites of 6.7 and 8.4 in individuals with CWP and FM, respectively. (Natvig, Bruusgaard & Eriksen, 2001)

A large international study analyzing data from over 12.000 individuals from the general population reported either low back pain, neck pain, or shoulder pain to be prevalent in over 30% of the included sample (Coggon et al., 2013). The high prevalence of pain at some anatomical sites results in multisite pain occurring by chance (Croft, Dunn & Von Korff, 2007). For example, shoulder pain is frequently reported with co-occurring neck pain and back pain (Engebretsen, Grotle, & Natvig, 2015), an association is reported between low back pain and neck as well as shoulder pain and upper extremity complaints in general (Ijzelenberg & Burdorf, 2004), and the majority of individuals with knee osteoarthritis have low back pain, nearly 30% reports shoulder pain and over 20% reports neck pain (Suri et al., 2010). The basic assumption is, therefore, that any pain is more likely to occur in the presence of another than in the absence of another. This may explain the high prevalence of multisite pain in the present study, and why the number of pain sites in the total sample in the present study is nearly equal the number of pain sites reported in epidemiological studies that have investigated a sample from the general population (Carnes et al., 2007; Christensen et al., 2017; Kamaleri et al., 2008a; Schmidt & Baumeister, 2007)

Association between the number of musculoskeletal pain sites and biopsychosocial patient characteristics

The simple linear regression investigated the linear relationship between the number of pain sites and included variables. An interpretation of some β-values might be helpful to understand the results from this analysis. In short, the beta coefficient is the degree of change in the outcome variable for every 1-unit of change in the independent variable. The β- value for age was -0.03, meaning that an individual of 40 years has 0.03 more pain sites than an individual of 41 years. In other words, an individual of 40 years has 0.3 more pain sites than an individual of 50 years. Because the β- value is negative, a higher number of pain sites is associated with lower age. The β- value for BMI was 0.05, meaning than an individual with a BMI of 21 has 0.05 more pain sites than an individual with a BMI of 20, or in other word, an individual with a BMI of 30 has 0.5 more pain sites than an individual with a BMI of 20. Although the regression analysis showed a statistically significant association between the number of pain sites and both age and BMI ($p<0.05$), the β -value shows that the association week.

The clinically meaningful improvement on the numerical rating scale for pain is assessed to be 30% (Olsen et al., 2017; Ostelo et al., 2008). This equal a difference of 3.3-points on the 11-point numerical scale. The β-value of 0.30 results in a clinically meaningful improvement on pain intensity will be associated with approximately one pain site lesser. By using the same clinically meaningful improvement on the work ability scale, work ability has a slightly weaker association because of the β-value of -0.24.

Mental distress showed a β-value of 1.94 (95% CI = 1.67;2.19), meaning that a change of 1-point on the Hopkins Symptom Check List is associated with a change of nearly two pain sites. It is difficult to interpret this finding because an index-score ranging from 1 (mental distress) to 4 (healthy) is usually calculated for the Hopkins Symptom Check List where a score of 1.85≤ is suggested to be the most representative indication of mental distress (Søgaard, Bjelland, Tell & Røysamb, 2003). But a 1-unit change is synonymous with a 25% change in the, which most likely is a considerable change. A ½-unit change is associated with approximately a change of one pain site.

Despite the varying associations between biopsychosocial patient characteristics and the number of pain sites, the findings from the simple linear regression analysis show that individuals with a greater number of pain sites reports a more severe / worsen level on all included biopsychosocial patient characteristics known to be prognostic variables (Artus et al., 2017; de Vos Andersen et al., 2017; Green et al., 2018; Lagersted-Olsen, Bay, Jørgensen, Holtermann & Søgaard, 2016; Mundal, Gråwe, Bjørngaard, Linaker & Fors, 2014; Valentin et al., 2016). The practical implication of the result is discussed below.

Most interestingly is the stepwise backward regression model. This final model shows the effect of biopsychosocial patient characteristics on the number of pain sites. The findings is congruent with the current understanding of pain which postulates a multidimensional holistic view on pain where physiological, psychological, and social factors mutually influence each other and result in persistent and complex pain conditions (Engel, 1977; Gatchel, McGeary, McGeary & Lippe, 2014; Melzack & Wall, 1965; Wade & Halligan, 2017).

Mental distress showed to be important for the number of pain sites. This is in line with previous research (Coggon et al., 2017; Coggon et al., 2013; Hoogeboom et al., 2012; Kamaleri er al., 2008a) and findings from longitudinal studies suggest that individuals reporting poor mental health are more likely to develop pain (Vargas-Prada et al., 2013) and multisite pain (Solidaki et al., 2013; Christensen, Johansen & Knardahl, 2017), but not necessary the other way around (Leino & Magni, 1993).

Although a relationship between pain and mental state is reported (Manchikanti, Fellows & Singh, 2002; Lang & Davis, 2006), the casual status of this relationship is not fully established (Vargas-Prada & Coggon, 2015). A dominating hypothesis, however, suggests that dysfunction in the hypothalamic–pituitary–adrenal, the autonomic nervous system and the immune system, which is often seen in nonspecific diagnosis included in the present study, (Sarzi-Puttini, Atzeni, Diana, Doria & Furlan, 2006; Staud, 2015) can contribute to altered pain perception (Maletic & Raison, 2009). This may occur through central sensitization, a process of hypersensitivity of neural nociceptive pathways and a lowered threshold for pain perception (Latremoliere & Woolf, 2009; Woolf, 2011) As a result, painful sensations may occur in the absence of either peripheral pathology or noxious stimuli (IASP, 2017).

The relationship between higher symptom reporting and mental distress may also be related to the tendency of experiencing mental distress in the form of somatic symptoms (Al Busaidi, 2010; Lipowski, 1988). This tendency is termed somatization (Lipowski, 1988) and is reported in individuals experiencing common musculoskeletal disorders like neck pain, shoulder pain, and low back pain (Coggon et al., 2017; Fujimoto et al., 2020; Oha et al., 2014). It involves bodily hypervigilance, the predisposition to focus and searching for weak and infrequent bodily sensations (Barsky, Wyshak, & Klerman, 1990; Eccleston, Crombez, Aldrich, & Stannard, 1997) and worry about them (Vargas-Prada & Coggon, 2015). This may result in higher symptom awareness and a lower threshold for pain and symptom reporting.

It has been stated that those who complain about pain might have a negative perception of work and work-related conditions, or that the presence of pain may influence the perception of work (Coggon & Ntani, 2017). But the association between work ability and number of pain sites is most likely reciprocal (de Fernandes & Burdorf, 2016; de Fernandes, da Pataro, de Carvalho & Burdorf, 2016; Miranda et al., 2010; Subas Neupane, Leino-Arjas, Nygård, Oakman & Virtanen, 2017; Vleeshouwers, Knardahl & Christensen, 2019) since physical working conditions like working positions, repetitive movement, and heavy lifting (Ariëns, Van Mechelen, Bongers, Bouter & van der Wal, 2000; Hoogendoorn, Van Poppel, Bongers, Koes & Bouter, 1999; Sim, Lacey & Lewis, 2006; Toivanen et al., 2010) and psychosocial working condition like strain and responsibility (Madsen et al., 2018; Neupane et al., 2011; Neupane et al., 2017) is associated with subsequent pain.

Because the presence of pain can impact physical and social activity negatively (Leeuw et al., 2007; Miles, Pincus, Carnes, Taylor & Underwood, 2011), it is reasonable to assume that with an increased number of pain sites, the consequences of pain is greater. Reduced physical and social activity because of non-confrontable pain behavior may in turn increase the number of pain sites, the pain intensity, and the duration (Lethem, Slade, Troup, & Bentley, 1983).

Reduced exposure to some risk factors such as the workplace and other psychosocial demands might explain the association between low age and a higher number of pain sites (McBeth & Jones, 2007; Picavet & Schouten, 2003). Another explanation might be due to a lower threshold for symptom reporting in younger individuals (Eriksen, Svendsrød, Ursin & Ursin, 1998), or that elderly have a higher acceptance of their musculoskeletal pain because other chronic diseases and conditions might be more dominating (Picavet & Schouten, 2003; Bot et al., 2005).

The evidence regarding the gender-specific differences in pain perception and pain prevalence is inconclusive (El-Shormilisy, Strong & Meredith, 2015; Fillingim, King, Ribeiro-Dasilva, Rahim-Williams & Riley, 2009) but biological, psychological and social factors have been discussed as contributing factors (Myers, Riley & Robinson, 2003; Pieretti et al., 2016).

It has been expressed that all models are wrong and that the scientist must be aware of what is importantly wrong (Box, 1976). Of course, the model in the present study is no exception. Because the final model explained 30% of the variance in the number of pain sites, there are other underlying characteristics of importance not included in the model. That could be variables like smoking (De Vos Andersen et al., 2017), genetic (Diatchenko, Fillingim, Smith & Maixner, 2013) or psychological factors other mental distress (Artus et al., 2017).

It is important not to assign non-significant inferring to variables that showed to be non-significant. There are many explanations for the loss of statistical significance between the number of pain sites and biopsychosocial patient characteristics when entering a multivariable analysis. Inclusion of a confounding variable, a variable that influences both the outcome variable and independent variable, is one (Greenland, Robins & Pearl, 1999; Vander Weele & Shpitser, 2013). Another explanation might be an inclusion of patient characteristics in the model that simultaneously influences other patient characteristics. For instance, sleep quality (Sintonen, 2001) was included in the model as a separate variable but is also as a sub-item in the Hopkins Symptom Check List (Derogatis et al., 1974), the measure of psychological distress in the present study.

