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"FACTORS INFLUENCING MUSCULOSKELETAL PAIN AMONG PHYSICAL THERAPISTS"

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"DOCTOR INTERNACIONAL"

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CERTIFICAN:

Que el presente trabajo, titulado “***“Factors influencing musculoskeletal pain among physical therapists”***”, ha sido realizado bajo su dirección en el *Departament de Fisioteràpia* de la *Universitat de València* y en “The National Research Centre for the Working Environment” (Copenhague, Dinamarca), por Dña. Yasmín Ezzatvar de Llago, para optar al grado de Doctor por la Universitat de València. Habiéndose concluido, y reuniendo a su juicio las condiciones de originalidad y rigor científico necesarias, autorizan su presentación a fin de que pueda ser defendido ante el tribunal correspondiente.

Y para que así conste, expiden y firman la presente certificación en Valencia, a 15 de Abril de 2020.

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- For the swarm! -

Preface

The present study was carried out in the Faculty of Physiotherapy of the University of Valencia, and in "The National Research Centre for the Working Environment", Copenhagen, Denmark. The supervisors of this investigation are Dr. José Casaña Granell, Dr. Joaquín Calatayud Villalba and Dr. Lars Louis Andersen.

This study received approval by the University of Valencia's Ethical Committee (H1530736596718) and has been performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. No funding or grant was involved in this study. The ethical approval document is included in the Appendix section at the end of the main text.

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English summary

Introduction: Work-related musculoskeletal disorders are a common condition with a considerable impact on an individual's life and is a major area of interest within the field of occupational health. These disabling yet in many cases preventable conditions are a frequent cause of workplace absenteeism, and are reported to significantly impact on quality of life, which can lead to a decrease in productivity and associate healthcare costs for workers, employers and healthcare professionals. However, this term and others such as "musculoskeletal disorders", "musculoskeletal pain" or "musculoskeletal injuries" are often used interchangeably, leading to terminological confusion. In order to be consistent and homogeneous, throughout this manuscript, the term "musculoskeletal pain" will be used. Musculoskeletal pain is common among healthcare professionals, including physical therapists (PTs), due to the physically demanding nature of their jobs. This is highly relevant, as PTs constitute 8.21% of the total European healthcare workforce (including nurses, physicians, dentists, pharmacists and PTs), with more than 500,000 professionals working in the 28 European countries. More specifically, Spanish PTs represent 7.4% of the total healthcare workforce. Actually, Spain is one of the European countries with more PTs, accounting for almost 10% of the total amount of PTs in Europe. In this context, physical therapy is an established and regulated profession which provides services to individuals and populations in circumstances where movement and function are threatened by ageing, injury, disease or environmental factors. However, the aforementioned factors that are typically present in those patients in need for physical therapy, paradoxically can also affect the physical therapy workforce. Even though PTs are specialists on body mechanics and injury prevention, a complex array of risk factors may contribute to the development of musculoskeletal pain. For instance, as part of their work, PTs are exposed to repeated liftings or movements, sustained and awkward postures, bending, carrying, repositioning or lifting patients, high mental demands, stress and also individual lifestyle factors. These factors can adversely worsen the quality of patient care or lead to absenteeism. Within this context, pain represents a significant occupational problem among PTs; however, its development is complex, as it is influenced by a myriad of factors. In fact, according to a recent systematic review, lifetime prevalence of musculoskeletal pain in PTs ranged between 53 and 91%, being the low-back the most commonly affected body area, followed by neck, thumbs, upper back and shoulders. However, these rates can vary depending on different factors related to the working environment. For example, due to the degree of physical dependence often characteristic of hospitalized patients, PTs working in hospitals are more likely to perform patient lifts

and transfers, whereas PTs in non-hospital-based locations have a greater frequency of using manual techniques rather than lifting heavy weights or transferring dependent patients. Actually, therapists who perform manual techniques and treat a large number of patients per day are more prone to have pain in the thumbs, hands or wrists, whereas other body areas such as upper back, lower back, neck, hip and knee are more commonly affected in other settings like neurologic rehabilitation or pediatrics. Lastly, another factor which may increase the risk of developing musculoskeletal pain in PTs is increasing age; which seems to be an issue of concern for younger than 30 years old or less experienced PTs, working in clinics rather than in public settings or being a woman. Therefore, improving the understanding of musculoskeletal pain and work-related factors among PTs may be relevant for keeping a healthy labor pool. However, musculoskeletal pain is particularly difficult to discuss in absolutes, suggesting that work only partly contributes to the onset of musculoskeletal pain. Despite biomechanical factors such as high physical exposure, body positions, etc. are commonly reported as main causes and/or risk factors for having musculoskeletal pain, these are not linearly related to prevalence rates of musculoskeletal pain. This justifies the need to analyze other variables that could influence musculoskeletal pain among these professionals. For instance, it has previously been reported that, among workers, musculoskeletal pain is considered the leading cause of disability and early retirement and poses a significant threat to work ability, at short and long term. As a matter of fact, while most observational studies have focused on single-site pain, it is well established that people with localized pain commonly have co-existing complaints in other body areas. Actually, experiencing pain in just one body part has been shown to increase the risk of developing pain in other/multiple body regions a year later. Multi-site pain seems to have a worse prognosis than single-site pain, and experiencing musculoskeletal pain in multiple body areas has been suggested to increase the likelihood of developing chronic pain. This may be related to a central sensitization of pain perception in conditions of chronic pain. Despite the large number of studies that have found associations between the presence of pain and work ability among workers from different occupational groups, much uncertainty still exists about this relationship in PTs.

This raises the question to which extent the presence of single- or multi-site musculoskeletal pain can influence the ability to work in PTs. Considering that poor work ability is a strong predictor of future work disability and early retirement, and its decline could challenge the profession to care for the health of the public, it is necessary to understand the contribution of single- and multi-site musculoskeletal pain and its potential association with lower work ability levels among PTs. Specially because the possibility of having a better and longer working life is strongly dependent on work ability.

For this reason, understanding how single- and multi-site pain can influence the work ability of PTs, and other modifiable factors such as the physical activity and strength training levels during leisure-time could also help to diminish the high prevalence rates found in this occupational group. Within this context, regular physical activity has shown to provide numerous health benefits, including improved quality of life, physical functioning and the lowering of mortality risk. Likewise, observational studies have found that physical exercise is positively associated with musculoskeletal pain in working populations. One proposed mechanism for these effects might be that when improving physical capacity, the relative physical workload may decrease. Therefore, workers could be more prepared to face the physical challenges inherent of their working tasks. Additionally, there is a growing body of literature that recognizes strength training as a cornerstone for the management and prevention of several health disorders. Strength training can prevent and/or decrease the risks associated with chronic diseases, as it is linked to a reduced risk of all-cause mortality, a significant reduction in type 2 diabetes or cardiovascular disease among others. However, the effects of strength training on musculoskeletal pain among working populations seem less clear, albeit promising. As well as dose magnitude requires to be prescribed with precision in drugs, a similar level of accuracy to prescription of strength training is needed to obtain optimal results. Unluckily, little is known about optimal intensity and frequency of strength training for effective management of musculoskeletal pain among working populations. Understanding the link between such variables and musculoskeletal pain will help to tailor specific interventions as well as to provide some guidance when evaluating current recommendations for keeping a healthy musculoskeletal system among PTs. However, before conducting such interventions among PTs, it is important to know their work demands and to study the habits and the specific working environment of this specific occupational group.

Objectives: This study sought to: i) investigate the association between work-related factors and musculoskeletal pain in the back, neck and upper extremities among PTs: we hypothesized that work-related factors such as not having enough professional experience, working in public hospital settings, and treating a higher number of patients per week could increase the odds for musculoskeletal pain among PTs; ii) analyze the association between moderate and vigorous physical activity and musculoskeletal pain in PTs: our hypothesis was that higher levels of both vigorous and moderate physical activity would have a protective effect for musculoskeletal pain, in comparison to those PTs less physically active; iii) investigate the prevalence of local and multi-site pain among PTs, the association between pain intensity and levels of work ability, and the association between the number of pain sites and work ability: we hypothesized that high levels of perceived pain intensity are associated with lower work ability among PTs, and that this association increases in a dose-response fashion with multiple pain sites; and iv) analyze the association between frequency and intensity of strength training and musculoskeletal pain in the back, neck-shoulder and arm-hand among PTs: we hypothesized that performing high intensity strength training: i.e., >80% of the Repetition Maximum (RM), more than 3 times per week would reduce musculoskeletal pain more than lower intensities.

Methods: The design of this investigation was cross-sectional. Prior to carrying out the investigation, ethical clearance was obtained from the University of Valencia's Ethical Committee. Potential participants included practicing PTs who were registered in the professional association of PTs of different communities across Spain. After contacting the main professional associations of PTs of different communities in Spain to ask for permission to invite their members to participate on a voluntary basis, and pilot-testing the questionnaire to ensure that each question was clear, the questionnaire was sent along with a cover letter which included the project description. The questionnaire was designed to collect information about the characteristics of PTs and their working environment, and included: Demographics, lifestyle and work-related questions; questions about the presence and intensity of musculoskeletal pain in 9 different body areas (using the Nordic Musculoskeletal Questionnaire, subjects reported the presence of musculoskeletal pain responding the question "Have you had pain or discomfort during at least 24 hours in the last month in the following body areas?" with options to answer 'yes' or 'no'); Work ability index (including its 7 subscales: 1) Current work ability in comparison to lifetime best, 2) work ability in relation to the physical and mental demands of the job, 3) number of current diseases diagnosed by a physician, 4) estimated work impairment due to diseases, 5) sick leaving during the past year, 6) own prognosis of work ability two years from now, and 7) mental resources); self-reported level of leisure physical activity (was reported according the Global Physical Activity Questionnaire) and; self-reported leisure-time strength training levels (by answering the following questions: "During a typical week, do you do any physical activity at your leisure time specifically designed to strengthen your muscles, such as weightlifting, elastic-band training, push-ups...?" and questions about training frequency and intensity). All statistical analyses were performed using the SAS statistical software for Windows (Proc Logistic, SAS v9.4). Descriptive statistics were used to report the prevalence of single and multi-site musculoskeletal pain, pain intensity (≥3 on a scale of 0-10 in the back, neck/shoulders and arm/hand), work-related factors (other works, years of experience, sector, type of employment, working hours per week, number of patients per week, treating more patients at the same time, primary type of patients and treatments, adjusting the examination table when needed and work position), leisure-time physical activity levels, strength training during leisure-time levels, and demographic characteristics (age, height, weight, sex, education, smoking or alcohol units per week). Using binary logistic regression, odds ratios (ORs) and 95% confidence intervals (CI) were calculated for examining the associations between: (Study 1) having moderate to high musculoskeletal pain (≥ 3 on a scale of 0-10, reference category: pain 0-2) in different body areas and work-related factors; (Study 2) having low musculoskeletal pain (<3 on a scale of 0-10) in different body areas (dependent variables) in function of the total amount of vigorous leisure physical activity (0, 1-74 and ≥75 minutes per week) and moderate leisure physical activity (0, 1-149 and ≥150 minutes per week) as mutually adjusted independent variables (reference category: 0 minutes per week); (Study 3) having lower level of work ability and its association with pain intensity and multi-site pain; and (Study 4) having low levels of musculoskeletal pain (<3 on a scale of 0-10) in different body areas (dependent variables) in function of the frequency (0, 1-2, and more than 3 times per week, respectively) and intensity (≤50% RM, 51-79% RM, and ≥80% RM, respectively) of strength training during leisure-time. These cut-points were stablished according to current general strength training guidelines. Potential confounders were adjusted into two different models: Model 1 controlled for age and sex; model 2 controlled for age, sex, education, and work-related factors (including years of experience, working hours, setting, type of treatment, number of patients per week and work position).

Results: Of the 1006 questionnaires which were returned by registered PTs, 25 questionnaires with missing information on the main study variables were excluded from analysis. Thus, data from the remaining 981 questionnaires were analyzed. The study population of PTs had a mean age of 34.3 ± 8.0 years, 29.4% were male and 70.6% were female, whom on average had a BMI of 23.3 ± 3.4 kg/m2. The results from binary logistic regression analyses showed that work-related factors associated with higher risk for having moderate to high pain (≥3 on a scale of 0-10) in upper body areas were "treating more patients at the same time" (low back OR 2.14 [95% CI, 1.53-2.99]), "working more than 45 hours per week" [OR, 1.73 (95% CI, 1.05-2.84)], and "work in a seated position" [OR, 2.04 (95% CI, 1.16-3.57)]. "More years of experience" showed a negative association for elbow pain [OR, 0.41 (95% CI, 0.21 - 0.78)] and low back pain [OR, 0.48 (95% CI, 0.29 - 0.79)] compared to their less experienced counterparts (Study 1). Regarding leisure-time physical activity, the odds for experiencing lower levels of pain in neck-shoulder were higher in PTs performing 75 or more minutes of vigorous leisure physical activity per week (OR 1.43; 95% CI: 1.05-1.94), with 0 minutes per week of vigorous physical activity as a reference. However, the analysis did not reveal any significant difference between vigorous leisure physical activity and pain in the arm-hand or back. The odds for having lower levels of pain were not significantly lower in those PTs performing moderate leisure-time physical activity (Study 2). The most commonly rated painful body part was the neck (36.3%), followed by the low back (32.3%), upper back (21.9%) and hand/wrist (21.6%). One-third of the respondents reported moderate pain intensity in the neck, followed by the low back (25.9%), upper back (22.4%) and hand/wrist (20.9%). The prevalence of high pain intensity in 0, 1-2, 3-4 and >5 body parts were 39.3%, 32.5%, 19.4% and 8.8% respectively. Furthermore, a dose-response relationship between the number of pain sites and lower work ability was found, especially when it was present at more than one site simultaneously. For instance, with low pain intensity as reference, a moderate to strong association for lower levels of work ability in PTs who reported pain of >5 in 1-2 body regions was found. This association was stronger when participants reported pain in 3-4 regions and even stronger when pain was experienced in 5 or more sites (Study 3). Strong associations for having lower levels of pain in all the studied body areas were found in those PTs who reported performing high intensity strength training (≥80% RM). However, the odds for having lower pain levels were not significantly higher among PTs performing lower intensities (≤50% RM and 51-79% RM) in any body part. The analysis did not show any significant association between strength training frequency and lower levels of pain in any body part (Study IV).