Implication for practice

The findings in the present study clearly have some implications for practice. Physiotherapists and other health care providers must be aware of the high prevalence of multisite pain in this population for several reasons. One reason is that individuals seeking medical care mainly report the primary complaint. If attention to this pain characteristic is not given, many complaints will be neglected resulting in insufficient treatment and poor outcome. In addition, individuals experiencing multisite pain have a significant poorer treatment outcome compared to individuals experiencing localized and dual-site pan (Moradi et al., 2010). Therefore, counting the number of pain sites can be used as a method to identify patients with a high or low risk of poor treatment outcomes. Furthermore, the number of pain sites provides guidelines for the right treatment regimen.

The right treatment may for individuals experiencing multisite pain be to focus on the extent rather than the original cause or site of pain (Smith, Elliott, Hannaford, Chambers & Smith, 2004). Patients with localized pain, however, may be more sensitive to interventions targeting the specific cause of pain (Gerhardt et al., 2016). If the complaint is part of more generalized symptomatology rather than alterations in tissues of the pain site, the patient is likely to benefit more from interventions targeting the central nervous system, including endogenous analgesia from exercise (Nijs, Kosek, Van Oosterwijck & Meeus, 2012; Mannerkorpi & Henriksson, 2007) and centrally-acting medications (Nir & Yarnitsky, 2015; Yarnitsky, 2015).

The high prevalence of multisite pain and the association with patient characteristics supports previous suggestions regarding increased attention towards prognostic variables in the management of musculoskeletal conditions (Green et al., 2018). Measuring these variables may give an indication of the holistic situation of the patient. This can help in decisions regarding the right treatment or the necessity of further examination. This is of importance because these variables are prognostic regardless of primary pain site (Artus et al., 2017; Artus et al., 2014; Green et al., 2018; Denison et al., 2004; Lagersted-Olsen et al., 2016; Valentin et al., 2016; de Vos Andersen et al., 2017) and several of them are modifiable by physiotherapists and other health care providers.

The workplace, for example, can be modified to so that patient can work despite having pain or be modified in a way that reduced the likelihood of development and exacerbation of pain. This include, among others, advices and guidelines regarding working positions, change of work tasks, the use of tools and equipment, flexibility related to workload and working hours, and exercise during working hours. A dialogue with the employer is also necessary so all parties have a common understanding of the situation.

The findings also have some implications for future research. Because few studies have investigated the number of pain sites in a clinical sample, there is a need for more cross-sectional studies investigating the number of pain sites and the association with biopsychosocial patient characteristics in clinical samples, including the ones in the present study. Longitudinal studies must investigate the impact of the number of pain sites on treatment outcome. Clinical trials must investigate different treatment approaches on individual's with different number of pain sites to determine the appropriate treatment approach. When interpreting results from other studies, the number of pain sites must be considered because of the associated with the prognostic biopsychosocial patient characteristics. In addition, a discussion regarding the current diagnostic system might be needed due to the high prevalence of multisite musculoskeletal pain.

Strengths and limitations

One strength of the present is the large number of individuals included which provide good statistical power and reduces the change of Type II errors (Columb & Atkinson, 2015). The large number of individuals also make the results more generalizable (Galea & Tracy, 2007). Because most studies in this field of research have investigated samples from the general population (e.g.: Carnes et al., 2007; Christensen et al., 2017; Kamaleri, 2008a; Schmidt & Baumeister, 2007), another strength is that data is from the primary health care service on patients seeking treatment.

This study also has some limitations, one of which is the cross-sectional design precluding the ability to conclude causation (Spector, 2019)

Response bias may have influenced the result in two ways. One way is because memory and cognition are reduced in individuals with pain conditions and the study used self-report questioners which depend on honesty and cognition (Hedges et al., 2019; Mazza, Frot & Rey, 2018). The other is because pain recall is inaccurate which may affect the outcome in on pain-related variables (Broderick et al., 2008; Eich, Reeves, Jaeger, & Graff-Radford, 1985; Eli, Baht, Kozlovsky, & Simon, 2000; Mazza et al., 2018)

The present study is also exposed to non-response bias (Sedgwick, 2015). A recent systematic review identified several factors influencing medical research participation (Jin, Cui & Liu, 2020). Among identified factors were socioeconomic status, education levels, gender and age. The study sample may be represented by a higher proportion of females than normally seen in the clinic. Consequently, the findings may be influenced by the gender-specific difference in pain epidemiology (Craft, 2007; Meng et al., 2015). The sample may also be overrepresented by individuals with high socioeconomic status, contributing to a result influenced by the positive association with and health status (McBeth & Jones, 2007). A study sample consisting of a higher participation rate of middle-aged is also possible (Jin et al., 2020).

Reporting's regarding the number of pain sites may have been influenced by measurement bias (Page & Henderson, 2008) from the Standardised Nordic questionnaires. Because the Standardised Nordic questionnaires measure pain, ache or discomfort in the 10 mentioned regions, there is no lower limit for complaint severity. This might result in an inclusion of pain sites without an impact on biopsychosocial pain characteristics.

Two different methods have been used to include individuals. This results in a study sample selected on different criteria. The inclusion method used guidelines that were developed based on information from individuals with an ICPC-code. There is no way to be sure that individuals included by using method two would have been diagnosed with an ICPC-code referring to the same anatomical site. This results in the possible of selection bias, influencing the homogeneity in the compliant group.

Inclusion of the oldest individuals (>69 years) may be a limitation because of protentional reduced cognitive and communicative functioning influencing the answer during the assessment (Knäuper et al., 2016). They also represent the non-working population (Rutledge, 2018). However, there are two reasons for the inclusion of this age group. First, osteoarthritis of the hip or knee was highly represented in this age group in the present study, but also in the general population (Clauw, 2014; Deveza et al., 2017). Second, exclusion of this age group did not influence the results considerably (data not shown).

Power analysis has not been conducted which results in uncertainty related to the required size of the study sample. Some authors argue that fewer than 10 observations per independent variable may be appropriate (David, Hosmer & Lemeshow, 2000). Others argue for as many as 70 observations per independent variable, and that there is no clear protocol regarding the number of observations, but that the specific research context determines (Maxwell, 2000).

By following the ”rule of thumb” which is a minimum of 10 to 15 observations per variable in linear models, the number of individuals included is satisfying (Babyak, 2004).

Although results have been double-checked after the transfer, the possibility of bias during this process remain. Due to ethical reasons, this bias could not be excluded, but using an external with statistical experience reduces the possibility of bias. The criticism of the multivariable model is discussed above.

SUMMARY

The present cross-sectional study found multisite pain to be common in individuals seeking physiotherapy in primary care due to musculoskeletal pain. Individuals with neck complaints experienced a greater number of pain sites than individuals with osteoarthritis of the hip or knee, and individuals with complaints in the shoulder and the back. The multisite pain / complex group had the highest prevalence of multisite pain. These findings are in line with previous research reporting multisite pain to be prevalent in the general population (Carnes et al., 2007; Christensen et al., 2017; Hoogeboom et al., 2012; Kamaleri et al., 2008a; Natvig, Bruusgaard & Eriksen, 2001; Natvig et al. 2010; Schmidt & Baumeister, 2007). Physiotherapists and other health care providers must be aware of the high prevalence of multisite pain in this population and increase the attention on the number of pain sites so that the treatment regime addresses all the needs of the patient.

An association between a higher number of pain sites and a more severe / worsen level on biopsychosocial patient characteristics known to be important prognostic variables was demonstrated. Results from the stepwise backward regression analysis showed that lower age, higher BMI, female gender, and a more severe / worsen level of pain intensity, pain duration, work ability and mental distress, was associated with a higher number of pain sites, accounting for 30% of the variance. This relationship is most likely very complex and interactive, and support increased attention towards prognostic variables in the management of musculoskeletal conditions (Green et al., 2018), especially because many of these variables are modifiable by the physiotherapist and other health care providers.