Strengths and limitations: A strength of this investigation is that the analyses were controlled for different confounding factors that might influence the results (e.g., age, sex, work-related factors and education). Moreover, by limiting the study population to only PTs who were actively working, we reduced the influence of confounding variables that might have resulted in a bias for our study, such as socioeconomic or education factors. On the other hand, some factors may limit the generalization of the results of this investigation. First, the cross-sectional nature of this study does not allow to determine causality, as the exposure and outcome were assessed in the same time moment. In the case of the relationship between work ability and musculoskeletal pain, one of the issues that emerges from this study is if the presence of pain is what leads to lower work ability, or if the fact of having lower work ability increases the odds for having musculoskeletal pain. However, previous studies suggest that the directional nature is from pain to work ability and not vice versa. Second, it was not possible to calculate the response-rate, because we had to contact to different associations in order to invite their members to participate in our study. This was a limitation for the calculation of the response rate, as not all the associations collaborated with us in the invitation to their members, and some of them added the link to the questionnaire and the cover letter in a newsletter, being difficult to calculate the exact number of PTs who actually received the invitation. Furthermore, the participants included in this study were exclusively from the Spanish workforce, which could additionally limit the generalization of our results. In addition, those PTs severely affected by musculoskeletal pain may not have been actively working during the investigation, and consequently, excluded from the study, thereby leaving behind a relatively healthy workforce—also known as the healthy worker effect, which could limit the generalization of our results. Moreover, because the questionnaire was online, younger participants might have been more disposed to participate as they tend to spend more time online than their older counterparts, and therefore, it could have limited the generalization of our results. Another limitation was that the data used in this investigation were extracted from PTs' self-reported experience. Even though validated and reliable questionnaires were used, the responses were based on subjective findings. For instance, the physical activity measurement was self-reported, so the total amount of physical activity could have been underestimated or overestimated by the social desirability or overcall bias. However, the questionnaire used facilitates its administration to a large number of subjects. Regardless, despite the inherent biases of self-reported questions, self-rates of work ability are less prone to the effect of existing social benefits and thus more appropriate for cross-study comparisons, in contrast to sick leave or disability pension data extracted from official sources, which tend to be tied to the current social security systems used by specific countries or employers. Additionally, as we reported frequency as the number of training days per week, those participants who trained more than once a day may have been represented inadequately. Nevertheless, results should be interpreted with caution.

Practical applications: Notwithstanding these limitations, the present investigation suggests that due to the noteworthy risk for developing musculoskeletal pain in this population, preventive strategies are needed to reduce musculoskeletal disorders and to ensure a better working life. Overall, and in line with our findings, having an appropriate level of physical fitness is considered the most reported current strategy used by healthcare workers to enable them to continue working. In fact, in workers with physically demanding jobs, high-intensity physical activity during leisure-time is associated in a dose-response manner with work ability. Thus, increasing the levels of physical activity during leisure could be an interesting approach to achieve this goal. However, promoting just a more physically active lifestyle and following current general physical activity recommendations might be an oversimplified recommendation, and still seems not be enough for reducing the high rates of musculoskeletal pain among this occupational group. Additionally, performing physical activity during leisure depends on different factors, such as having leisure time, access to activity spaces, cultural and individual factors, among others. Therefore, implementing workplace interventions could be an effective strategy to enhance physical activity levels among PTs and therefore, to reduce musculoskeletal pain. A systematic review found strong evidence for the positive effect of workplace programs on physical activity and musculoskeletal pain. From a biopsychosocial perspective, including psychological, biological, cognitive, affective, behavioral and social factors in the variability in the experience of pain between individuals, workplace interventions could potentially provide physiological benefits, but also positive effects on well-being and on socializing with colleagues, which would in turn, contribute to address more potential factors involved in musculoskeletal pain. For example, as performing high intensity strength training during leisure-time has showed to be strongly associated with lower levels of musculoskeletal pain, specialists should provide guidance on the most favorable intensity of muscle strengthening activities and encourage its practice for preventing and reducing musculoskeletal pain among workers with physically demanding tasks such as PTs. However, since evidence showing that one form of exercise is better than another is not available, recommendations should focus on programs that take individual needs, preferences and capabilities into account in deciding about the type of exercise, relying on evidentiary support. Although no interventions have been conducted targeting muscle strengthening to reduce musculoskeletal pain among PTs, previous studies in other occupational groups support the possibility of successfully intervening in PTs, thereby opening an avenue for future research. As an example, strength training focused on painful body areas, has shown to be effective in reducing neck and shoulder pain among workers of different settings. For instance, 20 weeks of high intensity strength training at the workplace showed to be effective in reducing neck and shoulder pain among laboratory technicians. Shorter interventions have also found similar results, for example, 10 weeks of high intensity strength training at the workplace compared with a home-based program showed positive effects reducing musculoskeletal pain and weekly intake of analgesics among female healthcare workers. Common for these studies is that the exercise was performed vigorously, i.e. with high intensity. Combined with the results of the present study this suggests that physical exercise or activities should preferably be performed vigorously to have a major positive influence on musculoskeletal pain. Future experimental studies should corroborate the effect of specific physical exercise on musculoskeletal pain in PTs. Regardless, general recommendations may serve as a guide, but because of the considerable interindividual variability in muscle strength responses, individualization might be imperative in order to achieve optimal results. As stated previously, it can be challenging to ascertain the optimal dose of strength training to reduce musculoskeletal pain among a working population, while still aligning with their work demands. However, it is feasible by studying the habits of specific occupational groups.

Conclusion: these findings suggest that different work-related factors, including lack of professional experience, working in private clinics, treating more patients at the same time, working in a seated position, treating more than 30 patients per week, and working more than 45 hour per week, are associated with musculoskeletal pain among PTs, especially in specific body areas such as the low back, the shoulders or the neck. The results of this study might be considered for developing clinical guidelines and to develop effective interventions to prevent work-related musculoskeletal pain and better working conditions among PTs. Furthermore, performing 75 or more minutes of vigorous physical activity per week is positively associated with having a lower level of musculoskeletal pain in neck and shoulders among PTs. In contrast, neither vigorous nor moderate physical activity are associated with musculoskeletal pain in arm-hand and back. In addition, after controlling for potential confounders, the presence of musculoskeletal pain, especially when it occurs at more than one site simultaneously, is strongly associated with lower levels of work ability among PTs. However, further research is needed to have a better understanding of the underlying mechanisms involved in the onset and maintenance of pain in this occupational group, as well as the role of coping, social support or psychosocial factors in the work ability of PTs. This would help to design more effective interventions to improve levels of work ability among PTs and to ensure a longer and better working life. And lastly, performing high intensity strength training (equal or above 80% RM) during leisure-time is strongly associated with lower levels of musculoskeletal pain in arm-hand, neck-shoulder and back. However, neither frequency nor lower intensities showed associations with musculoskeletal pain in any body part. These findings should provide guidance on the most favorable intensity of muscle strengthening activities and encourage its practice for preventing and reducing musculoskeletal pain among workers with physically demanding tasks such as PTs

Spanish summary

Introducción: los trastornos musculoesqueléticos relacionados con el trabajo son una afección común con un impacto considerable en la vida de un individuo y es un área de gran interés en el campo de la salud ocupacional. Estas condiciones incapacitantes, aunque en muchos casos prevenibles, son una causa frecuente de ausentismo en el lugar de trabajo, causando un impacto significativo en la calidad de vida, lo que puede conducir a una disminución de la productividad así como aumentar los costos de atención médica para los trabajadores, empleadores y profesionales de la salud. Sin embargo, este término y otros como "trastornos musculoesqueléticos", "dolor musculoesquelético" o "lesiones musculoesqueléticas" a menudo se usan indistintamente, lo que lleva a confusión terminológica. Para ser consistente y homogéneo, a lo largo de este manuscrito, se utilizará el término "dolor musculoesquelético". El dolor musculoesquelético es común entre los profesionales de la salud, incluidos los fisioterapeutas (PT), debido a la naturaleza físicamente exigente de sus trabajos. Esto es muy relevante, ya que los PT constituyen el 8.21% del total de la fuerza laboral europea de atención sanitaria (incluidas las enfermeras, los médicos, los dentistas, los farmacéuticos y los PT), con más de 500,000 profesionales trabajando en los 28 países europeos. Más específicamente, los PT españoles representan el 7,4% del total de la fuerza laboral sanitaria. En realidad, España es uno de los países europeos con más PT, representando casi el 10% de la cantidad total de PT en Europa. En este contexto, la fisioterapia es una profesión establecida y regulada que brinda servicios a individuos y poblaciones en circunstancias donde el movimiento y la función están amenazados por el envejecimiento, lesiones, enfermedades o factores ambientales. Sin embargo, los factores antes mencionados que normalmente están presentes en aquellos pacientes que necesitan terapia física, paradójicamente, también pueden afectar a la profesión de la fisioterapia. Aunque los PT son especialistas en biomecánica y prevención de lesiones, una compleja variedad de factores de riesgo puede contribuir al desarrollo del dolor musculoesquelético. Por ejemplo, como parte de su trabajo, los PT están expuestos a levantamientos o movimientos repetidos, posturas sostenidas e incómodas, agacharse, cargar, reposicionar o levantar pacientes, altas demandas mentales, estrés y también factores de estilo de vida individuales. Estos factores pueden empeorar negativamente la calidad de la atención al paciente o conducir al absentismo. Dentro de este contexto, el dolor representa un problema ocupacional significativo entre los PT; sin embargo, su desarrollo es complejo, ya que está influenciado por una miríada de factores. De hecho, de acuerdo con una revisión sistemática reciente, la prevalencia de dolor musculoesquelético en fisioterapeutas en el transcurso de la vida osciló entre 53 y 91%, siendo

la zona lumbar más comúnmente afectada, seguida por el cuello, los pulgares, la parte superior de la espalda y los hombros. Sin embargo, estas tasas pueden variar según los diferentes factores relacionados con el entorno de trabajo. Por ejemplo, debido al grado de dependencia física a menudo característico de los pacientes hospitalizados, los PT que trabajan en hospitales tienen más probabilidades de levantar y realizar transferencias de pacientes, mientras que los PT en ubicaciones no hospitalarias tienen una mayor frecuencia de usar técnicas manuales en lugar de levantar cargas pesados o trasladar pacientes dependientes. En realidad, los terapeutas que realizan técnicas manuales y tratan a un gran número de pacientes por día son más propensos a tener dolor en los pulgares, las manos o las muñecas, mientras que otras áreas del cuerpo, como la parte superior de la espalda, la espalda baja, el cuello, la cadera y la rodilla, son más prevalentes en otros entornos como la rehabilitación neurológica o la pediatría. Por último, otros factores que pueden aumentar el riesgo de desarrollar dolor musculoesquelético en los PT son el aumento de la edad; lo que parece ser un tema de preocupación para los PT menores de 30 años o menos experimentados, trabajar en clínicas en lugar de en lugares públicos o ser del sexo femenino. Por lo tanto, mejorar nuestro conocimiento acerca del dolor musculoesquelético y los factores relacionados con el trabajo entre los PT puede ser relevante para mantener a esta profesión en una condición saludable. Sin embargo, el dolor musculoesquelético es particularmente difícil de discutir en términos absolutos, lo que sugiere que el trabajo solo contribuye en parte a la aparición del dolor musculoesquelético. A pesar de que los factores biomecánicos, como la alta exposición física, las posiciones corporales, etc., se reportan comúnmente como causas principales y / o factores de riesgo para tener dolor musculoesquelético, estos no están relacionados linealmente con las tasas de prevalencia del dolor musculoesquelético descritas en la literatura. Esto justifica la necesidad de analizar otras variables que podrían influir en el dolor musculoesquelético entre estos profesionales. Por ejemplo, estudios previos han mostrado que, entre los trabajadores, el dolor musculoesquelético se considera la principal causa de discapacidad y jubilación anticipada y representa una amenaza significativa para la capacidad laboral, a corto y largo plazo. De hecho, si bien la mayoría de los estudios observacionales se han centrado en el dolor en un solo sitio, está bien establecido que las personas con dolor localizado comúnmente tienen quejas coexistentes en otras áreas del cuerpo. En realidad, experimentar dolor en una sola parte del cuerpo ha demostrado que aumenta el riesgo de desarrollar dolor en otras / múltiples regiones del cuerpo un año después. El dolor en múltiples sitios parece tener un peor pronóstico que el dolor en un solo sitio, y se ha sugerido que experimentar dolor musculoesquelético en múltiples áreas del cuerpo aumenta la probabilidad de desarrollar dolor crónico. Esto puede estar relacionado con una sensibilización central de la percepción del dolor en condiciones de dolor crónico. A pesar del gran número de estudios que han encontrado asociaciones entre la presencia de dolor y la capacidad laboral entre los trabajadores de diferentes grupos ocupacionales, todavía existe mucha incertidumbre sobre esta relación en los PT.

Esto plantea la pregunta de hasta qué punto la presencia de dolor musculoesquelético en un solo sitio o en múltiples sitios puede influir en la capacidad de trabajar en los PT. Teniendo en cuenta que la baja capacidad laboral es un fuerte predictor de la discapacidad laboral futura y la jubilación anticipada, y su declive podría desafiar a la profesión y a su trato de pacientes, es necesario comprender la contribución del dolor musculoesquelético en un solo sitio y en múltiples sitios y su potencial asociación con menores niveles de capacidad laboral entre los PT. Especialmente porque la posibilidad de tener una vida laboral mejor y más larga depende en gran medida de la capacidad laboral.

Por esta razón, comprender cómo el dolor en un solo sitio y en múltiples sitios puede influir en la capacidad de trabajo de los PT y otros factores modificables como la actividad física y los niveles de entrenamiento de fuerza durante el tiempo libre también podrían ayudar a disminuir las altas tasas de prevalencia encontradas en esta profesión. En este contexto, la actividad física regular ha demostrado proporcionar numerosos beneficios para la salud, incluida la mejora de la calidad de vida, el funcionamiento físico y la reducción del riesgo de mortalidad. Del mismo modo, los estudios observacionales han encontrado que el ejercicio físico se asocia positivamente con el dolor musculoesquelético en poblaciones de trabajo. Un mecanismo propuesto para estos efectos podría ser que al mejorar la capacidad física, la carga de trabajo física relativa puede disminuir. Por lo tanto, los trabajadores podrían estar más preparados para enfrentar los desafíos físicos inherentes a sus tareas laborales. Además, existe un creciente cuerpo de literatura que reconoce el entrenamiento de fuerza como piedra angular para el manejo y la prevención de varios trastornos de salud. El entrenamiento de fuerza puede prevenir y / o disminuir los riesgos asociados con enfermedades crónicas, ya que está relacionado con un menor riesgo de mortalidad por todas las causas, una reducción significativa en la diabetes tipo 2 o enfermedad cardiovascular, entre otros. Sin embargo, los efectos del entrenamiento de fuerza sobre el dolor musculoesquelético entre las poblaciones trabajadoras parecen menos claros, aunque prometedores. Del mismo modo que la magnitud de la dosis requiere ser prescrita con precisión en medicamentos, se necesita un nivel de precisión similar al de la prescripción de entrenamiento de fuerza para obtener resultados óptimos. Desafortunadamente, se sabe poco sobre la intensidad óptima y la frecuencia del entrenamiento de fuerza para el manejo efectivo del dolor musculoesquelético entre las poblaciones trabajadoras. Comprender el vínculo entre tales variables y el dolor musculoesquelético ayudará a adaptar las intervenciones específicas, así como a proporcionar alguna orientación al evaluar las recomendaciones actuales para mantener un sistema musculoesquelético saludable entre los PT. Sin embargo, antes de realizar tales intervenciones entre los PT, es importante conocer sus demandas de trabajo y estudiar los hábitos y el entorno laboral específico de este grupo ocupacional específico.

Objetivos: Este estudio buscó: i) investigar la asociación entre los factores relacionados con el trabajo y el dolor musculoesquelético en la espalda, el cuello y las extremidades superiores entre los PT: planteamos la hipótesis de que los factores relacionados con el trabajo, como no tener suficiente experiencia profesional, trabajar en un hospital público entornos y el tratamiento de un mayor número de pacientes por semana podría aumentar las probabilidades de dolor musculoesquelético entre los PT; ii) analizar la asociación entre la actividad física moderada y vigorosa y el dolor musculoesquelético en los PT: nuestra hipótesis era que niveles más altos de actividad física tanto vigorosa como moderada tendrían un efecto protector para el dolor musculoesquelético, en comparación con aquellos PT menos físicamente activos; iii) investigar la prevalencia del dolor local y multisitio entre los PT, la asociación entre la intensidad del dolor y los niveles de capacidad de trabajo, y la asociación entre el número de sitios de dolor y la capacidad de trabajo: planteamos la hipótesis de que los altos niveles de intensidad de dolor percibida están asociados con menor capacidad de trabajo entre los PT, y que esta asociación aumenta de forma dosis-respuesta con múltiples sitios de dolor; y iv) analizar la asociación entre la frecuencia y la intensidad del entrenamiento de fuerza y el dolor musculoesquelético en la espalda, el cuello, el hombro y la mano del brazo entre los PT: planteamos la hipótesis de que realizar un entrenamiento de fuerza de alta intensidad: es decir,> 80% del máximo de repetición (RM), más de 3 veces por semana reduciría el dolor musculoesquelético más que las intensidades más bajas.

Métodos: El diseño de esta investigación fue de corte transversal. Antes de llevar a cabo la investigación, se obtuvo la aprobación ética del Comité de Ética de la Universidad de Valencia. Entre los posibles participantes se encontraban PT trabajando activamente que estuvieran registrados en asociaciones profesionales de PT de diferentes comunidades de toda España. Después de contactar a las principales asociaciones profesionales de PT españolas para pedir permiso para invitar a sus miembros a participar de forma voluntaria, y realizar una prueba piloto del cuestionario para asegurarse de que cada pregunta fuera clara, el cuestionario se envió junto con una carta que incluía la descripción del proyecto. El cuestionario fue diseñado para recopilar información sobre las características de los PT y su entorno de trabajo, e incluyó: Demografía, estilo de vida y preguntas relacionadas con el trabajo; preguntas sobre la presencia e intensidad del dolor musculoesquelético en 9 áreas corporales diferentes (utilizando el Nordic Musculoskeletal Questionnaire, los sujetos informaron la presencia de dolor musculoesquelético respondiendo a la pregunta "¿Ha tenido dolor o molestias durante al menos 24 horas en el último mes en los siguientes áreas del cuerpo? ”con opciones para responder 'sí' o 'no'); Índice de capacidad de trabajo [incluidas sus 7 subescalas: 1) Capacidad de trabajo actual en comparación con la mejor calidad de vida, 2) capacidad de trabajo en relación con las demandas físicas y mentales del trabajo, 3) número de enfermedades actuales diagnosticadas por un médico, 4) estimado incapacidad laboral debido a enfermedades, 5) baja por enfermedad durante el año pasado, 6) pronóstico propio de la capacidad laboral dentro de dos años, y 7) recursos mentales]; nivel de actividad física durante el tiempo libre autoreportado (se informó según el Cuestionario de actividad física global) y; niveles de entrenamiento de fuerza autoreportados en el tiempo libre (respondiendo las siguientes preguntas: "Durante una semana típica, ¿realiza alguna actividad física en su tiempo libre específicamente diseñada para fortalecer sus músculos, como levantamiento de pesas, entrenamiento con banda elástica, flexiones...? "y preguntas sobre la frecuencia y la intensidad del entrenamiento). Todos los análisis estadísticos se realizaron con el software estadístico SAS para Windows (Proc Logistic, SAS v9.4). Se hizo estadística descriptiva para informar la prevalencia de dolor musculoesquelético único y multisitio, intensidad del dolor (>3 en una escala de 0-10 en la espalda, cuello / hombros y brazo / mano), factores relacionados con el trabajo (otros trabajos, años de experiencia, sector, tipo de empleo, horas de trabajo por semana, número de pacientes por semana, tratamiento de más pacientes al mismo tiempo, tipo primario de pacientes y tratamientos, ajuste de la camilla cuando sea necesario y posición de trabajo), niveles de actividad física durante el tiempo libre, entrenamiento de fuerza durante el tiempo libre y características demográficas (edad, altura, peso, sexo, educación, tabaquismo o unidades de alcohol por semana). Mediante la regresión logística binaria, se calcularon los odds ratios (OR) y los intervalos de confianza (IC) del 95% para examinar las asociaciones entre: (Estudio 1) con dolor musculoesquelético moderado a alto (> 3 en una escala de 0-10, categoría de referencia: dolor 0-2) en diferentes áreas del cuerpo y factores relacionados con el trabajo; (Estudio 2) tener dolor musculoesquelético bajo (<3 en una escala de 0-10) en diferentes áreas del cuerpo (variables dependientes) en función de la cantidad total de actividad física recreativa vigorosa (0, 1-74 y >75 minutos por semana) y actividad física moderada en el tiempo libre (0, 1-149 y >150 minutos por semana) como variables independientes mutuamente ajustadas (categoría de referencia: 0 minutos por semana); (Estudio 3) que tiene un nivel inferior de capacidad de trabajo y su asociación con la intensidad del dolor y el dolor en múltiples sitios; y (Estudio 4) que tiene niveles bajos de dolor musculoesquelético (<3 en una escala de 0-10) en diferentes áreas del cuerpo (variables dependientes) en función de la frecuencia (0, 1-2 y más de 3 veces por semana, respectivamente) e intensidad (≤50% RM, 51-79% RM y >80% RM, respectivamente) del entrenamiento de fuerza durante el tiempo libre. Estos puntos de corte se establecieron de acuerdo con las pautas generales actuales de entrenamiento de fuerza. Los posibles factores de confusión se ajustaron en dos modelos diferentes: el Modelo 1 controlado por edad y sexo; modelo 2 controlado por edad, sexo, educación y factores relacionados con el trabajo (incluidos años de experiencia, horas de trabajo, entorno, tipo de tratamiento, número de pacientes por semana y puesto de trabajo).

Resultados: De los 1006 cuestionarios que fueron devueltos por los PT registrados, 25 cuestionarios con información faltante sobre las principales variables del estudio fueron excluidos del análisis. Por lo tanto, se analizaron los datos de los 981 cuestionarios restantes. La población de PT de estudio tenía una edad media de 34,3 ± 8,0 años, el 29,4% eran hombres y el 70,6% mujeres, que en promedio tenían un IMC de 23,3 ± 3,4 kg / m2. Los resultados de los análisis de regresión logística binaria mostraron que los factores relacionados con el trabajo asociados con un mayor riesgo de tener dolor moderado a alto (>3 en una escala de 0-10) en las áreas superiores del cuerpo fueron "tratar a más pacientes al mismo tiempo" (OR 2.14 [IC 95%, 1.53-2.99]), "trabajar más de 45 horas por semana" [OR, 1.73 (IC 95%, 1.05-2.84)], y "trabajar sentado" [OR, 2.04 (IC 95%, 1.16-3.57)]. "Más años de experiencia" mostró una asociación negativa para el dolor en el codo [OR, 0,41 (IC del 95%, 0,21 - 0,78)] y dolor lumbar [OR, 0,48 (IC del 95%, 0,29 - 0,79)] en comparación con homólogos con menos experiencia (Estudio 1). Con respecto a la actividad física en el tiempo libre, las probabilidades de experimentar niveles más bajos de dolor en el cuello y el hombro fueron mayores en los PT que realizaban 75 minutos o más de actividad física recreativa vigorosa por semana (OR 1.43; IC 95%: 1.05-1.94), con 0 minutos por semana de actividad física vigorosa como referencia. Sin embargo, el análisis no reveló ninguna diferencia significativa entre la actividad física recreativa vigorosa y el dolor en el brazo, la mano o la espalda. Las probabilidades de tener niveles más bajos de dolor no fueron significativamente menores en aquellos PT que realizan actividad física moderada en el tiempo libre

(Estudio 2). La parte del cuerpo con dolor más comúnmente calificada fue el cuello (36.3%), seguido de la parte baja de la espalda (32.3%), la parte superior de la espalda (21.9%) y la mano / muñeca (21.6%). Un tercio de los encuestados informó una intensidad moderada del dolor en el cuello, seguido de la parte baja de la espalda (25.9%), la parte superior de la espalda (22.4%) y la mano / muñeca (20.9%). La prevalencia de alta intensidad del dolor en 0, 1-2, 3-4 y> 5 partes del cuerpo fue 39.3%, 32.5%, 19.4% y 8.8% respectivamente. Además, se encontró una relación dosis-respuesta entre el número de sitios de dolor y una menor capacidad de trabajo, especialmente cuando estaba presente en más de un sitio simultáneamente. Por ejemplo, con una intensidad de dolor baja como referencia, se encontró una asociación moderada a fuerte para niveles más bajos de capacidad de trabajo en los PT que informaron dolor de> 5 en 1-2 regiones del cuerpo. Esta asociación fue más fuerte cuando los participantes informaron dolor en 3-4 regiones e incluso más fuerte cuando el dolor se experimentó en 5 o más sitios (Estudio 3). Se encontraron fuertes asociaciones para tener niveles más bajos de dolor en todas las áreas corporales estudiadas en aquellos PT que informaron haber realizado un entrenamiento de fuerza de alta intensidad (>80% RM). Sin embargo, las probabilidades de tener niveles de dolor más bajos no fueron significativamente más altas entre los PT que realizan intensidades más bajas (≤50% RM y 51-79% RM) en cualquier parte del cuerpo. El análisis no mostró ninguna asociación significativa entre la frecuencia del entrenamiento de fuerza y menores niveles de dolor en ninguna parte del cuerpo (Estudio IV).

Fortalezas y limitaciones: Una fortaleza de esta investigación es que los análisis fueron controlados para diferentes factores de confusión que podrían influir en los resultados (por ejemplo, edad, sexo, factores relacionados con el trabajo y educación). Además, al limitar la población de estudio solo a los PT que estaban trabajando activamente, redujimos la influencia de variables de confusión que podrían haber dado lugar a un sesgo para nuestro estudio, como factores socioeconómicos o educativos. Por otro lado, algunos factores pueden limitar la generalización de los resultados de esta investigación. Primero, la naturaleza transversal de este estudio no permite determinar la causalidad, ya que la exposición y el resultado se evaluaron en el mismo momento. En el caso de la relación entre la capacidad laboral y el dolor musculoesquelético, una de las dudas que surge de este estudio es si la presencia de dolor es lo que conduce a una menor capacidad laboral, o si el hecho de tener una menor capacidad laboral aumenta las probabilidades de tener dolor musculoesquelético. Sin embargo, estudios previos sugieren que la naturaleza direccional es del dolor al trabajo y no al revés. En segundo lugar, no fue posible calcular la tasa de respuesta, ya que tuvimos que contactar con diferentes colegios profesionales para invitar a sus miembros a participar en nuestro estudio. Esto fue una limitación para el cálculo de la tasa de respuesta, ya que no todas los colegios colaboraron con nosotros en la invitación a sus miembros, y algunos de ellas agregaron el enlace al cuestionario y la carta de presentación en un boletín, siendo difícil calcular el número exacto de PT que realmente recibieron la invitación. Además, los participantes incluidos en este estudio eran exclusivamente de la fuerza laboral española, lo que además podría limitar la generalización de nuestros resultados. Además, aquellos PT severamente afectados por el dolor musculoesquelético pueden no haber estado trabajando activamente durante la investigación y, en consecuencia, excluidos del estudio, dejando así una fuerza laboral relativamente sana, también conocida como el efecto trabajador sano (healthy worker effect), que podría limitar la generalización de nuestros resultados. Además, debido a que el cuestionario era online, los participantes más jóvenes podrían haber estado más dispuestos a participar, ya que tienden a pasar más tiempo en línea que sus homólogos mayores, y por lo tanto, podría haber limitado la generalización de nuestros resultados. Otra limitación fue que los datos utilizados en esta investigación se extrajeron de la experiencia autoreportada de los PT. Aunque se utilizaron cuestionarios validados y confiables, las respuestas se basaron en hallazgos subjetivos. Por ejemplo, la medición de la actividad física fue autoreportada, por lo que la cantidad total de actividad física podría haber sido subestimada o sobrestimada por conveniencia social. Sin embargo, el cuestionario utilizado facilita su administración a un gran número de sujetos. En cualquier caso, a pesar de los sesgos inherentes a las preguntas autoreportadas, las respuestas autoreportadas de la capacidad laboral son menos propensas al efecto de los beneficios sociales existentes y, por lo tanto, son más apropiadas para las comparaciones entre estudios, en contraste con los datos de baja por enfermedad o pensión por discapacidad extraídos de fuentes oficiales, que tienden a estar vinculadas a los sistemas actuales de seguridad social utilizados por países o empleadores específicos. Además, como informamos la frecuencia como el número de días de entrenamiento por semana, los participantes que entrenaron más de una vez al día pueden haber sido representados inadecuadamente. Por este motivo, los resultados deben interpretarse con precaución.