Increased knowledge on this pain characteristic is needed to increase the current understanding of the phenomena. Longitudinal studies and clinical trials must investigate the impact of the number of pain sites on treatment outcomes, and the number of pain sites must be considered when interpreting results from research

REFERENCES

Ahlstrom, L., Grimby-Ekman, A., & Dellve, L. (2010). The Work Ability Index and single-item question: associations with sick leave, symptoms and health-a prospective study of women on long-term sick leave Multiple Chemical Sensitivity: Toxicological Questions and Mechanisms View project Women on long-term s. *Article in Scandinavian Journal of Work*, (June 2014). https://doi.org/10.2307/40967876

Akinwande, M. O., Dikko, H. G., & Samson, A. (2015). Variance Inflation Factor: As a Condition for the Inclusion of Suppressor Variable(s) in Regression Analysis. *Open Journal of Statistics*, *05*(07), 754–767. https://doi.org/10.4236/ojs.2015.57075

Al Busaidi, Z. Q. (2010, August 1). The concept of somatisation: A cross-cultural perspective. *Sultan Qaboos University Medical Journal*, Vol. 10, pp. 180–186. Retrieved from /pmc/articles/PMC3074701/?report=abstract

Andersen, I., Frydenberg, H., & Mæland, J. G. (2009). Muskel- og skjelettplager og fremtidig sykefravær. *Tidsskrift for Den Norske Laegeforening*, *129*(12), 1210–1213. https://doi.org/10.4045/tidsskr.09.32410

Ang, D. C., Kroenke, K., & McHorney, C. A. (2006). Impact of pain severity and location on health-related quality of life. *Rheumatology International*, *26*(6), 567–572. https://doi.org/10.1007/s00296-005-0025-z

Arden, N., & Nevitt, M. C. (2006, February 1). Osteoarthritis: Epidemiology. *Best Practice and Research: Clinical Rheumatology*, Vol. 20, pp. 3–25. https://doi.org/10.1016/j.berh.2005.09.007

Ariëns, G. A. M., Van Mechelen, W., Bongers, P. M., Bouter, L. M., & Van Der Wal, G. (2000). Physical risk factors for neck pain. *Scandinavian Journal of Work, Environment and Health*, *26*(1), 7–19. https://doi.org/10.5271/sjweh.504

Artus, M., Campbell, P., Mallen, C. D., Dunn, K. M., & van der Windt, D. A. W. (2017). Generic prognostic factors for musculoskeletal pain in primary care: a systematic review. *BMJ Open*, *7*(1), e012901. https://doi.org/10.1136/bmjopen-2016-012901

Artus, M., Van Der Windt, D., Jordan, K. P., & Croft, P. R. (2014). The clinical course of low back pain: A meta-analysis comparing outcomes in randomised clinical trials (RCTs) and observational studies. *BMC Musculoskeletal Disorders*, *15*(1), 68. https://doi.org/10.1186/1471-2474-15-68

Babyak, M. A. (2004). What you see may not be what you get: A brief, nontechnical introduction to overfitting in regression-type models. *Psychosomatic Medicine*, *66*(3), 411–421. https://doi.org/10.1097/01.psy.0000127692.23278.a9

Barsky, A. J., Wyshak, G., & Klerman, G. L. (1990). The Somatosensory Amplification Scale and its relationship to hypochondriasis. *Journal of Psychiatric Research*, *24*(4), 323–334. https://doi.org/10.1016/0022-3956(90)90004-A

Bernard, A. M., & Wright, S. W. (2004). Chronic pain in the ED. *American Journal of Emergency Medicine*, *22*(6), 444–447. https://doi.org/10.1016/j.ajem.2004.07.026

Berthelot, J. M., Nizard, J., & Maugars, Y. (2019, July 1). The negative Hawthorne effect: Explaining pain overexpression. *Joint Bone Spine*, Vol. 86, pp. 445–449.

https://doi.org/10.1016/j.jbspin.2018.10.003

Bilberg, A., Bremell, T., Balogh, I., & Mannerkorpi, K. (2015). Significantly impaired shoulder function in the first years of rheumatoid arthritis: A controlled study. *Arthritis Research and Therapy*, *17*(1). https://doi.org/10.1186/s13075-015-0777-0

Blyth, F. M., Briggs, A. M., Schneider, C. H., Hoy, D. G., & March, L. M. (2019). The global burden of musculoskeletal pain—where to from here? *American Journal of Public Health*, *109*(1), 35–40. https://doi.org/10.2105/AJPH.2018.304747

Bot, S. D. M., Van Der Waal, J. M., Terwee, C. E., Van Der Windt, D. A. W. M., Schellevis, F. G., Bouter, L. M., & Dekker, J. (2005). Incidence and prevalence of complaints of the neck and upper extremity in general practice. *Annals of the Rheumatic Diseases*, *64*(1), 118–123. https://doi.org/10.1136/ard.2003.019349

Botsis, T., Bassøe, C. F., & Hartvigsen, G. (2010). Sixteen years of ICPC use in Norwegian primary care: Looking through the facts. *BMC Medical Informatics and Decision Making*, *10*(1), 1–10. https://doi.org/10.1186/1472-6947-10-11

Box, G. E. P. (1976). Science and Statistics. *Journal of the American Statistical Association*, *71*(356), 791. https://doi.org/10.2307/2286841

Briggs, A. M., Cross, M. J., Hoy, D. G., Sànchez-Riera, L., Blyth, F. M., Woolf, A. D., & March, L. (2016). Musculoskeletal Health Conditions Represent a Global Threat to Healthy Aging: A Report for the 2015 World Health Organization World Report on Ageing and Health. *The Gerontologist*, *56 Suppl 2*, S243-55. https://doi.org/10.1093/geront/gnw002

Briggs, A. M., Woolf, A. D., Dreinhöfer, K., Homb, N., Hoy, D. G., Kopansky-Giles, D., … March, L. (2018). Reducing the global burden of musculoskeletal conditions. *Bulletin of the World Health Organization*, *96*(5), 366–368. https://doi.org/10.2471/BLT.17.204891

Broderick, J. E., Schwartz, J. E., Vikingstad, G., Pribbernow, M., Grossman, S., & Stone, A. A. (2008). The accuracy of pain and fatigue items across different reporting periods. *Pain*, *139*(1), 146–157. https://doi.org/10.1016/j.pain.2008.03.024

Bruusgaard, D., Tschudi-Madsen, H., Ihlebæk, C., Kamaleri, Y., & Natvig, B. (2012). Symptom load and functional status: Results from the Ullensaker population study. *BMC Public Health*, *12*(1). https://doi.org/10.1186/1471-2458-12-1085

Caridi, J. M., Pumberger, M., & Hughes, A. P. (2011, October 9). Cervical Radiculopathy: A Review. *HSS Journal*, Vol. 7, pp. 265–272. https://doi.org/10.1007/s11420-011-9218-z

Carnes, D., Parsons, S., Ashby, D., Breen, A., Foster, N. E., Pincus, T., … Underwood, M. (2007). Chronic musculoskeletal pain rarely presents in a single body site: results from a UK population study. *Rheumatology (Oxford, England)*, *46*(7), 1168–1170. https://doi.org/10.1093/rheumatology/kem118

Choi, B. W., Kim, S. S., Lee, D. H., & Kim, J. W. (2017). Cervical radiculopathy combined with cervical myelopathy: prevalence and characteristics. *European Journal of Orthopaedic Surgery and Traumatology*, *27*(7), 889–893. https://doi.org/10.1007/s00590-017-1972-2

Christensen, J. O., Johansen, S., & Knardahl, S. (2017). Psychological predictors of change in the number of musculoskeletal pain sites among Norwegian employees: a prospective study. *BMC Musculoskeletal Disorders*, *18*(1), 1–13. https://doi.org/10.1186/s12891-017-1503-7

Cimmino, M. A., Ferrone, C., & Cutolo, M. (2011). Epidemiology of chronic musculoskeletal pain. *Best Practice and Research: Clinical Rheumatology*, *25*(2), 173–183. https://doi.org/10.1016/j.berh.2010.01.012

Clauw, D. J. (2014, April 16). Fibromyalgia: A clinical review. *JAMA - Journal of the American Medical Association*, Vol. 311, pp. 1547–1555. https://doi.org/10.1001/jama.2014.3266

Cleland, J. A., Noteboom, J. T., Whitman, J. M., & Allison, S. C. (2008, August 1). A primer on selected aspects of evidence-based practice relating to questions of treatment, Part 1: Asking questions, finding evidence, and determining validity. *Journal of Orthopaedic and Sports Physical Therapy*, Vol. 38, pp. 476–484. https://doi.org/10.2519/jospt.2008.2722

Coggon, D., & Ntani, G. (2017). Trajectories of multisite musculoskeletal pain and implications for prevention. *Occupational and Environmental Medicine*, Vol. 74, pp. 465–466. https://doi.org/10.1136/oemed-2016-104196

Coggon, D., Ntani, G., Palmer, K. T., Felli, V. E., Harari, R., Barrero, L. H., … Gray, A. (2013). Patterns of multisite pain and associations with risk factors. *Pain*, *154*(9), 1769–1777. https://doi.org/10.1016/j.pain.2013.05.039

Coggon, D., Ntani, G., Walker-Bone, K., Palmer, K. T., Felli, V. E., Harari, R., … Salazar Vega, E. J. (2017). Epidemiological Differences between Localized and Nonlocalized Low Back Pain. *Spine*, *42*(10), 740–747. https://doi.org/10.1097/BRS.0000000000001956

Columb, M. O., & Atkinson, M. S. (2015). Statistical analysis: sample size and power estimations. *BJA Education*, *16*(5), 159–161. https://doi.org/10.1093/bjaed/mkv034

Craft, R. M. (2007, November 1). Modulation of pain by estrogens. *Pain*, Vol. 132, p. S3. https://doi.org/10.1016/j.pain.2007.09.028

Croft, P., Dunn, K. M., & Von Korff, M. (2007). Chronic pain syndromes: You can’t have one without another. *Pain*, *131*(3), 237–238. https://doi.org/10.1016/j.pain.2007.07.013

David W.. Hosmer, & Lemeshow, S. (2000). *Applied logistic regression*. New York: Wiley.

De Fernandes, R. C. P., Da Pataro, S. M. S., De Carvalho, R. B., & Burdorf, A. (2016). The concurrence of musculoskeletal pain and associated work-related factors: A cross sectional study. *BMC Public Health*, *16*(1). https://doi.org/10.1186/s12889-016-3306-4

De Vos Andersen, N. B., Kent, P., Hjort, J., & Christiansen, D. H. (2017). Clinical course and prognosis of musculoskeletal pain in patients referred for physiotherapy: does pain site matter? *BMC Musculoskeletal Disorders*, *18*(1). https://doi.org/10.1186/s12891-017-1487-3

Denison, E., Asenlöf, P., & Lindberg, P. (2004). Self-efficacy, fear avoidance, and pain intensity as predictors of disability in subacute and chronic musculoskeletal pain patients in primary health care. *Pain*, *111*(3), 245–252.

https://doi.org/10.1016/j.pain.2004.07.001

Derogatis, L. R., Lipman, R. S., Rickels, K., Uhlenhuth, E. H., & Covi, L. (1974). The Hopkins Symptom Checklist (HSCL). A measure of primary symptom dimensions. *Modern Problems of Pharmacopsychiatry*, *7*(0), 79–110. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/4607278

Deveza, L. A., Melo, L., Yamato, T. P., Mills, K., Ravi, V., & Hunter, D. J. (2017, December 1). Knee osteoarthritis phenotypes and their relevance for outcomes: a systematic review. *Osteoarthritis and Cartilage*, Vol. 25, pp. 1926–1941. https://doi.org/10.1016/j.joca.2017.08.009

Diatchenko, L., Fillingim, R. B., Smith, S. B., & Maixner, W. (2013). The phenotypic and genetic signatures of common musculoskeletal pain conditions. *Nat. Rev. Rheumatol*, *9*, 340–350. https://doi.org/10.1038/nrrheum.2013.43

Dunn, K. M., Jordan, K. P., & Croft, P. R. (2011). Contributions of prognostic factors for poor outcome in primary care low back pain patients. *European Journal of Pain*, *15*(3), 313–319. https://doi.org/10.1016/j.ejpain.2010.07.008

Eccleston, C., Crombez, G., Aldrich, S., & Stannard, C. (1997). Attention and somatic awareness in chronic pain. *Pain*, *72*(1–2), 209–215. https://doi.org/10.1016/S0304-3959(97)00030-4

Eich, E., Reeves, J. L., Jaeger, B., & Graff-Radford, S. B. (1985). Memory for pain: Relation between past and present pain intensity. *Pain*, *23*(4), 375–380. https://doi.org/10.1016/0304-3959(85)90007-7

El-Shormilisy, N., Strong, J., & Meredith, P. J. (2015). Associations among gender, coping patterns and functioning for individuals with chronic pain: A systematic review. *Pain Research and Management*, *20*(1), 48–55. https://doi.org/10.1155/2015/490610

El Fassi, M., Bocquet, V., Majery, N., Lair, M. L., Couffignal, S., & Mairiaux, P. (2013). Work ability assessment in a worker population: Comparison and determinants of Work Ability Index and Work Ability score. *BMC Public Health*, *13*(1), 305. https://doi.org/10.1186/1471-2458-13-305

Eli, I., Baht, R., Kozlovsky, A., & Simon, H. (2000). Effect of gender on acute pain prediction and memory in periodontal surgery. *European Journal of Oral Sciences*, *108*(2), 99–103. https://doi.org/10.1034/j.1600-0722.2000.00777.x

Engebretsen, K. B., Grotle, M., & Natvig, B. (2015). Patterns of shoulder pain during a 14-year follow-up: results from a longitudinal population study in Norway. *Shoulder & Elbow*, *7*(1), 49–59. https://doi.org/10.1177/1758573214552007

Engel, G. L. (1977). The need for a new medical model: A challenge for biomedicine. *Science*, *196*(4286), 129–136. https://doi.org/10.1126/science.847460

Eriksen, H. R., Svendsrød, R., Ursin, G., & Ursin, H. (1998). Prevalence of subjective health complaints in the Nordic European countries in 1993. *European Journal of Public Health*, *8*(4), 294–298. https://doi.org/10.1093/eurpub/8.4.294

Evensen, K. A. I., Robinson, H. S., Meisingset, I., Woodhouse, A., Thielemann, M., Bjorbækmo, W. S., … Vøllestad, N. K. (2018). Characteristics, course and outcome of patients receiving physiotherapy in primary health care in Norway: design of a longitudinal observational project. *BMC Health Services Research*, *18*(1), 1–10. https://doi.org/10.1186/s12913-018-3729-y

Ferreira-Valente, M. A., Pais-Ribeiro, J. L., & Jensen, M. P. (2011). Validity of four pain intensity rating scales. *Pain*, *152*(10), 2399–2404. https://doi.org/10.1016/j.pain.2011.07.005

Fillingim, R. B., King, C. D., Ribeiro-Dasilva, M. C., Rahim-Williams, B., & Riley, J. L. (2009, May 1). Sex, Gender, and Pain: A Review of Recent Clinical and Experimental Findings. *Journal of Pain*, Vol. 10, pp. 447–485. https://doi.org/10.1016/j.jpain.2008.12.001

Fujimoto, Y., Fujii, T., Oshima, Y., Oka, H., Tanaka, S., & Matsudaira, K. (2020). The association between neck and shoulder discomfort–Katakori–and high somatizing tendency. *Modern Rheumatology*, *30*(1), 191–196. https://doi.org/10.1080/14397595.2018.1551177

Galea, S., & Tracy, M. (2007). Participation Rates in Epidemiologic Studies. *Annals of Epidemiology*, *17*(9), 643–653. https://doi.org/10.1016/j.annepidem.2007.03.013

Gatchel, R. J., McGeary, D. D., McGeary, C. A., & Lippe, B. (2014). Interdisciplinary chronic pain management. *American Psychologist*, *69*(2), 119–130. https://doi.org/10.1037/a0035514

Gerhardt, A., Eich, W., Janke, S., Leisner, S., Treede, R.-D., & Tesarz, J. (2016). Chronic Widespread Back Pain is Distinct From Chronic Local Back Pain. *The Clinical Journal of Pain*, *32*(7), 568–579. https://doi.org/10.1097/AJP.0000000000000300

Gerhardt, A., Eich, W., Treede, R. D., & Tesarz, J. (2017). Conditioned pain modulation in patients with nonspecific chronic back pain with chronic local pain, chronic widespread pain, and fibromyalgia. *Pain*, *158*(3), 430–439. https://doi.org/10.1097/j.pain.0000000000000777

Goldfeld, S. M., & Quandt, R. E. (1965). Some Tests for Homoscedasticity. *Journal of the American Statistical Association*, *60*(310), 539–547. https://doi.org/10.1080/01621459.1965.10480811

Green, D. J., Lewis, M., Mansell, G., Artus, M., Dziedzic, K. S., Hay, E. M., … van der Windt, D. A. (2018). Clinical course and prognostic factors across different musculoskeletal pain sites: A secondary analysis of individual patient data from randomised clinical trials. *European Journal of Pain (London, England)*, *22*(6), 1057–1070. https://doi.org/10.1002/ejp.1190

Greenland, S., Robins, J. M., & Pearl, J. (1999). Confounding and Collapsibility in Causal Inference. *Statistical Science*, *14*(1), 29–46. https://doi.org/10.1214/SS/1009211805

Gummesson, C., Atroshi, I., & Ekdahl, C. (2004). The quality of reporting and outcome measures in randomized clinical trials related to upper-extremity disorders. *Journal of Hand Surgery*, *29*(4), 727–734. https://doi.org/10.1016/j.jhsa.2004.04.003

Haavet, O. R., Sirpal, M. K., Haugen, W., & Christensen, K. S. (2011). Diagnosis of depressed young people in primary health care--a validation of HSCL-10. *Family*

Practice, *28*(2), 233–237. https://doi.org/10.1093/fampra/cmq078

Hagen, K., Svebak, S., & Zwart, J. A. (2006). Incidence of musculoskeletal complaints in a large adult Norwegian county population. The HUNT study. *Spine*, *31*(18), 2146–2150. https://doi.org/10.1097/01.brs.0000231734.56161.6b

Haldorsen, E. M. H. (2003). The right treatment to the right patient at the right time. *Occupational and Environmental Medicine*, *60*(4), 235–236. https://doi.org/10.1136/oem.60.4.235

Hedayat, A., & Robson, D. S. (1970). Independent stepwise residuals for testing homoscedasticity. *Journal of the American Statistical Association*, *65*(332), 1573–1581. https://doi.org/10.1080/01621459.1970.10481186

Hedges, D., Farrer, T. J., Bigler, E. D., Hopkins, R. O., Hedges, D., Farrer, T. J., … Hopkins, R. O. (2019). Chronic Pain and Cognition. In *The Brain at Risk* (pp. 113–124). https://doi.org/10.1007/978-3-030-14260-5_9

Holth, H. S., Kine, H., Werpen, B., Zwart, J.-A., & Hagen, K. (2008). *Physical inactivity is associated with chronic musculoskeletal complaints 11 years later: results from the Nord-Trøndelag Health Study*. https://doi.org/10.1186/1471-2474-9-159

Hoogeboom, T. J., den Broeder, A. A., Swierstra, B. A., de Bie, R. A., & van den Ende, C. H. M. (2012). Joint-pain comorbidity, health status, and medication use in hip and knee osteoarthritis: A cross-sectional study. *Arthritis Care & Research*, *64*(1), 54–58. https://doi.org/10.1002/acr.20647

Hoogendoorn, W. E., Van Poppel, M. N. M., Bongers, P. M., Koes, B. W., & Bouter, L. M. (1999). Physical load during work and leisure time as risk factors for back pain. *Scandinavian Journal of Work, Environment and Health*, *25*(5), 387–403. https://doi.org/10.5271/sjweh.451

Hoven, L. H. J., Gorter, K. J., & Picavet, H. S. J. (2010). Measuring musculoskeletal pain by questionnaires: The manikin versus written questions. *European Journal of Pain*, *14*(3), 335–338. https://doi.org/10.1016/j.ejpain.2009.06.002