Aplicaciones prácticas: a pesar de estas limitaciones, la presente investigación sugiere que debido al riesgo notable de desarrollar dolor musculoesquelético en esta población, se necesitan estrategias preventivas para reducir los trastornos musculoesqueléticos y garantizar una mejor vida laboral. En general, y de acuerdo con nuestros hallazgos, tener un nivel apropiado de condición física se considera la estrategia actual más reportada utilizada por los trabajadores de la salud para que puedan seguir trabajando. De hecho, en los trabajadores con trabajos físicamente exigentes, la actividad física de alta intensidad durante el tiempo libre se asocia de manera dosis-respuesta con la capacidad laboral. Por lo tanto, aumentar los niveles de actividad física durante el tiempo libre podría ser un enfoque interesante para lograr este objetivo. Sin embargo, promover solo un estilo de vida más activo físicamente y seguir las recomendaciones actuales de actividad física general podría ser una recomendación demasiado simple, y aún así no parece ser suficiente para reducir las altas tasas de dolor musculoesquelético en este grupo ocupacional. Además, realizar actividad física durante el tiempo libre depende de diferentes factores, como tener tiempo libre, acceso a espacios de actividad, factores culturales e individuales, entre otros. Por lo tanto, la implementación de intervenciones en el lugar de trabajo podría ser una estrategia efectiva para mejorar los niveles de actividad física entre los PT y, por lo tanto, para reducir el dolor musculoesquelético. Una revisión sistemática encontró pruebas sólidas del efecto positivo de los programas en el lugar de trabajo sobre la actividad física y el dolor musculoesquelético. Desde una perspectiva biopsicosocial, que incluye factores psicológicos, biológicos, cognitivos, afectivos, conductuales y sociales en la variabilidad en la experiencia del dolor entre individuos, las intervenciones en el lugar de trabajo podrían proporcionar beneficios fisiológicos, pero también efectos positivos sobre el bienestar y la socialización con colegas, lo que a su vez, contribuiría a abordar más factores potenciales involucrados en el dolor musculoesquelético. Por ejemplo, como el entrenamiento de fuerza de alta intensidad durante el tiempo libre ha demostrado estar fuertemente asociado con niveles más bajos de dolor musculoesquelético, los profesionales deben brindar orientación sobre la intensidad más favorable de las actividades de fortalecimiento muscular y fomentar su práctica para prevenir y reducir el dolor musculoesquelético entre trabajadores con tareas físicamente exigentes como los PT. Sin embargo, dado que la evidencia que muestra que una forma de ejercicio es mejor que otra no está disponible, las recomendaciones deben centrarse en programas que tengan en cuenta las necesidades, preferencias y capacidades individuales al decidir sobre el tipo de ejercicio, basándose en la evidencia científica. Aunque no se han realizado intervenciones dirigidas al fortalecimiento muscular para reducir el dolor musculoesquelético entre los PT, estudios previos en otros grupos ocupacionales respaldan la posibilidad de intervenir con éxito en los PT, lo que abre una vía para futuras investigaciones. Como ejemplo, el entrenamiento de fuerza enfocado en áreas dolorosas del cuerpo, ha demostrado ser efectivo para reducir el dolor de cuello y hombro entre trabajadores de diferentes entornos. Por ejemplo, 20 semanas de entrenamiento de fuerza de alta intensidad en el lugar de trabajo demostraron ser efectivas para reducir el dolor de cuello y hombro entre los técnicos de laboratorio. Intervenciones más cortas también han encontrado resultados similares, por ejemplo, 10 semanas de entrenamiento de fuerza de alta intensidad en el lugar de trabajo en comparación con un programa en el hogar mostraron efectos positivos que reducen el dolor musculoesquelético y la ingesta semanal de analgésicos entre las trabajadoras de la salud. Común para estos estudios es que el ejercicio se realizó vigorosamente, es decir, con alta intensidad. En combinación con los resultados del presente estudio, esto sugiere que el ejercicio físico o las actividades deben realizarse de manera vigorosa para tener una influencia positiva importante en el dolor musculoesquelético. Los estudios experimentales futuros deberían corroborar el efecto del ejercicio físico específico sobre el dolor musculoesquelético en los PT. En cualquier caso, las recomendaciones generales pueden servir de guía, pero debido a la considerable variabilidad interindividual en las respuestas de fuerza muscular, la individualización puede ser imprescindible para lograr resultados óptimos. Como se indicó anteriormente, puede ser un desafío determinar la dosis óptima de entrenamiento de fuerza para reducir el dolor musculoesquelético en una población activa, sin dejar de alinearse con sus demandas laborales. Sin embargo, es factible estudiando los hábitos de grupos ocupacionales específicos.

Conclusión: estos hallazgos sugieren que diferentes factores relacionados con el trabajo, incluida la falta de experiencia profesional, trabajar en clínicas privadas, tratar a más pacientes al mismo tiempo, trabajar en una posición sentada, tratar a más de 30 pacientes por semana y trabajar más de 45 hora por semana, se asocian con dolor musculoesquelético entre los PT, especialmente en áreas específicas del cuerpo como la espalda baja, los hombros o el cuello. Los resultados de este estudio podrían considerarse para desarrollar guías clínicas y desarrollar intervenciones efectivas para prevenir el dolor musculoesquelético relacionado con el trabajo y mejores condiciones laborales entre los PT. Además, realizar 75 o más minutos de actividad física vigorosa por semana se asocia positivamente con tener un menor nivel de dolor musculoesquelético en el cuello y los hombros entre los PT. Por el contrario, ni la actividad física vigorosa ni la moderada se asocian con dolor musculoesquelético en brazo y mano. Además, después de controlar posibles factores de confusión, la presencia de dolor musculoesquelético, especialmente cuando ocurre en más de un sitio simultáneamente, está fuertemente asociada con niveles más bajos de capacidad de trabajo entre los PT. Sin embargo, se necesita más investigación para comprender mejor los mecanismos subyacentes involucrados en la aparición y el mantenimiento del dolor en este grupo ocupacional, así como el papel de la superación, el apoyo social o los factores psicosociales en la capacidad laboral de los PT. Esto ayudaría a diseñar intervenciones más efectivas para mejorar los niveles de capacidad laboral entre los PT y para garantizar una vida laboral más larga y mejor. Y, por último, realizar un entrenamiento de fuerza de alta intensidad (igual o superior al 80% de RM) durante el tiempo libre está fuertemente asociado con niveles más bajos de dolor musculoesquelético en brazo, mano, cuello, hombro y espalda. Sin embargo, ni la frecuencia ni las intensidades más bajas mostraron asociaciones con el dolor musculoesquelético en ninguna parte del cuerpo. Estos hallazgos deberían proporcionar orientación sobre la intensidad más favorable de las actividades de fortalecimiento muscular y fomentar su práctica para prevenir y reducir el dolor musculoesquelético entre los trabajadores con tareas físicamente exigentes, como los PT.

List of abbreviations

GPAQ	Global Physical Activity Questionnaire
PA	Physical activity
PT	Physical therapist
RM	Repetition Maximum
OR	Odds Ratio
WAI	Work Ability Index
WRMDs	Work-related Musculoskeletal Disorders

List of studies

The present doctoral thesis is composed of the following four studies:

Study I

Ezzatvar, Y., Calatayud, J., Andersen, L. L., Aiguadé, R., Benítez, J., & Casaña, J. (2020). Professional experience, work setting, work posture and workload influence the risk for musculoskeletal pain among physical therapists: a cross-sectional study. International Archives of Occupational and Environmental Health, 93(2), 189-196.

Study II

Ezzatvar, Y., Calatayud, J., Andersen, L. L., & Casaña, J. (2020). Are Moderate and Vigorous Leisure-Time Physical Activity Associated With Musculoskeletal Pain? A Cross-Sectional Study Among 981 Physical Therapists. American Journal of Health Promotion, 34(1), 67-70.

Study III

Ezzatvar, Y., Calatayud, J., Andersen, L. L., Vinstrup, J., Alarcon J., & Casaña, J. (2020). Dose-response association between multi-site musculoskeletal pain and work ability in physical therapists: Cross-sectional study. International Archives of Occupational and Environmental Health, *1-8*.

Study IV

Ezzatvar, Y., Calatayud, J., Andersen, L. L., & Casaña, J. (2020). Importance of frequency and intensity of strength training for reduced musculoskeletal pain in the back, neck-shoulder and arm-hand among physical therapists. Journal of Physical Activity & Health, *1-6*.

Full text of the above-mentioned studies is contained in the Appendix section, at the end of the main text of this document.

Introduction

1. Introduction

Work-related Musculoskeletal Disorders (WRMDs)* are defined as a variety of conditions which can affect muscles, tendons, ligaments, joints, peripheral nerves, or supporting blood vessels, and occurs as a result of a work-related activity (Luttmann et al., 2003).

WRMDs are a common condition which have considerable impact on an individual's life and is a major area of interest within the field of occupational health. These disabling yet in many cases preventable conditions are a frequent cause of work place absenteeism (Luger et al., 2017), and are reported to significantly impact on quality of life, which can lead to a decrease in productivity and associate healthcare costs for workers, employers and healthcare professionals (Bhattacharya, 2014).

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* There is a common misconception about the term WRMDs in the current literature. Terms like *WRMDs, musculoskeletal disorders, musculoskeletal pain, musculoskeletal injuries* are often used interchangeably and without precision. The vast majority of studies use these terms when they really mean "musculoskeletal pain", as the assessment tool they use for obtaining data is typically the Nordic Musculoskeletal Questionnaire (an instrument that assesses the presence of pain in different body areas, not specific disorders). However, pain is a rather nebulous term, and yet it is a concept difficult to define precisely. Its definition varies in the literature and there exists terminological confusion. This shows a need to be explicit about exactly what is meant by the term 'musculoskeletal pain'.

While a variety of definitions of the term 'pain' have been suggested, throughout this thesis, the term 'musculoskeletal pain' will use the definition promulgated by the International Association for the Study of Pain (IASP) (1979) who saw pain as "*an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage*" (Merskey, 1979). There is no agreed definition on what constitutes musculoskeletal pain, however, this definition can explain why many people report pain in the absence of tissue damage or any likely pathophysiological cause, as it considers the biopsychological context of the individual in the experience of pain.

Musculoskeletal pain is common among healthcare professionals. The healthcare workforce comprises a substantial part of the total workforce in most countries. According to EuroStat, only in Europe, near 7 million healthcare professionals are actively working (Eurostat, 2018). In fact, as seen in **Figure 1**, PTs constitute 8.21% of the total European healthcare workforce (including nurses, physicians, dentists, pharmacists and PTs), with more than 500,000 professionals working in the 28 European countries. More specifically, Spanish PTs represent 7.4% of the total healthcare workforce (Instituto Nacional de Estadística, 2018). Actually, Spain is one of the European countries with more PTs, accounting for almost 10% of the total amount of PTs in Europe.

Total Healthcare workforce in Europe-28 (EuroStat 2018)

EU- total Nurses: 3,677,379 (53,46%)

EU- total Physicians: 1,821,050 (26,47%)

EU-total Dentists: 362,798 (5,27%)

EU-total Pharmacists: 452,989 (6,58%)

EU-total PTs: 564,762 (8,21%)

Figure 1. Total Healthcare workforce in Europe-28 (Belgium, Bulgaria, Czechia, Denmark, Germany, Estonia, Ireland, Greece, Spain, France, Croatia, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden and United Kingdom). Data extracted from EuroStat, 2018.

According to the World Confederation of Physical Therapists (WCPT), physical therapy is an established and regulated profession which provides services to individuals and populations in circumstances where movement and function are threatened by ageing, injury, disease or environmental factors (World Confederation for Physical Therapy, 2019). However, the aforementioned factors that are typically present in those patients in need for physical therapy, paradoxically can also affect the physical therapy workforce. Even though PTs are specialists on body mechanics and injury prevention, a complex array of risk factors may contribute to the development of musculoskeletal pain. For instance, as part of their work, PTs are exposed to repeated liftings or movements, sustained and awkward postures, bending, carrying, repositioning or lifting patients (Devreux et al., 2012; Vieira et al., 2016), high mental demands, stress and also individual lifestyle factors. These factors can adversely worsen the quality of patient care or lead to absenteeism. Within this context, pain represents a significant occupational problem among PTs; however, its development is complex, as it is influenced by a myriad of factors. In fact, according to a recent systematic review, lifetime prevalence of musculoskeletal pain in PTs ranged between 53 and 91%, being the low-back the most commonly affected body area, followed by neck, thumbs, upper back and shoulders (Vieira et al., 2016). However, these rates can vary depending on different factors related to the working environment. For example, due to the degree of physical dependence often characteristic of hospitalized patients, PTs working in hospitals are more likely to perform patient lifts and transfers (Bork et al., 1996), whereas PTs in non-hospital-based locations have a greater frequency of using manual techniques rather than lifting heavy weights or transferring dependent patients. Actually, therapists who perform manual techniques and treat a large number of patients per day are more prone to have pain in the thumbs, hands or wrists (Caragianis, 2002; Power & Fleming, 2007), whereas other body areas such as upper back, lower back, neck, hip and knee are more commonly affected in other settings like neurologic rehabilitation or pediatrics (Bork et al., 1996). Lastly, another factor which may increase the risk of developing musculoskeletal pain in PTs is increasing age; which seems to be an issue of concern for younger than 30 years old or less experienced PTs (Kallistratos et al., 2009; Rozenfeld et al., 2010), working in clinics rather than in public settings (Liao et al., 2016) or being a woman (Bork et al., 1996; Nordin et al., 2011).

It has previously been reported that, among workers, musculoskeletal pain is considered the leading cause of disability and early retirement (Brooks, 2006) and poses a significant threat to work ability (Miranda et al., 2010), at short and long term (Kapteyn et al., 2008; Neupane et al., 2013). As a matter of fact, while most observational studies have focused on single-site pain, it is well established that people with localized pain commonly have co-existing complaints in other body areas (Hagen et al., 2006; IJzelenberg et al., 2004; Macfarlane et al., 2000). Actually, experiencing pain in just one body part has been shown to increase the risk of developing pain in other/multiple body regions a year later (Andersen, Clausen, Carneiro, et al., 2012). Multi-site pain seems to have a worse prognosis than single-site pain (Haukka et al., 2013; Øverland et al., 2012), and experiencing musculoskeletal pain in multiple body areas has been suggested to increase the likelihood of developing chronic pain (Croft et al., 2006). This may be related to a central sensitization of pain perception in conditions of chronic pain (Sluka & Clauw, 2016). Despite the large number of studies that have found associations between the presence of pain and work ability among workers from different occupational groups, much uncertainty still exists about this relationship in PTs.