Hoy, D. G., Smith, E., Cross, M., Sanchez-Riera, L., Buchbinder, R., Blyth, F. M., … Hoy, D. (2014). *The global burden of musculoskeletal conditions for 2010: an overview of methods*. https://doi.org/10.1136/annrheumdis-2013-204344

Huisstede, B. M. A., Wijnhoven, H. A., Bierma-Zeinstra, S. M., Koes, B. W., Verhaar, J. A., & Picavet, S. (2008). Prevalence and characteristics of complaints of the arm, neck, and/or shoulder (CANS) in the open population. *Clinical Journal of Pain*, *24*(3), 253–259. https://doi.org/10.1097/AJP.0b013e318160a8b4

Ihlebæk, C., Brage, S., Natvig, B., & Bruusgaard, D. (2010). Forekomst av muskel- og skjelettlidelser i Norge. *Tidsskrift for Den Norske Laegeforening*, Vol. 130, pp. 2365–2368. https://doi.org/10.4045/tidsskr.09.0802

Ijzelenberg, W., & Burdorf, A. (2004). Impact of musculoskeletal co-morbidity of neck and upper extremities on healthcare utilisation and sickness absence for low back pain. *Occupational and Environmental Medicine*, *61*(10), 806–810. https://doi.org/10.1136/oem.2003.011635

International Association for the Study of Pain Taxonomy (2017, 14. December). IASP Terminology. Retrieved from http://www.iasp-pain.org/Education/Content.aspx?ItemNumber=1698&navItemNumber=576 2011

James, G., Witten, D., Hastie, T., & Tibshirani, R. (2000). An introduction to Statistical Learning. In *Current medicinal chemistry* (Vol. 7). https://doi.org/10.1007/978-1-4614-7138-7

Jin, H., Cui, M., & Liu, J. (2020). Factors affecting people's attitude toward participation in medical research: a systematic review. *Current Medical Research and Opinion*. https://doi.org/10.1080/03007995.2020.1760807

Kamaleri, Y., Natvig, B., Ihlebaek, C. M., Benth, J. S., & Bruusgaard, D. (2008). Number of pain sites is associated with demographic, lifestyle, and health-related factors in the general population. *European Journal of Pain*, *12*(6), 742–748. https://doi.org/10.1016/j.ejpain.2007.11.005

Kamaleri, Y., Natvig, B., Ihlebaek, C. M., & Bruusgaard, D. (2008). Localized or widespread musculoskeletal pain: does it matter? *Pain*, *138*(1), 41–46. https://doi.org/10.1016/j.pain.2007.11.002

Kamaleri, Y., Natvig, B., Ihlebaek, C. M., & Bruusgaard, D. (2009). Does the number of musculoskeletal pain sites predict work disability? A 14-year prospective study. *European Journal of Pain (London, England)*, *13*(4), 426–430. https://doi.org/10.1016/j.ejpain.2008.05.009

Klinedinst, N. J., Resnick, B., Yerges-Armstrong, L. M., & Dorsey, S. G. (2015). The interplay of genetics, behavior, and pain with depressive symptoms in the elderly. *Gerontologist*, *55*, S67–S77. https://doi.org/10.1093/geront/gnv015

Knäuper, B., Carrière, K., Chamandy, M., Xu, Z., Schwarz, N., & Rosen, N. O. (2016, June 1). How aging affects self-reports. *European Journal of Ageing*, Vol. 13, pp. 185–193. https://doi.org/10.1007/s10433-016-0369-0

Kovacs, F. M., Abraira, V., Zamora, J., & Fernández, C. (2005). The Transition from Acute to Subacute and Chronic Low Back Pain. *Spine*, *30*(15), 1786–1792. https://doi.org/10.1097/01.brs.0000172159.47152.dc

Kuorinka, I., Jonsson, B., Kilbom, A., Vinterberg, H., Biering-Sørensen, F., Andersson, G., & Jørgensen, K. (1987). Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. *Applied Ergonomics*, *18*(3), 233–237. https://doi.org/10.1016/0003-6870(87)90010-X

Kurtze, N., Rangul, V., Hustvedt, B. E., & Flanders, W. D. (2008). Reliability and validity of self-reported physical activity in the Nord-Trøndelag Health Study — HUNT 1. *Scandinavian Journal of Public Health*, *36*(1), 52–61. https://doi.org/10.1177/1403494807085373

Lærum, E., Brage, S., Ihlebæk, C., Johnsen, K., Natvig, B., & Aas, E. (2013). Et muskel- og skjelettregnskap: forekomst og kostnader knyttet til skader, sykdommer og plager i muskel- og skjelettsystemet. In *Formi*.

Lagersted-Olsen, J., Bay, H., Jørgensen, M. B., Holtermann, A., & Søgaard, K. (2016). Low back pain patterns over one year among 842 workers in the DPhacto study and predictors for chronicity based on repetitive measurements. *BMC Musculoskeletal Disorders*, *17*(1), 1–11. https://doi.org/10.1186/s12891-016-1307-1

Latremoliere, A., & Woolf, C. J. (2009). Central Sensitization: A Generator of Pain Hypersensitivity by Central Neural Plasticity. *Frontiers in Bioscience*, *10*(9), 895–926. https://doi.org/10.1016/j.jpain.2009.06.012

Leeuw, M., Goossens, M. E. J. B., Linton, S. J., Crombez, G., Boersma, K., & Vlaeyen, J. W. S. (2007, February 20). The fear-avoidance model of musculoskeletal pain: Current state of scientific evidence. *Journal of Behavioral Medicine*, Vol. 30, pp. 77–94. https://doi.org/10.1007/s10865-006-9085-0

Leino, P., & Magni, G. (1993). Depressive and distress symptoms as predictors of low back pain, neck-shoulder pain, and other musculoskeletal morbidity: a 10-year follow-up of metal industry employees. *Pain*, *53*(1), 89–94. https://doi.org/10.1016/0304-3959(93)90060-3

Lethem, J., Slade, P. D., Troup, J. D. G., & Bentley, G. (1983). Outline of a fear-avoidance model of exaggerated pain perception-I. *Behaviour Research and Therapy*, *21*(4), 401–408. https://doi.org/10.1016/0005-7967(83)90009-8

Leveille, S. G., Bean, J., Ngo, L., McMullen, W., & Guralnik, J. M. (2007). The pathway from musculoskeletal pain to mobility difficulty in older disabled women. *Pain*, *128*(1–2), 69–77. https://doi.org/10.1016/j.pain.2006.08.031

Linton, S. J., Nicholas, M., & Macdonald, S. (2011). Development of a short form of the Örebro Musculoskeletal Pain Screening Questionnaire. *Spine*, *36*(22), 1891–1895. https://doi.org/10.1097/BRS.0b013e3181f8f775

Lipowski, Z. J. (1988). Somatization: The concept and its clinical application. *American Journal of Psychiatry*, Vol. 145, pp. 1358–1368. https://doi.org/10.1176/ajp.145.11.1358

Ludewig, P. M., Kamonseki, D. H., Staker, J. L., Lawrence, R. L., Camargo, P. R., & Braman, J. P. (2017). CHANGING OUR DIAGNOSTIC PARADIGM: MOVEMENT SYSTEM DIAGNOSTIC CLASSIFICATION. *International Journal of Sports Physical Therapy*, *12*(6), 884–893. https://doi.org/10.26603/ijspt20170884

Madsen, I. E. H., Gupta, N., Budtz-Jørgensen, E., Bonde, J. P., Framke, E., Flachs, E. M., … Rugulies, R. (2018). Physical work demands and psychosocial working conditions as predictors of musculoskeletal pain: A cohort study comparing self-reported and job exposure matrix measurements. *Occupational and Environmental Medicine*, *75*(10), 752–758. https://doi.org/10.1136/oemed-2018-105151

Maletic, V., & Raison, C. L. (2009). Neurobiology of depression, fibromyalgia and neuropathic pain. *Frontiers in Bioscience*, *14*(14), 5291–5338. https://doi.org/10.2741/3598

Manchikanti, L., Fellows, B., & Singh, V. (2002). Understanding psychological aspects of chronic pain in interventional pain management. *Pain Physician*, *5*(1), 57–82.

Mannerkorpi, K., & Henriksson, C. (2007, June 1). Non-pharmacological treatment of chronic widespread musculoskeletal pain. *Best Practice and Research: Clinical Rheumatology*, Vol. 21, pp. 513–534. https://doi.org/10.1016/j.berh.2007.04.001

Manske, R. C., & Lehecka, B. J. (2012). Evidence - based medicine/practice in sports physical therapy. *International Journal of Sports Physical Therapy, 7*(5), 461–473. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/23091778%0Ahttp://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC3474298

Martinez, J. E., Filho, I. S. B., Kubokawa, K., Pedreira, I. S., Machado, L. A. M., & Cevasco, G. (2001). Evaluation of the quality of life in Brazilian women with fibromyalgia, through the medical outcome survey 36 item short-form study. *Disability and Rehabilitation*, *23*(2), 64–68. https://doi.org/10.1080/dre.23.2.64.68

Maxwell, S. E. (2000). Sample Size and Multiple Regression Analysis. *Psychological Methods*, *5*(4), 434–458.