This raises the question to which extent the presence of single- or multi-site musculoskeletal pain can influence the ability to work in PTs. Considering that poor work ability is a strong predictor of future work disability (Ilmarinen et al., 1997) and early retirement (Chiu et al., 2007), and its decline could challenge the profession to care for the health of the public, it is necessary to understand the contribution of single- and multi-site musculoskeletal pain and its potential association with lower work ability levels among PTs. Specially because the possibility of having a better and longer working life is strongly dependent on work ability (Ilmarinen, 2001).

Musculoskeletal pain is particularly difficult to discuss in absolutes, suggesting that work only partly contributes to the onset of musculoskeletal pain. Despite biomechanical factors such as high physical exposure, body positions, etc. are commonly reported as main causes and/or risk factors for having musculoskeletal pain (Adegoke et al., 2008; Rozenfeld et al., 2010), these are not linearly related to prevalence rates of musculoskeletal pain. Within this context, individuals have the capacity to change as a result of their responses to physical, psychological, social and environmental factors. For instance, lifestyle factors are considered an interesting target to promote health interventions aimed to reduce risk factors and to prevent chronic health problems. Among these, regular physical activity has shown to provide numerous health benefits, including improved quality of life, physical functioning and the lowering of mortality risk (Arem et al., 2015). Likewise, observational studies have found that physical exercise is positively associated with musculoskeletal pain in working populations (Barbosa et al., 2013; Sundstrup et al., 2014). One proposed mechanism for these effects might be that when improving physical capacity, the relative physical workload may decrease. Therefore, workers could be more prepared to face the physical challenges inherent of their working tasks.

Additionally, there is a growing body of literature that recognizes strength training as a cornerstone for the management and prevention of several health disorders. Strength training can prevent and/or decrease the risks associated with chronic diseases, as it is linked to a reduced risk of all-cause mortality (Dankel et al., 2016; Kraschnewski et al., 2016; Ruiz et al., 2008), a significant reduction in type 2 diabetes or cardiovascular disease (Shiroma et al., 2017), among others. However, the effects of strength training on musculoskeletal pain among working populations seem less clear, albeit promising. As well as dose magnitude requires to be prescribed with precision in drugs, a similar level of accuracy to prescription of strength training is needed to obtain optimal results. Unluckily, little is known about optimal intensity and frequency of strength training for effective management of musculoskeletal pain among working populations. For instance, workplace interventions based on strength training have showed to reduce musculoskeletal pain in workers from different settings, including industrial workers (Zebis et al., 2011), healthcare personnel (Jakobsen et al., 2015) or office workers (Blangsted et al., 2008). Although no interventions to date have been carried out targeting physical training in order to reduce musculoskeletal pain specifically among PTs, the above-mentioned studies indicate that it may prove a successful intervention among this population of the work force as well. However, before conducting such interventions among PTs, it is important to know their work demands and to study the habits and the specific working environment of this specific occupational group. Understanding the link between such variables and musculoskeletal pain will help to tailor specific interventions as well as to provide some guidance when evaluating current recommendations for keeping a healthy musculoskeletal system among PTs.

1.1. Objectives and hypotheses

Thus, the objectives and hypotheses of this project were to:

- Investigate the association between work-related factors and musculoskeletal pain in the back, neck and upper extremities among PTs. We hypothesized that work-related factors such as not having enough professional experience, working in public hospital settings, and treating a higher number of patients per week could increase the odds for musculoskeletal pain among PTs (Study I).

- Analyze the association between moderate and vigorous physical activity and musculoskeletal pain in PTs. We hypothesized that higher levels of both vigorous and moderate physical activity would have a protective effect for musculoskeletal pain, in comparison to those PTs less physically active (Study II).

- Investigate (i) the prevalence of local and multi-site pain among PTs, (ii) the association between pain intensity and levels of work ability, and (iii) the association between the number of pain sites and work ability. We hypothesized that high levels of perceived pain intensity are associated with lower work ability among PTs, and that this association increases in a dose-response fashion with multiple pain sites (Study III).

- Analyze the association between frequency and intensity of strength training and musculoskeletal pain in the back, neck-shoulder and arm-hand among PTs. We hypothesized that performing high intensity strength training: i.e., >80% of the Repetition Maximum (RM), more than 3 times per week would reduce musculoskeletal pain more than lower intensities (Study IV).

Methods

2. Methods

2.1. Overview

The study design of this investigation was cross-sectional. Data on work-related factors, musculoskeletal pain, work ability, physical activity and strength training levels were collected using an online questionnaire sent to PTs in Spain. In order to ensure comprehensive reporting of the data of this investigation, the STROBE guidelines were followed (von Elm et al., 2007). The data collection was conducted from January to June 2017.

2.2. Participants

Potential participants for this study included practicing PTs who were registered in the professional association of PTs of different communities across Spain. Those participants who were retired or were not actively working at the time of the investigation were excluded.

2.3. Sample size

According to an online tool (https://www.surveymonkey.com) and considering the estimated number of PTs in Spain (i.e., 54,258) and in Europe (i.e., 554,000), a sample size of 783 was appropriate to have a confident level of 95% and a margin of error of 3.5%.

2.4. Procedures

Prior to undertaking the investigation, ethical clearance was obtained from the University of Valencia's Ethical Committee (H1530736596718), in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments. After that, the researchers contacted the main professional associations of PTs of different communities in Spain to ask for permission to invite their members to participate on a voluntary basis. The members received the invitation letter along with the project description via e-mail and with a link to the online questionnaire. By responding to the questionnaire each participant was giving consent to participate in the study and permission for the results to be published. The name and contact information of the researchers were included in the cover letter in case of doubt. The online questionnaire took about 20 minutes to complete. One month following the original e-mail, a reminder was sent to everyone inviting the PTs to participate if they had not done so previously. Due to the recruiting procedure, the exact number of invited participants was unknown.

2.5. Questionnaire content

The questionnaire was designed to collect information about the characteristics of PTs and their working environment. To assess the content validity and question clarity of the questionnaire, ten PTs from academic, hospital and private-office settings, reviewed each question and pilot tested the questionnaire. Their feedback was taken into consideration, and some items were reformulated by the researchers to ensure that each question was clear and easy to respond to. Once the questions were reviewed and amended, an online questionnaire was created which was finally composed of five sections:

1. Demographics, lifestyle and work-related questions;
2. Presence and intensity of musculoskeletal pain in 9 different body areas;
3. Work ability index (including its 7 subscales);
4. Leisure-time physical activity;
5. Strength training during leisure-time.

Due to data privacy reasons the setting of the survey system was set to "anonymous", i.e. it was not possible to link the individual responses to neither individual e-mails nor IP-addresses of the participants.

2.5.1. Demographics, lifestyle and work-related questions

The first section of the questionnaire consisted of closed-ended questions about participants' demographics, lifestyle and work-related information. Participants provided data about their age, sex, height, weight, alcohol consumption, smoking habits, education and leisure physical activity. Work-related questions included: years of professional experience, working hours per week in the main physical therapy job, number of patients treated per week, if they treated more than one patient at the same time, primary type of patients, primary type of treatment, if they adjusted the examination table when necessary, work position and practice setting of the main physical therapy job.

2.5.2. Musculoskeletal pain

The second section included modified questions from the Nordic Musculoskeletal Questionnaire (Kuorinka et al., 1987) to report the prevalence and severity of musculoskeletal pain in the upper extremities and the trunk during the last month. Using a simple body diagram (**Figure 2**) highlighted with 9 specific body areas (neck, shoulders, upper back, low back, elbow/forearm and hand/wrist), subjects reported the presence of musculoskeletal pain responding the question "Have you had pain or discomfort during at least 24 hours in the last month in the following body areas?" with options to answer 'yes' or 'no'. When the answer was 'yes', they were asked to rate pain intensity using a 0-10 numeric rating scale, where 0 meant "no pain at all" and 10 was considered "worst imaginary pain". The election of choosing one-month prevalence from the Nordic questionnaire was an attempt to overcome recall bias.

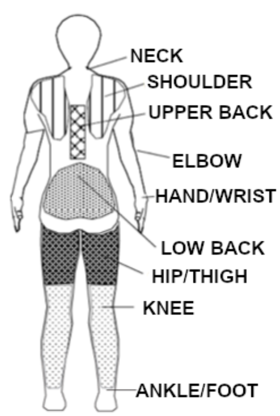

Figure 2. Body diagram highlighted with specific body areas. Extracted from the Nordic Musculoskeletal Questionnaire (Kuorinka et al., 1987).

This questionnaire has shown to have an acceptable validity to be used as a screening tool (Kuorinka et al., 1987), and when compared to clinical examination it has shown sensitivity ranging between 66 and 92%, and specificity between 71 and 88% (Ohlsson et al., 1994). Likewise, it has proven highly predictive in relation to the risk of future long-term sickness absence (Andersen, Clausen, Burr, et al., 2012).

2.5.3. Work ability

Participants' self-reported work ability was measured using the Work Ability Index (WAI). This instrument consists of the following seven categories: 1) Current work ability in comparison to lifetime best, 2) work ability in relation to the physical and mental demands of the job, 3) number of current diseases diagnosed by a physician, 4) estimated work impairment due to diseases, 5) sick leaving during the past year, 6) own prognosis of work ability two years from now, and 7) mental resources. The final score is calculated by summing up the estimated points for each item (J. Ilmarinen, 2007). WAI score ranges from 7 to 49 points, distinguishing four different categories: poor WAI (7-27 points), moderate WAI (28-36), good WAI (37-43) and excellent WAI (44-49 points). The internal validity of this instrument has been previously described, finding a satisfactory relationship between subjective results of the index in comparison with more objective assessments (Eskelinen et al., 1991; Nygård et al., 1991), as well as a satisfactory test-retest reliability (De Zwart et al., 2002).

2.5.4. Leisure-time physical activity

Self-reported level of leisure physical activity was reported according the Global Physical Activity Questionnaire (GPAQ) (Armstrong & Bull, 2006). A categorical score of low, moderate and vigorous leisure physical activity was allocated and re-coded, resulting in a binary variable indicating moderate and vigorous leisure physical activity. Moderate physical activity was defined as "activities that require moderate physical effort and cause small increases in breathing or heart rate", and vigorous physical activity referred to "activities that require hard physical effort and cause large increases in breathing or heart rate". Each of these variables were categorized according to the sum of minutes recommended during a normal week (0, 0-149 min or >150 min of moderate physical activity, or 0, 0-74 or >75 min of vigorous physical activity) (Garber et al., 2011). This questionnaire has shown to be valid and reliable for the measurement of physical activity (Bull et al., 2009).

2.5.5. Strength training during leisure-time

Participants reported their involvement in strength training by answering the following questions: "During a typical week, do you do any physical activity at your leisure time specifically designed to strengthen your muscles, such as weightlifting, elastic-band training, push-ups...?" Those who answered 'yes' were then asked about training frequency and intensity. Frequency was defined as the number of training sessions per week and was categorized in 0; 1-2; or more than 3 times per week. Intensity was defined as the magnitude of the effort while training in reference of their RM, allowing for three possible responses: ≤50% RM; 51-79% RM; or ≥80% RM. These cut-points were stablished according to current general strength training guidelines.

2.6. Statistical analysis

Study I: All statistical analyses were performed using the SAS statistical software for Windows (Proc Logistic, SAS v9.4). Descriptive statistics were used to report the prevalence musculoskeletal pain in the upper body, and demographic characteristics (age, height, weight, sex, education, smoking, alcohol units per week and levels of physical activity). Using binary logistic regression, odds ratios (ORs) and 95% confidence intervals (CI) were calculated for having moderate to high musculoskeletal pain (≥ 3 on a scale of 0-10, reference category: pain 0-2) in different body areas (dependent variables). The independent variables were work-related factors, such as other works, years of experience, sector, type of employment, working hours per week, number of patients per week, treating more patients at the same time, primary type of patients and treatments, adjusting the examination table when needed and work position as mutually adjusted independent variables.

According to a previous study that compared ORs with effect sizes (Cohen's d), ORs of 1.68, 3.47 and 6.71 correspond to small, medium and large effect sizes, respectively (Chen et al., 2010). As we analyzed effects rather than associations, we used the terms 'weak', 'moderate' and 'strong' positive associations for ORs of 1.68, 3.47 and 6.71, respectively. For ORs lower than 1, the reciprocal of the OR should be considered, that is, ORs of 0.60, 0.29 and 0.15 correspond to 'weak', 'moderate' and 'strong' negative associations, respectively.

Study II: All statistical analyses were performed using the SAS statistical software for Windows (Proc Logistic, SAS v9.4). Descriptive statistics were used to report demographic characteristics of the participants, including age, body mass index (BMI), sex, education, smoking, alcohol units per week and pain intensity (≥3 on a scale of 0-10 in the back, neck/shoulders and arm/hand). Using binary logistic regression, odds ratios (ORs) and 95% confidence intervals (CI) were calculated for having low musculoskeletal pain (<3 on a scale of 0-10) in different body areas (dependent variables) in function of the total amount of vigorous leisure physical activity (0, 1-74 and ≥75 minutes per week) and moderate leisure physical activity (0, 1-149 and ≥150 minutes per week) as mutually adjusted independent variables (reference category: 0 minutes per week).

Study III: The odds of having lower level of work ability as a function of pain intensity and multi-site pain were determined using binary logistic regression (Proc Logistic of SAS version 9.4), where the ORs express the odds for having poor to fair work ability (reference: good to excellent work ability). Analyses were performed for the combined WAI score, which includes work ability in relation to the current work ability compared with lifetime best, with work ability in relation to demands of the job, with the number of current diseases diagnosed by a physician, with the estimated work impairment due to diseases, with sick leave during the past year, with own prognosis of work ability two years from now, with mental resources and overall. Odds ratios (ORs) and 95% confidence intervals (95% CI) were calculated with work ability as the dependent variable and the different variables as independent variables. Potential confounders were adjusted into two different models: Model 1 controlled for age and sex; model 2 controlled for age, sex, education, and work-related factors (including years of experience, working hours, setting, type of treatment, number of patients per week and work position).

Study IV: All statistical analyses were performed using the SAS statistical software for Windows (Proc Logistic, SAS v9.4). Descriptive statistics were used to report demographic characteristics of the participants, including age, BMI, sex, education, smoking, alcohol units per week and pain intensity (≥3 on a scale of 0-10 in the back, neck/shoulders and arm/hand). Using binary logistic regression, odds ratios (ORs) and 95% confidence intervals (CI) were calculated for having low levels of musculoskeletal pain (<3 on a scale of 0-10) in different body areas (dependent variables) in function of the frequency (0, 1-2, and more than 3 times per week, respectively) and intensity (≤50% RM, 51-79% RM, and ≥80% RM, respectively) of strength training as mutually adjusted independent variables (reference category: 0 minutes per week for the frequency, and ≤50% for the intensity), after adjusting for confounding factors (sex, education, experience, work-factors).

Results

3. Results

Of the 1006 questionnaires which were returned by registered PTs, 25 questionnaires with missing information on the main study variables were excluded from analysis. Thus, data from the remaining 981 questionnaires were analyzed. Because the findings of this investigation have been divided in four different studies, the *Results* section will be structured accordingly.

Overall, participant characteristics are described in **Table 1**. The study population of PTs had a mean age of 34.3 ± 8.0 years, 29.4% were male and 70.6% were female, whom on average had a BMI of 23.3 ± 3.4 kg/m2.

Table 1. Characteristics of the participants.

	N	Mean	SD	%
Sex				
Men	288			29.4
Women	693			70.6
Education				
Bachelor (3-year)	479			48.8
Bachelor (4-year)	236			24.1
Master	258			26.3
PhD	8			0.8
Smoking				
No	852			86.9
Yes	129			13.2
Age (years)	981	34.3	8.0	
BMI (kg/m^2)	981	23.3	3.4	
Alcohol (units per week)	981	2.2	2.3	

Abbreviations: N= sample size; SD= Standard Deviation; BMI= Body Mass Index; PhD=Doctor of Philosophy

3.1. Work-related factors and musculoskeletal pain (Study I)

The first set of analyses examined the association of work-related factors and musculoskeletal pain. The table below (**Table 2**) shows ORs for having moderate to high musculoskeletal pain (≥3 on a scale of 0-10) in upper body areas (neck, shoulders, upper back, low-back, elbow/forearm and hand/wrist) in relation to different work-related factors. Closer inspection of the table shows that the work-related factors associated with higher risk for having moderate to high pain (≥3 on a scale of 0-10) in upper body areas were "treating more patients at the same time" (low back OR 2.14 [95% CI, 1.53-2.99]), "working more than 45 hours per week" [OR, 1.73 (95% CI, 1.05-2.84)], and "work in a seated position" [OR, 2.04 (95% CI, 1.16-3.57)]. "More years of experience" showed a negative association for elbow pain [OR, 0.41 (95% CI, 0.21 - 0.78)] and low back pain [OR, 0.48 (95% CI, 0.29 - 0.79)] compared to their less experienced counterparts.

Table 2. Odds ratios and 95% CI for having moderate to high pain (≥ 3 on a scale of 0-10) in the different body regions in relation to different work factors.

Question	Response	N	%	Neck OR (95% CI)	Shoulders OR (95% CI)	Upper back OR (95% CI)	Low back OR (95% CI)	Elbow/forearm OR (95% CI)	Hand/wrist OR (95% CI)
Other work	No	896	89.2	1	1	1	1	1	1
	Yes	109	10.9	1.38 (0.87 - 2.18)	1.54 (0.98 - 2.41)	1.00 (0.62 - 1.60)	1.12 (0.72 - 1.74)	0.68 (0.36 - 1.29)	0.76 (0.47 - 1.23)
Experience	0-5 yrs	256	25.5	1	1	1	1	1	1
	6-15 yrs	495	49.3	0.86 (0.58 - 1.27)	**0.62 (0.41 - 0.92)**	1.06 (0.72 - 1.58)	**0.63 (0.43 - 0.93)**	**0.58 (0.35 - 0.94)**	1.15 (0.77 - 1.72)
	> 15 yrs	254	25.3	**0.57 (0.35 - 0.94)**	**0.51 (0.30 - 0.85)**	0.87 (0.52 - 1.46)	**0.48 (0.29 - 0.79)**	**0.41 (0.21 - 0.78)**	0.90 (0.53 - 1.52)
Sector	Public	276	27.5	1	1	1	1	1	1
	Public and private	44	4.4	1.95 (0.91 - 4.17)	**2.80 (1.34 - 5.82)**	1.08 (0.51 - 2.32)	0.94 (0.45 - 1.93)	0.97 (0.39 - 2.44)	1.57 (0.76 - 3.24)
	Private	685	68.2	**1.54 (1.07 - 2.21)**	**1.49 (1.01 - 2.20)**	1.41 (0.97 - 2.06)	1.20 (0.84 - 1.72)	0.83 (0.51 - 1.34)	0.97 (0.66 - 1.43)
Type of employment	Contract	644	64.1	1	1	1	1	1	1
	Self-employed	361	35.9	1.31 (0.92 - 1.84)	1.32 (0.93 - 1.88)	0.97 (0.69 - 1.37)	1.04 (0.74 - 1.45)	1.02 (0.65 - 1.59)	1.41 (0.99 - 2.00)
Working hours per week	< 35	317	31.5	1	1	1	1	1	1
	35-45	568	56.5	0.91 (0.65 - 1.26)	1.24 (0.88 - 1.75)	1.37 (0.98 - 1.93)	1.31 (0.95 - 1.82)	0.81 (0.53 - 1.24)	0.84 (0.60 - 1.18)
	>45	120	11.9	1.37 (0.82 - 2.31)	1.18 (0.70 - 2.00)	**2.10 (1.25 - 3.50)**	**1.73 (1.05 - 2.84)**	1.64 (0.89 - 3.02)	1.31 (0.79 - 2.16)
Number of patients per week	<30	357	35.6	1	1	1	1	1	1
	30-50	319	31.8	1.06 (0.75 - 1.49)	**1.57 (1.09 - 2.25)**	1.05 (0.74 - 1.48)	0.79 (0.56 - 1.11)	1.15 (0.73 - 1.81)	0.94 (0.65 - 1.34)
	>50	328	32.7	1.27 (0.84 - 1.91)	**1.86 (1.21 - 2.86)**	**0.65 (0.42 - 0.98)**	0.70 (0.47 - 1.05)	1.12 (0.66 - 1.90)	1.10 (0.72 - 1.67)
Treating more patients at same time	No	523	52.0	1	1	1	1	1	1
	Yes	482	48.0	1.28 (0.91 - 1.80)	0.84 (0.59 - 1.19)	1.16 (0.82 - 1.63)	**2.14 (1.53 - 2.99)**	1.26 (0.82 - 1.95)	1.19 (0.84 - 1.69)
Primary type of patients	Musculoskeletal	800	79.6	1	1	1	1	1	1
	Neurological	171	17.0	1.09 (0.74 - 1.60)	1.28 (0.86 - 1.91)	1.28 (0.87 - 1.88)	1.29 (0.88 - 1.88)	0.62 (0.35 - 1.08)	0.99 (0.66 - 1.49)
	Other	34	3.4	1.26 (0.57 - 2.77)	1.11 (0.49 - 2.53)	**0.51 (0.19 - 1.33)**	**0.40 (0.17 - 0.94)**	1.43 (0.54 - 3.76)	0.71 (0.29 - 1.75)
Primary type of treatment	Manual therapy	783	77.9	1	1	1	1	1	1
	Physical exercise	176	17.5	**0.66 (0.46 - 0.95)**	1.06 (0.72 - 1.55)	0.97 (0.66 - 1.42)	0.89 (0.62 - 1.28)	0.83 (0.51 - 1.35)	0.73 (0.49 - 1.08)
	Machines	31	3.1	0.95 (0.43 - 2.07)	0.51 (0.19 - 1.41)	**3.02 (1.37 - 6.64)**	0.61 (0.28 - 1.37)	1.04 (0.38 - 2.90)	0.82 (0.35 - 1.94)
	Other	15	1.5	1.82 (0.50 - 6.56)	1.11 (0.33 - 3.72)	1.41 (0.45 - 4.45)	0.96 (0.30 - 3.10)	0.96 (0.19 - 4.87)	**0.36 (0.08 - 1.70)**
Adjusting stretcher when necessary	No	96	9.6	1	1	1	1	1	1
	Yes	909	90.5	1.40 (0.88 - 2.21)	0.69 (0.43 - 1.09)	1.10 (0.68 - 1.77)	0.96 (0.61 - 1.51)	1.35 (0.70 - 2.60)	1.47 (0.89 - 2.43)
Work position	Standing	610	60.7	1	1	1	1	1	1
	Standing and seated	325	32.3	1.10 (0.82 - 1.47)	1.15 (0.85 - 1.56)	0.93 (0.69 - 1.26)	0.78 (0.58 - 1.04)	1.32 (0.90 - 1.92)	0.94 (0.69 - 1.28)
	Seated	70	7.0	1.40 (0.80 - 2.46)	0.90 (0.50 - 1.61)	1.36 (0.78 - 2.35)	**2.04 (1.16 - 3.57)**	1.35 (0.66 - 2.74)	0.99 (0.56 - 1.78)

Abbreviations: N= sample size; CI= Confidence Interval

3.2. Leisure-time physical activity and musculoskeletal pain (Study II)

The odds for having lower intensity of pain in neck-shoulder, arm-hand and back as a function of different durations of moderate and vigorous leisure physical activity are described in **Table 3**. The odds for experiencing lower levels of pain in neck-shoulder were higher in those PTs performing 75 or more minutes of vigorous leisure physical activity per week (OR 1.43; 95% CI: 1.05-1.94), with 0 minutes per week of vigorous physical activity as a reference. However, the analysis did not reveal any significant difference between vigorous leisure physical activity and pain in the arm-hand or back. The odds for having lower levels of pain were not significantly lower in those PTs performing moderate leisure physical activity.

Table 3. Odds ratios (95% confidence intervals) for having a low level of musculoskeletal pain (<3 on a scale of 0-10) in the neck-shoulders, arm-hand and back from different durations of moderate and vigorous physical activity during leisure.

	Min/week	N	%	Neck-shoulder pain OR (95% CI)	Arm-hand pain OR (95% CI)	Back pain OR (95% CI)
Moderate PA	0	256	25.5	1	1	1
	1-149	360	35.8	1.15 (0.80 - 1.66)	1.17 (0.77 - 1.76)	1.13 (0.79 - 1.62)
	150 or more	389	38.7	0.80 (0.56 - 1.15)	1.07 (0.72 - 1.61)	0.98 (0.69 - 1.39)
Vigorous PA	0	409	40.7	1	1	1
	1-74	104	10.4	0.92 (0.57 - 1.48)	0.71 (0.41 - 1.21)	0.72 (0.45 - 1.15)
	75 or more	492	49.0	**1.43 (1.05 - 1.94)**	0.84 (0.59 - 1.19)	1.20 (0.89 - 1.63)

Abbreviations: PA= Physical activity; OR= Odds Ratio; CI= Confidence Interval

3.3. Single- and multi-site pain and work ability (Study III)

Table 4 shows the prevalence of pain intensity categorized into low (<2), moderate (2-5) and high (5-10) levels of self-reported pain in 9 different body regions during the last month.

The most commonly rated painful body part was the neck (36.3%), followed by the low back (32.3%), upper back (21.9%) and hand/wrist (21.6%). One-third of the respondents reported moderate pain intensity in the neck, followed by the low back (25.9%), upper back (22.4%) and hand/wrist (20.9%).

Table 4. Odds ratios (95% confidence intervals) for lower levels of work ability in relation to pain in different body regions.

Body region	Pain intensity (0-10)	N	%	Model 1 OR (95% CI)	Model 2 OR (95% CI)
Neck	Low (<2)	312	31.0	1	1
	Moderate (2-5)	328	32.6	**1.67 (1.00 - 2.79)**	**1.72 (1.01 - 2.94)**
	High (5-10)	365	36.3	**2.43 (1.50 - 3.96)**	**2.59 (1.55 - 4.33)**
Shoulder	Low (<2)	602	59.9	1	1
	Moderate (2-5)	195	19.4	**2.69 (1.71 - 4.23)**	**2.93 (1.81 - 4.73)**
	High (5-10)	208	20.7	**2.66 (1.71 - 4.15)**	**2.96 (1.83 - 4.78)**
Upper back	Low (<2)	560	55.8	1	1
	Moderate (2-5)	224	22.3	**1.65 (1.05 - 2.60)**	**1.70 (1.05 - 2.74)**
	High (5-10)	220	21.9	**1.73 (1.11 - 2.71)**	**1.94 (1.20 - 3.14)**
Elbow/forearm	Low (<2)	780	77.6	1	1
	Moderate (2-5)	133	13.2	1.54 (0.93 - 2.54)	1.50 (0.88 - 2.55)
	High (5-10)	92	9.2	**2.45 (1.45 - 4.15)**	**2.91 (1.63 - 5.20)**
Hand/wrist	Low (<2)	578	57.5	1	1
	Moderate (2-5)	210	20.9	1.33 (0.81 - 2.17)	1.46 (0.87 - 2.47)
	High (5-10)	217	21.6	**2.61 (1.72 - 3.98)**	**2.95 (1.88 - 4.63)**
Hip/leg	Low (<2)	831	82.7	1	1
	Moderate (2-5)	83	8.3	**2.51 (1.44 - 4.37)**	**2.54 (1.41 - 4.58)**
	High (5-10)	91	9.1	**2.68 (1.58 - 4.53)**	**2.62 (1.50 - 4.59)**
Knee	Low (<2)	801	79.7	1	1
	Moderate (2-5)	112	11.1	**2.60 (1.58 - 4.27)**	**2.44 (1.43 - 4.14)**
	High (5-10)	92	9.2	**3.71 (2.22 - 6.20)**	**3.94 (2.27 - 6.83)**
Ankle/feet	Low (<2)	908	90.4	1	1
	Moderate (2-5)	54	5.4	**4.14 (2.24 - 7.68)**	**4.24 (2.19 - 8.20)**
	High (5-10)	43	4.3	**2.58 (1.24 - 5.34)**	**2.51 (1.13 - 5.59)**
Low-back	Low (<2)	420	41.8	1	1
	Moderate (2-5)	260	25.9	**2.27 (1.33 - 3.88)**	**2.29 (1.31 - 4.01)**
	High (5-10)	325	32.3	**4.58 (2.85 - 7.35)**	**4.73 (2.88 - 7.77)**

Model 1: Adjusted for age and sex

Model 2: Adjusted for age, sex, education and work-related factors

Table 5 shows the odds ratio for lower levels of work ability in relation to number of pain sites of at least 5 on a scale of 0-10. The prevalence of high pain intensity in 0, 1-2, 3-4 and >5 body parts were 39.3%, 32.5%, 19.4% and 8.8% respectively. With low pain intensity as reference, a moderate to strong association for lower levels of work ability in PTs who reported pain of >5 in 1-2 body regions was found. This association was stronger when participants reported pain in 3-4 regions and even stronger when pain was experienced in 5 or more sites.