Mazza, S., Frot, M., & Rey, A. E. (2018, December 20). A comprehensive literature review of chronic pain and memory. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, Vol. 87, pp. 183–192. https://doi.org/10.1016/j.pnpbp.2017.08.006

McBeth, J., & Jones, K. (2007, June). Epidemiology of chronic musculoskeletal pain. *Best Practice and Research: Clinical Rheumatology*, Vol. 21, pp. 403–425. https://doi.org/10.1016/j.berh.2007.03.003

Meisingset, I., Vasseljen, O., Vøllestad, N. K., Robinson, H. S., Woodhouse, A., Engebretsen, K. B., … Skarpsno, E. S. (2020). Novel approach towards musculoskeletal phenotypes. *European Journal of Pain*, ejp.1541. https://doi.org/10.1002/ejp.1541

Melzack, R., & Wall, P. D. (1965). Pain mechanisms: a new theory. *Science*, *150*(3699), 971–979.

Meng, W., Deshmukh, H. A., Donnelly, L. A., Torrance, N., Colhoun, H. M., Palmer, C. N. A., & Smith, B. H. (2015). A Genome-wide Association Study Provides Evidence of Sex-specific Involvement of Chr1p35.1 (ZSCAN20-TLR12P) and Chr8p23.1 (HMGB1P46) With Diabetic Neuropathic Pain. *EBioMedicine*, *2*(10), 1386–1393. https://doi.org/10.1016/j.ebiom.2015.08.001

Miles, C. L., Pincus, T., Carnes, D., Taylor, S. J. C., & Underwood, M. (2011). Measuring pain self-efficacy. *Clinical Journal of Pain*, *27*(5), 461–470. https://doi.org/10.1097/AJP.0b013e318208c8a2

Moradi, B., Zahlten-Hinguranage, A., Barié, A., Caldeira, F., Schnatzer, P., Schiltenwolf, M., & Neubauer, E. (2010). The impact of pain spread on the outcome of multidisciplinary therapy in patients with chronic musculoskeletal pain - a prospective clinical study in 389 patients. *European Journal of Pain (London, England)*, *14*(8), 799–805. https://doi.org/10.1016/j.ejpain.2010.02.002

Mortimer, M., & Ahlberg, G. (2003). To seek or not to seek? Care-seeking behaviour among people with low-back pain. *Scandinavian Journal of Public Health*, *31*(3), 194–203. https://doi.org/10.1080/14034940210134086

Mose, S., Christiansen, D. H., Jensen, J. C., & Andersen, J. H. (2016). Widespread pain - Do pain intensity and care-seeking influence sickness absence? - A population-based cohort study. *BMC Musculoskeletal Disorders*, *17*(197). https://doi.org/10.1186/s12891-016-1056-1

Mundal, I., Bjørngaard, J. H., Nilsen, T. I. L., Nicholl, B. I., Gråwe, R. W., & Fors, E. A. (2016). Long-Term Changes in Musculoskeletal Pain Sites in the General Population: The HUNT Study. *Journal of Pain*, *17*(11), 1246–1256. https://doi.org/10.1016/j.jpain.2016.08.006

Mundal, I., Gråwe, R. W., Bjørngaard, J. H., Linaker, O. M., & Fors, E. A. (2014). Prevalence and long-term predictors of persistent chronic widespread pain in the general population in an 11-year prospective study: The HUNT study. *BMC Musculoskeletal Disorders*, *15*(1), 213. https://doi.org/10.1186/1471-2474-15-213

Murphy, D. R., Hurwitz, E. L., Gregory, A., & Clary, R. (2006). A Nonsurgical Approach to the Management of Patients With Cervical Radiculopathy: A Prospective Observational Cohort Study. *Journal of Manipulative and Physiological Therapeutics*, *29*(4), 279–287. https://doi.org/10.1016/j.jmpt.2006.03.005

Murray, C. J. L., Vos, T., Lozano, R., Naghavi, M., Flaxman, A. D., Michaud, C., … Lopez, A. D. (2012). Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990-2010: A systematic analysis for the Global Burden of Disease Study 2010. *The Lancet*, *380*(9859), 2197–2223. https://doi.org/10.1016/S0140-6736(12)61689-4

Myers, C. D., Riley, J. L., & Robinson, M. E. (2003). Psychosocial contributions to sex-correlated differences in pain. *Clinical Journal of Pain*, *19*(4), 225–232. https://doi.org/10.1097/00002508-200307000-00005

Natvig, B., Bruusgaard, D., & Eriksen, W. (2001). Localized low back pain and low back pain as part of widespread musculoskeletal pain: Two different disorders? A cross-sectional population study. *Journal of Rehabilitation Medicine*, *33*(1), 21–25. https://doi.org/10.1080/165019701300006498

Natvig, Bård, Ihlebæk, C., Grotle, M., Brage, S., & Bruusgaard, D. (2010). Neck pain is often a part of widespread pain and is associated with reduced functioning. *Spine*, *35*(23), E1285-9. https://doi.org/10.1097/BRS.0b013e3181e38e73

Natvig, Bård, Ihlebæk, C., Kamaleri, Y., & Bruusgaard, D. (2011). Number of pain sites - a simple measure of population risk? In *Chronic Pain Epidemiology: From Aetiology to Public Health*. https://doi.org/10.1093/acprof:oso/9780199235766.003.0007

Neupane, S, Miranda, H., Virtanen, P., Siukola, A., & Nygård, C.-H. (2011). Multi-site pain and work ability among an industrial population. *Occupational Medicine (Oxford, England)*, *61*(8), 563–569. https://doi.org/10.1093/occmed/kqr130

Neupane, Subas, Leino-Arjas, P., Nygård, C. H., Oakman, J., & Virtanen, P. (2017). Developmental pathways of multisite musculoskeletal pain: What is the influence of physical and psychosocial working conditions? *Occupational and Environmental Medicine*, *74*(7), 468–475. https://doi.org/10.1136/oemed-2016-103892

Newman, A. B., Haggerty, C. L., Goodpaster, B., Harris, T., Kritchevsky, S., Nevitt, M., … Visser, M. (2003). Strength and muscle quality in a well-functioning cohort of older adults: The Health, Aging and Body Composition Study. *Journal of the American*

Geriatrics Society, *51*(3), 323–330. https://doi.org/10.1046/j.1532-5415.2003.51105.x

Ngian, G. S., Guymer, E. K., & Littlejohn, G. O. (2011). The use of opioids in fibromyalgia. *International Journal of Rheumatic Diseases*, *14*(1), 6–11. https://doi.org/10.1111/j.1756-185X.2010.01567.x

Nicholas, M. K., McGuire, B. E., & Asghari, A. (2015). A 2-item short form of the pain self-efficacy questionnaire: Development and psychometric evaluation of PSEQ-2. *Journal of Pain*, *16*(2), 153–163. https://doi.org/10.1016/j.jpain.2014.11.002

Nielsen, M. N., Aaen-Larsen, B., Vedsted, P., Nielsen, C. V., & Hjøllund, N. H. (2008). [Diagnosis coding of the musculoskeletal system in general practice]. *Ugeskrift for Laeger*, *170*(37), 2881–2884. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/18796284

Nijs, J., Kosek, E., Van Oosterwijck, J., & Meeus, M. (2012). Dysfunctional endogenous analgesia during exercise in patients with chronic pain: to exercise or not to exercise? *Pain Physician*, *15*(3 Suppl). Retrieved from www.painphysicianjournal.com

Nir, R. R., & Yarnitsky, D. (2015). Conditioned pain modulation. *Current Opinion in Supportive and Palliative Care*, *9*(2), 131–137. https://doi.org/10.1097/SPC.0000000000000126

Nordstoga, A. L., Nilsen, T. I. L., Vasseljen, O., Unsgaard-Tøndel, M., & Mork, P. J. (2017). The influence of multisite pain and psychological comorbidity on prognosis of chronic low back pain: Longitudinal data from the Norwegian HUNT Study. *BMJ Open*, *7*(5). https://doi.org/10.1136/bmjopen-2016-015312

Oha, K., Animägi, L., Pääsuke, M., Coggon, D., & Merisalu, E. (2014). Individual and work-related risk factors for musculoskeletal pain: A cross-sectional study among Estonian computer users. *BMC Musculoskeletal Disorders*, *15*(1). https://doi.org/10.1186/1471-2474-15-181

Olofsson, Y., Book, C., & Jacobsson, L. T. H. (2003). Scandinavian Journal of Rheumatology Shoulder joint involvement in patients with newly diagnosed rheumatoid arthritisPrevalence and associations. *Taylor & Francis*, *32*(1), 25–32. https://doi.org/10.1080/03009740310000364

Olsen, M. F., Bjerre, E., Hansen, M. D., Hilden, J., Landler, N. E., Tendal, B., & Hróbjartsson, A. (2017). Pain relief that matters to patients: Systematic review of empirical studies assessing the minimum clinically important difference in acute pain. *BMC Medicine*, *15*(1). https://doi.org/10.1186/s12916-016-0775-3

OMS. (2000). Obesity : Preventing and managing the global epidemic. World Health Organization: Technical Report Series. *WHO Technical Report Series, No. 894.*, p. 252. https://doi.org/ISBN 92 4 120894 5

Ostelo, R. W. J. G., Deyo, R. A., Stratford, P., Waddell, G., Croft, P., Von Korff, M., … De Vet, H. C. (2008). Interpreting change scores for pain and functional status in low back pain: Towards international consensus regarding minimal important change. *Spine*, *33*(1), 90–94. https://doi.org/10.1097/BRS.0b013e31815e3a10