Table 5. Odds ratios (95% confidence intervals) for lower levels of work ability in relation to number of pain sites of at least 5 on a scale of 0-10.

Number of pain sites > 5 on a scale of 0-10	N	%	Model 1 OR (95% CI)	Model 2 OR (95% CI)
0	395	39.3	1	1
1-2	326	32.5	**2.14 (1.27 - 3.60)**	**2.28 (1.33 - 3.90)**
3-4	195	19.4	**4.02 (2.36 - 6.82)**	**4.30 (2.45 - 7.52)**
5 or more	88	8.8	**6.13 (3.31 - 11.38)**	**7.07 (3.63 - 13.75)**

Model 1: Adjusted for age and sex

Model 2: Adjusted for age, sex, education and work-related factors

3.4. Strength training variables and musculoskeletal pain (Study IV)

The OR estimates for experiencing a lower level of pain (<3 on a scale of 0-10) in the neck-shoulders, arm-hand and back as a function of leisure-time strength training frequency and intensity are detailed in **Table 6**. Strong associations for having lower levels of pain in all the studied body areas were found in those PTs who reported performing high intensity strength training (≥80% RM). However, the odds for having lower pain levels were not significantly higher among PTs performing lower intensities (≤50% RM and 51-79% RM) in any body part. As shown in Table 6, the analysis did not show any significant association between strength training frequency and lower levels of pain in any body part.

Table 6. Odds ratios (95% confidence intervals) for having a low level of musculoskeletal pain (<3 on a scale of 0-10) in the neck-shoulders, arm-hand and back from frequency and intensity of strength training.

Strength training frequency	N	%	Neck-shoulder pain OR (95% CI)	Arm-hand pain OR (95% CI)	Back pain OR (95% CI)
$0 \cdot wk^{-1}$	611	61.0	1	1	1
$1\text{-}2 \cdot wk^{-1}$	213	21.3	0.91 (0.65 - 1.27)	0.88 (0.60 - 1.29)	1.09 (0.77 - 1.53)
$\geq 3 \cdot wk^{-1}$	178	17.8	0.97 (0.68 - 1.39)	1.00 (0.66 - 1.52)	1.01 (0.71 - 1.45)
Strength training intensity					
≤ 50%	143	36.7	1	1	1
51-79%	220	56.4	0.95 (0.59 - 1.55)	1.20 (0.70 - 2.09)	0.98 (0.60 - 1.60)
≥80%	27	6.9	**5.08 (1.36 - 18.92)**	**5.22 (1.11 - 24.51)**	**5.22 (1.41 - 19.28)**

Discussion

4. Discussion

The present study was designed to explore the factors associated with musculoskeletal pain among PTs, including those related with work itself (addressed in Study I), physical activity (Studies II and IV), and the association of musculoskeletal pain in multiple sites with the work ability of PTs (Study III).

As an attempt to provide an easy-to-read discussion of the main findings of this study with the scientific literature, this section will be divided in six subsections, addressing each one of the major topics in which the present investigation has been focused on, and two final sections addressing the strengths and limitations, and practical applications.

4.1. Work-related factors and musculoskeletal pain (Study I)

Regarding the first research question, it was found that work-related factors such as the lack of professional experience, working in private clinics, working in a seated position and high workload were associated with higher risk for experiencing musculoskeletal pain among PTs.

These results are consistent with a recent systematic review which suggested that the high prevalence rates of musculoskeletal pain in PTs with fewer years of professional experience could be explained due to the lack of patient management skills and the dearth of practice on reducing the risk of developing musculoskeletal pain (Vieira et al., 2016). As a matter of fact, one previous study (Nyland & Anne, 2003), reported that even undergraduate physiotherapy students have a higher likelihood of developing low back pain during their training, suggesting that new PTs may be entering the workforce with existing low back pain. Other studies suggested that the low prevalence of musculoskeletal pain in older therapists might be related with the development of injury-prevention strategies for coping with the physical demands of their jobs, such as modification of treatment techniques or increasing the use of support staff when required (Bork et al., 1996). The healthy workers effect may also be at play, i.e. therapists who do not adopt preventive strategies may leave the profession earlier or change their job, being a possible explanation of the low prevalence rates of musculoskeletal pain in this age group (Bork et al., 1996). It could be also plausible that less experienced PTs are less familiarized with the physical demands from their workplace while more experienced PTs developed a higher pain threshold due to a higher work volume. Considering these results, future studies should investigate in more detail the age-related aspects of musculoskeletal pain in PTs. It could be speculated that the risk decreases after the first years due to better working routines and practice and that the risk then increases again after many years of exposing the body to physically strenuous working conditions.

The type of treatment seems to play an important role too in the prevalence of musculoskeletal pain in PTs. Our results showed a positive association for having pain when manual therapy is the primary type of treatment. We found that there existed a weak to moderate positive association for having moderate to high pain (≥3 on a scale of 0-10) in the hand/wrist and in the neck, when comparing with other types of primary treatments such as physical exercise, which showed a negative association with neck pain. As reported previously, procedures such as joint mobilization, manual traction and/or orthopedic manual therapy techniques, were associated with pain in the hand/wrist (Bork et al., 1996; Cromie et al., 2000; Grooten et al., 2011). Indeed, Bork et al., 1996 reported that those PTs who habitually performed manual therapy were 3.5 times more prone to have wrist or hand symptoms than those who did not perform such techniques, suggesting that manual therapy techniques could increase mechanical stress on specific anatomical areas, being a major source of upper limb pain (Bork et al., 1996).

The significant association between those who were treating a higher number of patients per week and shoulder pain was not surprising. This could be explained by their primary role in the movement of the upper limbs, and therefore, be more prone to exhaustion after higher workloads. In fact, repetition and monotony have been reported as contributor factors for developing shoulder pain (Buckle & Devereux, 2002). Interestingly, negative associations were found for upper back pain and treating more than 50 patients per week, in comparison to those PTs who treated less patients. Upper back muscles have a stabilizing function, so probably this musculature may be better adapted to higher work demands, and consequently, might play some role as a protective mechanism for musculoskeletal pain. However, associations were weak, so further studies are needed to corroborate this assumption.

PTs who work more hours per week are also at greater risk for low back pain than those who work less. In line with our results, previous investigations have reported a strong relationship between working more hours per week and risk of injury among health professionals (Trinkoff et al., 2003), and more specifically among PTs (Cromie et al., 2000). Accordingly, a previous study found weak to moderate associations between the number of weekly hours performing rehabilitation treatments and an increased risk of musculoskeletal pain in shoulder/elbow, as well as an increased risk in the wrist/thumb for those PTs who work more hours and perform manual treatments (Rozenfeld et al., 2010). However, these results should be interpreted with caution, as different risk factors can coexist in combination with others, and when two or more are present together, it may increase the odds for developing musculoskeletal pain, especially when these professionals have excessive workload, prolonged duration of work, insufficient rest periods or monotonous work without task variations (Yassi, 1997).

Although previous investigations have reported the association between working in public hospitals and a higher prevalence of musculoskeletal pain compared with their non-hospital-based counterparts (Alrowayeh et al., 2010; Bork et al., 1996), the present study found opposite results. PTs who worked in the private sector (i.e., private clinic), compared with those who worked in public hospitals were more likely to report higher levels of musculoskeletal pain, especially in the neck and shoulders. These associations were even more pronounced in those PTs who were working in both public and private sectors. A possible explanation of these findings could be the nature of the physical therapy profession in Spain, as PTs that work in the private sector tend to have longer journeys compared with those who work in public settings, who have a fixed working day length of 7 hours. During this time, they have several breaks, which allows them to move and walk. However, in private settings, working time may be variable, including more hours and less breaks, especially when the salary depends on the volume of treatments. In addition, PTs in private clinics usually have a more limited space than in hospitals, having a lower possibility to move (which can also determine the type of treatment used). According to a previous study (Liao et al., 2016), private physiotherapy clinics may have not adequate equipment and less undergraduate students to undertake primary care. In this sense, alternating work "which allows breaks in otherwise repetitive or maintained activities" is essential in the prevention of such musculoskeletal complaints (Cromie et al., 2000), being a possible explanation for the lower rates of musculoskeletal pain among PTs working in public hospitals.

Our findings suggest that working mainly in a seated position increases the odds for developing MP, especially in the lower back. These results are in concordance with a previous study among a general working population, which reported that these associations could be produced by a possible relation between prolonged sitting and continuous static load on the musculoskeletal system (J. H. Andersen et al., 2007).

4.2. Leisure-time physical activity and musculoskeletal pain (Study II)

To shed some light into the role that leisure-time physical activity has on musculoskeletal pain, we sought to analyze these associations in PTs. The main findings were that ≥75 minutes of vigorous physical activity per week were associated with lower levels of neck and shoulder pain among PTs. However, the same level of vigorous physical activity seemed to not confer the same benefit in the back or in the arm-hand, so our hypothesis was partially confirmed. Moderate physical activity during leisure time did not show any significant association with musculoskeletal pain among PTs.

In our study, the prevalence of pain (intensity >3 on a scale of 0 to 10) in the neck-shoulder and in the back was 43.4% and 42.1% respectively. Similar rates have been previously described among PTs (Vieira et al., 2016) in terms of lifetime prevalence. The physically demanding nature of the PT work could be a possible explanation for these findings, assuming that this may surpass the physical capacity of the worker. Consequently, the association found between vigorous physical activity and musculoskeletal pain would suggest that increasing the total amount of vigorous leisure physical activity might be effective in preventing and/or reducing neck-shoulder pain among PTs. Our results are consistent with previous studies among healthcare professionals, which also found an association between leisure-time physical activity and pain (Barbosa et al., 2013). In that study, participants included physicians, nurses, dentists, occupational therapists and PTs among others, however, the authors did not distinguish between vigorous or moderate physical activity. Nevertheless, these results do not rule out the influence of other factors, as pain is influenced by a multifaceted mesh of many factors that makes its management a challenging task (Hua & Cabot, 2014).

While physical exercise is a recommended treatment for the primary care management of acute and chronic low back pain (Foster et al., 2018), the associations between physical activity and low back pain are characterized by conflicting findings. In line with our results, two previous systematic reviews could not establish a relationship between physical activity and non-specific low back pain outcome measures (Hendrick et al., 2011; Sitthipornvorakul et al., 2011). This apparent lack of association could be attributed to the multifactorial nature of low back pain. By contrast, a recent systematic review concluded that leisure time physical activity may have a modest protective effect reducing the risk of developing low back pain by 11% to 16% (Shiri & Falah-hassani, 2017). These rather contradictory results may be due to the heterogeneity and limitations of the original studies, however, the role of leisure-time physical activity in low back pain in working population still remains unclear.

According to the physical activity guidelines for adults by the World Health Organization, adults should do at least 150 minutes of moderate physical activity per week, or 75 minutes of vigorous intensity physical activity, or an equivalent combination of both types of physical activity (World Health Organization, 2010). Greater amounts of physical activity may provide additional benefits. Contrariwise, over 25% of those surveyed reported not to perform any moderate physical activity on a weekly basis, and almost 40% reported not to do any vigorous physical activity during leisure time. However, these results should be interpreted carefully, as subjects with pain tend to underestimate their self-reported physical activity levels (Vollenbroek-Hutten & Hermens, 2011), and also may could have been influenced by the recall bias. Still, these rates might alert us that physical activity does not receive enough attention among PTs.

The relation of physical training on musculoskeletal pain can be also inferred from randomized controlled trials investigating physical activity interventions among working populations. In this regard, several attempts have been made to find the optimal dose and type of exercise to obtain clinically relevant benefits in musculoskeletal pain levels among workers. While some studies have not found better improvements of exercise interventions in neck pain compared with ordinary activity (Viljanen et al., 2003), others have reported significant reductions of musculoskeletal pain using different modalities of exercise. Particularly, strength training focused on the affected body areas, has shown to be effective in reducing neck and shoulder pain among workers of different settings. For instance, 20 weeks of high intensity strength training at the workplace showed to be effective in reducing neck and shoulder pain among laboratory technicians (Zebis et al., 2011). Shorter interventions have also found similar results, for example, 10 weeks of high intensity strength training at the workplace compared with a home-based program showed positive effects reducing musculoskeletal pain and weekly intake of analgesics among female healthcare workers (Jakobsen et al., 2015). Common for these studies is that the exercise was performed vigorously, i.e. with high intensity. Combined with the results of the present study this suggests that physical exercise or activities should preferably be performed vigorously to have a major positive influence on musculoskeletal pain.

4.3. Single-and multi-site pain and work ability (Study III)

The intensity of pain in different body areas was found to be associated with lower work ability among actively working PTs. Likewise, a strong dose-response association was evident between number of pain sites and lower work ability. Interestingly, low-back pain was not only one of the most prevalent body areas affected with musculoskeletal pain, but also was strongly associated with lower levels of work ability. Participants who reported high levels of low-back pain, had more than four times increased risk for lower levels of work ability compared to those who rated their pain intensity with scores <2.

Pain in the hands or in any other part of the upper extremity may significantly affect the work ability of PTs, as manual techniques in one way or another are an inherent part of the physical therapy profession. However, one unanticipated finding was that only high pain intensity – and not moderate - in the elbow/forearm and hand/wrist was associated with lower levels of work ability. One possible explanation would be that PTs develop coping strategies to continue working despite the presence of moderate pain, by performing other techniques in which the upper extremity might not be involved, or using protective measures such as thumb splints, mobilization wedges or soft tissue devices (Campo et al., 2008). Therefore, a decrease of manual therapy techniques would explain the reduction in the risk for wrist and hand disorders. Accordingly, the results of our study suggest that most of those PTs who had moderate pain in their hands/wrists or elbows, might not perform manual therapy techniques as frequently as those who reported high pain intensity. Consequently, they do not present a significant risk for lower levels of work ability, compared with their manual therapists' counterparts.