Page, L. A., & Henderson, M. (2008). Appraising the evidence: What is measurement bias? In

Evidence-Based Mental Health (Vol. 11). https://doi.org/10.1136/ebmh.11.2.36

Pan, F., Laslett, L., Blizzard, L., Cicuttini, F., Winzenberg, T., Ding, C., & Jones, G. (2017). Associations Between Fat Mass and Multisite Pain: A Five-Year Longitudinal Study. *Arthritis Care and Research*, *69*(4), 509–516. https://doi.org/10.1002/acr.22963

Peat, G., Thomas, E., Wilkie, R., & Croft, P. (2006). Multiple joint pain and lower extremity disability in middle and old age. *Disability and Rehabilitation*, *28*(24), 1543–1549. https://doi.org/10.1080/09638280600646250

Picavet, H. S. J., & Schouten, J. S. A. G. (2003). Musculoskeletal pain in the Netherlands: Prevalences, consequences and risk groups, the DMC3-study. *Pain*, *102*(1–2), 167–178. https://doi.org/10.1016/s0304-3959(02)00372-x

Pieretti, S., Di Giannuario, A., Di Giovannandrea, R., Marzoli, F., Piccaro, G., Minosi, P., & Aloisi, A. M. (2016). Gender differences in pain and its relief. *Annali Dell'Istituto Superiore Di Sanita*, *52*(2), 184–189. https://doi.org/10.4415/ANN_16_02_09

Russell, G., Mandy, W., Elliott, D., White, R., Pittwood, T., & Ford, T. (2019, March 1). Selection bias on intellectual ability in autism research: A cross-sectional review and meta-analysis. *Molecular Autism*, Vol. 10, pp. 1–10. https://doi.org/10.1186/s13229-019-0260-x

Rutledge, M. (2018). What Explains the Widening Gap in Retirement Ages by Education? In *dlib.bc.edu*. Retrieved from http://crr.bc.edu/wp-content/uploads/2018/05/IB_18-10.pdf

Sarzi-Puttini, P., Atzeni, F., Diana, A., Doria, A., & Furlan, R. (2006). Increased neural sympathetic activation in fibromyalgia syndrome. *Annals of the New York Academy of Sciences*, *1069*(1), 109–117. https://doi.org/10.1196/annals.1351.009

Schmidt, C. O., & Baumeister, S. E. (2007). Simple patterns behind complex spatial pain reporting? Assessing a classification of multisite pain reporting in the general population. *Pain*, *133*(1–3), 174–182. https://doi.org/10.1016/j.pain.2007.04.022

Schofield, Deborah, J., Shrestha, R. N., Cunich, M., Tanton, R., Kelly, S., Passey, M. E., & Veerman, L. J. (2015). Lost productive life years caused by chronic conditions in australians aged 45-l64 years, 2010-2030. *Medical Journal of Australia*, *203*(6), 260.e1-260.e6. https://doi.org/10.5694/mja15.00132

Schofield, D., Kelly, S., Shrestha, R., Callander, E., Passey, M., & Percival, R. (2012). The impact of back problems on retirement wealth. *Pain*, *153*(1), 203–210. https://doi.org/10.1016/j.pain.2011.10.018

Sedgwick, P. (2015). Bias in observational study designs: Cross sectional studies. *BMJ (Online)*, *350*(March 2015), 10–12. https://doi.org/10.1136/bmj.h1286

Silman, A. J., & Pearson, J. E. (2002, May 9). Epidemiology and genetics of rheumatoid arthritis. *Arthritis Research*, Vol. 4, pp. S265–S272. https://doi.org/10.1186/ar578

Sim, J., Lacey, R. J., & Lewis, M. (2006). The impact of workplace risk factors on the occurrence of neck and upper limb pain: A general population study. *BMC Public Health*, *6*. https://doi.org/10.1186/1471-2458-6-234

Smith, B. H., Elliott, A. M., Hannaford, P. C., Chambers, W. A., & Smith, W. C. (2004).

Factors Related to the Onset and Persistence of Chronic Back Pain in the Community: Results from a General Population Follow-up Study. *Spine*, *29*(9), 1032–1040. https://doi.org/10.1097/00007632-200405010-00016

Søgaard, A. J., Bjelland, I., Tell, G. S., & Røysamb, E. (2003). A comparison of the CONOR Mental Health Index to the HSCL-10 and HADS. In *Norsk Epidemiologi*. Retrieved from https://pdfs.semanticscholar.org/173b/f2c931b8b8945417ccae15514ea9532fd8be.pdf

Solidaki, E., Chatzi, L., Bitsios, P., Coggon, D., Palmer, K. T., & Kogevinas, M. (2013). Risk factors for new onset and persistence of multi-site musculoskeletal pain in a longitudinal study of workers in Crete. *Occupational and Environmental Medicine*, *70*(1), 29–34. https://doi.org/10.1136/oemed-2012-100689

Spector, P. E. (2019). Do Not Cross Me: Optimizing the Use of Cross-Sectional Designs. *Journal of Business and Psychology*, *34*(2), 125–137. https://doi.org/10.1007/s10869-018-09613-8

Staud, R. (2015). Cytokine and Immune System Abnormalities in Fibromyalgia and Other Central Sensitivity Syndromes. *Current Rheumatology Reviews*, *11*(2), 109–115. https://doi.org/10.2174/1573397111666150619094819

Steinsbekk, A., Adams, J., Sibbritt, D., Jacobsen, G., & Johnsen, R. (2007). The profiles of adults who consult alternative health practitioners and/or general practitioners. *Scandinavian Journal of Primary Health Care*, *25*(2), 86–92. https://doi.org/10.1080/02813430701267439

Stewart, M., Brown, J. B., Donner, A., McWhinney, I. R., Oates, J., Weston, W. W., & Jordan, J. (2000). The impact of patient-centered care on outcomes. *Journal of Family Practice*, *49*(9), 796–804. Retrieved from http://www.academia.edu/download/51652032/The_Impact_of_Patient-Centered_Care_on_O20170205-14690-b5zuzm.pdf

Suri, P., Morgenroth, D. C., Kwoh, C. K., Bean, J. F., Kalichman, L., & Hunter, D. J. (2010). Low back pain and other musculoskeletal pain comorbidities in individuals with symptomatic osteoarthritis of the knee: Data from the osteoarthritis initiative. *Arthritis Care & Research*, *62*(12), 1715–1723. https://doi.org/10.1002/acr.20324

Toivanen, A. T., Heliövaara, M., Impivaara, O., Arokoski, J. P. A., Knekt, P., Lauren, H., & Kröger, H. (2010). Obesity, physically demanding work and traumatic knee injury are major risk factors for knee osteoarthritis-a population-based study with a follow-up of 22 years. *Rheumatology*, *49*(2), 308–314. https://doi.org/10.1093/rheumatology/kep388

Tüzün, E. H., Albayrak, G., Eker, L., Sözay, S., & Daşkapan, A. (2004). A comparison study of quality of life in women with fibromyalgia and myofascial pain syndrome. *Disability and Rehabilitation*, *26*(4), 198–202. https://doi.org/10.1080/09638280310001639696

Valentin, G. H., Pilegaard, M. S., Vaegter, H. B., Rosendal, M., Ørtenblad, L., Væggemose, U., & Christensen, R. (2016, January 1). Prognostic factors for disability and sick leave in patients with subacute non-malignant pain: A systematic review of cohort studies. *BMJ Open*, Vol. 6, p. e007616. https://doi.org/10.1136/bmjopen-2015-007616

Vander Weele, T. J., & Shpitser, I. (2013). On the definition of a confounder. *Annals of Statistics*, *41*(1), 196–220. https://doi.org/10.1214/12-AOS1058

Vargas-Prada, S., & Coggon, D. (2015, June 1). Psychological and psychosocial determinants of musculoskeletal pain and associated disability. *Best Practice and Research: Clinical Rheumatology*, Vol. 29, pp. 374–390. https://doi.org/10.1016/j.berh.2015.03.003

Vargas-Prada, S., Martínez, J. M., Coggon, D., Delclos, G., Benavides, F. G., & Serra, C. (2013). Health beliefs, low mood, and somatizing tendency: Contribution to incidence and persistence of musculoskeletal pain with and without reported disability. *Scandinavian Journal of Work, Environment and Health*, *39*(6), 589–598. https://doi.org/10.5271/sjweh.3377

Vasseljen, O., Woodhouse, A., Bjørngaard, J. H., & Leivseth, L. (2013). Natural course of acute neck and low back pain in the general population: The HUNT study. *Pain*, *154*(8), 1237–1244. https://doi.org/10.1016/j.pain.2013.03.032

Vleeshouwers, J., Knardahl, S., & Christensen, J. O. (2019). Effects of psychosocial work factors on number of pain sites: The role of sleep quality as mediator. *BMC Musculoskeletal Disorders*, *20*(1). https://doi.org/10.1186/s12891-019-2946-9

Von Korff, M., Ormel, J., Keefe, F. J., & Dworkin, S. F. (1992). Grading the severity of chronic pain. *Pain*, *50*(2), 133–149. https://doi.org/10.1016/0304-3959(92)90154-4

Vos, T., Abajobir, A. A., Abbafati, C., Abbas, K. M., Abate, K. H., Abd-Allah, F., … Murray, C. J. L. (2017). Global, regional, and national incidence, prevalence, and years lived with disability for 328 diseases and injuries for 195 countries, 1990-2016: A systematic analysis for the Global Burden of Disease Study 2016. *The Lancet*, *390*(10100), 1211–1259. https://doi.org/10.1016/S0140-6736(17)32154-2

Wade, D. T., & Halligan, P. W. (2017, August 1). The biopsychosocial model of illness: A model whose time has come. *Clinical Rehabilitation*, Vol. 31, pp. 995–1004. https://doi.org/10.1177/0269215517709890

Walker-Bone, K., Palmer, K. T., Reading, I., Coggon, D., & Cooper, C. (2004). Prevalence and impact of musculoskeletal disorders of the upper limb in the general population. *Arthritis Care & Research*, *51*(4), 642–651. https://doi.org/10.1002/art.20535

Watroba, J. (2011). Simply to Match the Straight or Linear Regression Analysis in Practice. *StatSoft Polska*, 31–44.

Wepking, K. N., Mohamed, A., Kurd, M. F., Lee, J. K., Ahmadinia, K., & An, H. S. (2013). The Prevalence of Cervical Radiculopathy in Patients with Cervical Myelopathy. *The Spine Journal*, *13*(9), S21–S22. https://doi.org/10.1016/j.spinee.2013.07.082

Wolfe, F., Clauw, D. J., Fitzcharles, M.-A., Goldenberg, D. L., Katz, R. S., Mease, P., … Yunus, M. B. (2010). The American College of Rheumatology Preliminary Diagnostic Criteria for Fibromyalgia and Measurement of Symptom Severity. *Arthritis Care & Research*, *62*(5), 600–610. https://doi.org/10.1002/acr.20140

Wolfe, F., Smythe, H. A., Yunus, M. B., Bennett, R. M., Bombardier, C., Goldenberg, D. L., … Sheon, R. P. (1990). The american college of rheumatology 1990 criteria for the classification of fibromyalgia. *Arthritis & Rheumatism*, *33*(2), 160–172. https://doi.org/10.1002/art.1780330203

Woolf, C. J. (2011). Central sensitization: Implications for the diagnosis and treatment of pain. *Pain*, *152*(SUPPL.3). https://doi.org/10.1016/j.pain.2010.09.030

World Organization of National Colleges, Academies, & Academic Associations of General Practitioners/Family Physicians. (2005). *ICPC-2-R: International Classification of Primary Care*. Oxford University Press, USA.

Yarnitsky, D. (2015). Role of endogenous pain modulation in chronic pain mechanisms and treatment. *PAIN*, *156*(4), S24–S31. https://doi.org/10.1097/01.j.pain.0000460343.46847.58

Zhang, A., & Lee, Y. C. (2018, October 1). Mechanisms for Joint Pain in Rheumatoid Arthritis (RA): from Cytokines to Central Sensitization. *Current Osteoporosis Reports*, Vol. 16, pp. 603–610. https://doi.org/10.1007/s11914-018-0473-5

APPENDIX 1

Inclusion guidelines for inclusion method two

Hip or knee osteoarthritis

Data were included in the complaint group “hip or knee osteoarthritis” if:

- the primary pain site or complaint variable for either hip or knee joint was marked and in a combination with the arthritis variable or,
- the primary pain site or complaint variable for either hip or knee joint was marked and in a combination with the and the arthritis variable and descriptions of symptoms of arthritis in the free text variable or,
- the primary pain site or complaint variable for hip or knee was marked and in combination with the word arthritis in the free text variable or,
- the arthritis variable was marked in combination with the word hip or knee in the free text variable.

Data were excluded if

- it was not implicit related to hip or knee osteoarthritis or if the postoperative treatment was marked.
- any of the combinations above also included one of the following variables: rheumatism, central neurological disease, peripheral neurological disease.

Multisite pain/complex

Data were included in the complaint group “multisite pain /complex” if:

- the primary pain site or complaint variable for widespread pain was marked and in combination with the variable myalgia or pain more than six months or,
- the primary pain site or complaint variable for widespread pain was marked and in combination with one of the following variables: headache/ migraine, psychological health or dizziness, and one of the following words / symptoms in the free text variable: tense, palpate soreness or pain, myalgia, reduced bodily contact, bodily readiness, fibromyalgia, mental stress and complex issues or,

- the primary pain site or complaint variable for widespread pain was marked and an indication of myalgia and/or psychological stress in the free text variable. That could be a combination of the following words or synonyms in the free text variable: tense, palpate soreness or pain, myalgia, reduced bodily contact, bodily readiness, fibromyalgia, mental stress, and complex issues.

Data were excluded if:

- any of the combinations above also included one of the following variables: rheumatism, central neurological disease, peripheral neurological disease or,
- the primary pain site or complaint variable for widespread pain was marked and the free text variable included specific diseases like reactive arthritis or neurological diseases or,
- the primary pain site or complaint variable for widespread pain was marked in combination with the variables stroke, asthma, and cancer without any specification in the free text variable or,
- the primary pain site or complaint variable for widespread pain was marked without any specification in the free text variable.

Neck complaint

Data were included in the neck complaint group if:

- the primary pain site or complaint variable for neck pain was marked and an indication of neck pain/symptoms/complaint/syndromes in the free text variable. That could be a combination of two or more of the following words or a synonym to these words: muscular ailments, reduced muscle strength, increased tension/reduced relaxation ability, myalgia, palpate sourness or pain, reduced or increased range of motion or,
- the primary pain site or complaint variable for neck pain was marked in combination with one of the following variables: myalgia, tendinopathy, central neurological disease, peripheral neurological disease, headache/migraine, dizziness, trauma ligament, trauma muscle, and chronic as well as a symptom/verification in the free text variable. That could be one of the following words or a synonym to one of the following words: muscular ailments, reduced muscle strength, increased tension/reduced relaxation ability, myalgia, palpate sourness or pain, reduced or increased range of motion.

- Primary pain site or complaint variabel for neck pain in combination with the words prolapse, protuberance, nerve root affection, cervical radiculopathy
- Free text variable described the location of pain or complaint and clear symptoms of neck complaint/pain or,
- Free text variable described the location of pain or complaint in combination with on the following variables: myalgia, tendinopathy, headache/migraine, dizziness, trauma ligament, trauma muscle and chronic

Data were excluded if:

- the primary pain site or complaint variable for neck pain was marked and no other information was filled out or,
- the primary pain site or complaint variable for neck pain was filled out in combination with unsatisfying information in the free text variable. That could be descriptions like “reduced technique” or “reduced work ability” or,
- any of the combinations above also included one of the following variables: rheumatism, central neurological disease, peripheral neurological disease.

Shoulder complaint

Data were included in the shoulder complaint group if:

- the primary pain site or complaint variable for shoulder pain was marked and an indication of shoulder pain/symptoms/complaint/syndromes in the free text variable. That could be one or more of the following words or a synonym to these words: muscular ailments, reduced muscle strength, increased tension/reduced relaxation ability, myalgia, palpate sourness or pain, reduced or increased range of motion, instability, laxity, reduced function, tendinopathy, bursitis tendinitis, impingement, subacromial pain, ligament of tendon rupture, labrum lesion and frozen shoulder or,
- the primary pain site or complaint variable for shoulder pain in combination with one of the following diagnosis variables myalgia, tendinopathy, chronic, ligament, arthrosis, postoperative and a verification in the free text variable or,

- if free text variable included location in shoulder and descriptions of symptoms or pathology. That could pathology like tendinopathy, bursitis tendinitis, impingement, subacromial pain, ligament of tendon rupture, labrum lesion and frozen shoulder.

Data were excluded if:

- the primary pain site or complaint variable for shoulder pain and and no other information was filled out or,
- the primary pain site or complaint variable for shoulder pain in combination with unsatisfying information in the free text variable or,
- any of the combinations above also included the variables rheumatism, central neurological disease, peripheral neurological disease or,
- clear indications of neurological pathology in free text variable

Back complaint

Data were included in the back complaint group if:

- the primary pain site or complaint variable for back pain was marked and an indication of back pain/symptoms/complaint/syndromes in the free text variable. That could be a combination of two or more of the following words or a synonym to these words: unspecified low back pain, myalgia, reduced range of movement, reduced muscle strength, increased tension/reduced relaxation ability, myalgia, palpate sourness or pain, pelvic pain, reduced muscular control, IS-joint complaint, thoracic or lumbar joint dysfunction, reduced quality of life or,
- the primary pain site or complaint variable for back pain was marked in combination with one of the following variable: myalgia, tendinopathy, central neurological disease, peripheral neurological disease, headache/migraine, dizziness, trauma ligament, trauma muscle, arthrosis and chronic in addition to a symptom in the free text variable which verifies back issues as primry complaint or,
- the primary pain site or complaint variable for back pain was marked and in combination with one of the the words prolapse, protuberance, nerve root affection, spinal stenosis, radiculopathy or,

- the primary pain site or complaint variable for back pain was marked in combination with one or more of the following variables myalgia, tendinopathy, central neurological disease, peripheral neurological disease, headache/migraine, dizziness, trauma ligament, trauma muscle, arthrosis and chronic or,
- the free text variable described the location of pain or complaint and clear symptoms of back complaint. That could be unspesified back pain or spinal stenosis of lumbal.

Data were excluded if:

- the primary pain site or complaint variable for back pain was marked in combination with unsatisfying information in the free text variable. That could be descriptions like "reduced technique" or "reduced work ability"
- the primary pain site or complaint variable for back pain was marked no other information was filled out or,
- any of the combinations above also included one of the following variables: rheumatism, central neurological disease, peripheral neurological disease.