In line with our findings, the literature seems to be consistent with the presence of musculoskeletal pain and its negative impact on work ability. For instance, a previous study revealed that both musculoskeletal pain and increased stress are independently associated with lower work ability in another occupation also relying on upper-extremity work during large parts of the working day, namely female laboratory technicians (Jay et al., 2015). As the WAI includes 7 different categories, it could be suggested that its second and seventh subscale (work ability in relation to the physical and mental demands of the job, and mental resources) could be lower in those PTs with high workload or those who are treating more patients per week, resulting in higher levels of pain through, for example, an increased muscle tension. One of the issues that emerges from this assumption is if the presence of pain is what leads to lower work ability, or if having lower work ability increases the odds for having musculoskeletal pain. However, previous studies suggest that the directional nature is from pain to work ability and not vice versa (Lindegård et al., 2014; Miranda et al., 2010).

Furthermore, other authors found that workers who reported having pain in two or more sites had lower levels of health-related functioning compared to those who only reported having pain in one site (Kamaleri et al., 2008; Saastamoinen et al., 2006). Our study demonstrated that multi-site pain in PTs has a strong association with lower levels of work ability. In those PTs who presented high pain intensity in 1-2 regions, the odds for lowering levels of work ability was more than twice, compared to those with low pain intensity. When the number of pain sites was 3-4, the risk was more than 4 times as high, and in those PTs with pain in 5 or more body sites, the risk was 6 times higher after adjustment for age and sex, and more than 7 times higher when adjusted for age, sex, education and work-related factors.

Unfortunately, the majority of literature investigating multi-site pain as a predictor of poor work ability used workers of the general working population (Miranda et al., 2010; Neupane et al., 2011). Because physical and psychosocial exposures vary largely between job groups, performing analyses on specific occupations is necessary. Among the few studies that included health care professionals, only one study included PTs; albeit only representing 5.1% of the total number of participants (Phongamwong & Deema, 2015). In the aforementioned study, authors found that the probability of developing poor work ability was 3 times higher when participants experienced multiple pain sites vs. no pain.

Experiencing multiple pain sites has shown to predict early disability retirement (Haukka et al., 2015) , and has a strong association with the risk of long-term work disability as well as with a declining psychological health, educational levels and sleep quality (Kamaleri et al., 2008). However, the underlying mechanisms behind these associations are not yet established.

In this regard, autoimmune rheumatic diseases (e.g. rheumatoid arthritis, systemic lupus erythematosus, scleroderma or systemic vasculitides) among others, can manifest muscle symptoms as generalized myalgia (Goldblatt & O'Neill, 2013), which could partially explain the high prevalence rates of multi-site pain and the associations found with lower levels of work ability. However, taking aside specific cases of actual pathology, other variables might be considered to understand the implications that multi-site pain have in PTs.

For instance, the results of the World Mental Health Surveys, a study which involved 17 countries and included more than 85,000 participants, showed noteworthy differences in the prevalence rates of chronic back and neck pain, ranging from 9.7% and 42.1%. These differences are too wide to be justified by mechanical stress, suggesting that other factors such as mental disorders (e.g. depression or anxiety) could play an important role (Demyttenaere et al., 2007). However, the aforementioned study only analyzed chronic pain conditions, and its cross-sectional nature cannot determine if the presence of mental disorders is a cause or a consequence for experiencing pain. A previous study found that psychological distress and psychosocial factors such as job demands, poor support from colleagues and work dissatisfaction, do predict future reported pain in cohorts of newly employed workers (Nahit et al., 2003). Furthermore, a longitudinal study of Spanish nurses and office workers found that poor mental health and somatising tendency predicted the incidence of low-back pain (Vargas-Prada et al., 2013). Other occupational groups from Spain (i.e. podiatrists) have also showed a significant prevalence of musculoskeletal pain in the low-back, upper back and neck during the previous 7 days (33.02%, 21.85% and 21.62% respectively) (Losa et al., 2011). The authors of this study found that younger age groups, women and married podiatrists had higher prevalence of musculoskeletal pain, suggesting that individual factors might play an important role in these rates too. However, it still remains poorly understood their role in the onset and maintenance of musculoskeletal pain among PTs.

Another possible explanation might be related with how healthcare professionals, and particularly PTs, understand pain. Consistent evidence regarding the harmful influence of negative perceptions and beliefs about pain is present in the literature (Bishop et al., 2008; Casey et al., 2008). Misperceptions about pain are common among health care practitioners, including PTs (Bishop et al., 2008; Buchbinder et al., 2009). This raises concerns for the potential risk that their own profession produces on themselves, as the confluence of previously reported misperceptions found among PTs, such as anatomic/structural vulnerability or conferring more importance on the tissue damage than in the level of pain or functional disability, might trigger an unfortunate cycle of pain and negative beliefs that aggravate pain, which would lead to undesirable consequences on different spheres of life, including work. However, further research is needed to corroborate these assumptions.

For this reason, more effective approaches are substantially needed to prevent and manage pain in order to maintain a healthy workforce, to lower the burden of pain among specific subgroups and to enable the working population to maintain high levels of work ability throughout their work life.

4.4. Strength training variables and musculoskeletal pain (Study IV)

High intensity strength training (≥80% RM) showed to be strongly associated with lower levels of musculoskeletal pain in neck-shoulder, arm-hand and back among PTs. However, the number of sessions of strength training per week (frequency) and lower intensities were not significantly associated with pain in any body part.

Overall, current evidence recognize that high intensities in strength training are more effective than low intensities to improve muscle strength (Schoenfeld et al., 2015), neural adaptations (Jenkins et al., 2017), and seem to be more effective in the treatment of chronic musculoskeletal disorders (Lars L. Andersen et al., 2014; Ciolac & Rodrigues-da-Silva, 2016; Kristensen & Franklyn-Miller, 2012; Sveaas et al., 2019). Because PTs with higher workload (i.e. working more than 45 hours per week, or treating more patients at the same time) have increased risk for developing musculoskeletal pain (Ezzatvar et al., 2020), those performing high intensity muscle strengthening activities during leisure-time may be better prepared to face the inherent physical challenges of their profession, likely decreasing the relative exposure during strenuous work activities. This could, in turn, reduce work-related disorders and musculoskeletal pain. Supporting this assumption, previous studies using workplace interventions in other occupational groups have reported comparable results. For instance, 20 weeks of high intensity strength training at the workplace reduced neck and shoulder pain among laboratory technicians (Jay et al., 2015), and reduced neck/shoulder pain and headache among office workers (Gram et al., 2014).

Interestingly, our analysis did not reveal any association between frequency and musculoskeletal pain, so our hypothesis is partially confirmed. Thus, strength training frequency might not be determinant for achieving pain reductions, whereas other parameters like intensity or volume may play a more important role. In fact, it could be plausible that under intensity and volume-equated conditions, higher frequencies would help avoid the accumulation of fatigue within training sessions, which would consequently contribute to reduce musculoskeletal pain. However, the lack of associations of our results are consistent with previous research. For example, a previous study compared three different strength training programs among office workers with neck and shoulder pain, finding that 1 hour per week of specific strength training was enough to produce reductions in neck pain in spite of the time combination (1 session of 60 min; 3 sessions of 20 minutes; and 9 sessions of 7 minutes, respectively) (C. H. Andersen, Andersen, Gram, et al., 2012). Moreover, in a recent study among resistance-trained men, no hypertrophy or muscular endurance differences were found between training 3 and 6 times per week when volume was equated (Saric et al., 2019). In the same vein, a recent systematic review with meta-analysis found no differences on muscle strength gains after different volume-equated strength training frequencies (Grgic et al., 2018).

Evidence supports the notion that exercise is protective for numerous health disorders through multiple pathways (Fiuza-Luces et al., 2018). However, the biological mechanisms by which strength training can reduce musculoskeletal pain remain poorly understood. Previous studies have suggested that increased muscle strength could reduce the relative workload during daily activities (Lars L. Andersen et al., 2008), correct movement patterns (Gross et al., 2012), and it could also be influenced by the additional supply of oxygen rich blood to the region being trained (O'Riordan et al., 2014). Other suggested mechanism is the increase in circulating blood levels of endocannabinoids and the activation of the endogenous opioid system during exercise, leading to exercise-induced hypoalgesia, which is the typical response to an acute bout of exercise (including aerobic and resistance exercise) in healthy pain-free subjects (Rice et al., 2019). In addition, inflammation has been associated with the development and persistence of various pathological pain states (Watkins et al., 2003). Therefore, the anti-inflammatory response of strength training might have influenced the lower levels of musculoskeletal pain in our study population. It has been shown that among young adults, protocols using high intensities have a more favorable response in low-grade inflammation than low intensities, for example, by reducing C-reactive protein or Interleukine-6 (Calle & Fernandez, 2010). Besides the potential effect in reducing musculoskeletal pain, strength training interventions may also have the ability to elicit additional benefits in terms of mental and physical health. Thus, a dual effect is realized for PTs performing strength training activities, including improved quality of life and cognitive function (Kimura et al., 2010), which from a biopsychosocial standpoint, may contribute to address more potential risk factors associated with musculoskeletal pain.

There are inherent challenges in defining the optimal dose for reducing and/or preventing musculoskeletal pain among specific occupational groups. Foremost, it is difficult to separate the impact of one training variable from the others. However, based on our results, promotion of strength training to reduce musculoskeletal pain should emphasize the use of high intensities, while frequency seems less relevant. Despite the optimal training intensity for targeting musculoskeletal pain has yet to be determined, it seems that to obtain health benefits in terms of reduction of pain, strength training has to be of sufficient intensity to cause adaptive changes in the neuromuscular system. Supporting this assumption, our results suggest that the most beneficial intensity of strength training to target musculoskeletal pain among PTs in arm-hand, shoulder-neck and back is ≥80% 1RM. Besides this, the previous physical fitness level of a subject can drastically determine the physiological response of strength training. For instance, greater and faster neural adaptations (e.g., motor unit recruiting and firing patterns) can be expected in untrained subjects (Gabriel et al., 2006) as well as longer elevated protein synthesis (Damas et al., 2015; Phillips et al., 1997). It could be hypothesized that these differences in muscle adaptations could also affect the potential for achieving musculoskeletal pain reductions, but new studies are needed to confirm it. Thus, general recommendations may serve as a guide, but because of the considerable interindividual variability in muscle strength responses, individualization might be imperative in order to achieve optimal results.

As stated previously, it can be challenging to ascertain the optimal dose of strength training to reduce musculoskeletal pain among a working population, while still aligning with their work demands. However, it is feasible by studying the habits of specific occupational groups.

4.5. Strengths and limitations

Having discussed our main findings in context with the current literature, the final part of this section addresses a critical appraisal of the findings of this research, considering its strengths and limitations.

A strength of this investigation is that the analyses were controlled for different confounding factors that might influence the results (e.g., age, sex, work-related factors and education). Moreover, by limiting the study population to only PTs who were actively working, we reduced the influence of confounding variables that might have resulted in a bias for our study, such as socioeconomic or education factors.

On the other hand, the main limitation of the present study is its cross-sectional design, as it cannot determine causality because the exposure and outcome are simultaneously assessed.

Secondly, the exact number of invited participants was unknown, so we could therefore not perform a non-response analysis. This was because in Spain, PTs need to be registered in a professional association in order to be able to work. However, each autonomous community of Spain (there are 17 autonomous communities in our country) has its own professional association of PTs. For this reason, we had to contact to different associations in order to invite their members to participate in our study. This was a limitation for the calculation of the response rate, as not all the associations collaborated with us in the invitation to their members, and some of them added the link to the questionnaire and the cover letter in a newsletter, being difficult to calculate the exact number of PTs who actually received the invitation. Furthermore, the participants included in this study were exclusively from the Spanish workforce, which could additionally limit the generalization of our results.

In addition, those PTs severely affected by musculoskeletal pain may not have been actively working during the investigation, and consequently, excluded from the study, thereby leaving behind a relatively healthy workforce—also known as the healthy worker effect, which could limit the generalization of our results.

Besides, because the questionnaire was online, younger participants might have been more disposed to participate as they tend to spend more time online than their older counterparts, and therefore, it could have limited the generalization of our results.

Another limitation was that the data used in this investigation were extracted from PTs' self-reported experience. Even though we used validated and reliable questionnaires, the responses were based on subjective findings. For instance, the physical activity measurement was self-reported, so the total amount of physical activity could have been underestimated or overestimated by the social desirability or overcall bias. However, the questionnaire used facilitates its administration to a large number of subjects. Regardless, despite the inherent biases of self-reported questions, self-rates of work ability are less prone to the effect of existing social benefits and thus more appropriate for cross-study comparisons, in contrast to sick leave or disability pension data extracted from official sources, which tend to be tied to the current social security systems used by specific countries or employers. Additionally, as we reported frequency as the number of training days per week, those participants who trained more than once a day may have been represented inadequately. Nevertheless, results should be interpreted with caution.

4.6. Practical applications

Notwithstanding these limitations, the present investigation suggests that due to the noteworthy risk for developing musculoskeletal pain in this population, preventive strategies are needed to reduce musculoskeletal disorders and to ensure a better working life. Overall, and in line with our findings, having an appropriate level of physical fitness is considered the most reported current strategy used by healthcare workers to enable them to continue working. In fact, in workers with physically demanding jobs, high-intensity physical activity during leisure-time is associated in a dose-response manner with work ability (Calatayud et al., 2015). Thus, increasing the levels of physical activity during leisure could be an interesting approach to achieve this goal. However, promoting just a more physically active lifestyle and following current general physical activity recommendations might be an oversimplified recommendation, and still seems not be enough for reducing the high rates of musculoskeletal pain among this occupational group. Additionally, performing physical activity during leisure depends on different factors, such as having leisure time, access to activity spaces, cultural and individual factors, among others.

Therefore, implementing workplace interventions could be an effective strategy to enhance physical activity levels among PTs and therefore, to reduce musculoskeletal pain. A systematic review found strong evidence for the positive effect of workplace programs on physical activity and musculoskeletal pain (Proper et al., 2003). From a biopsychosocial perspective, including psychological, biological, cognitive, affective, behavioral and social factors in the variability in the experience of pain between individuals, workplace interventions could potentially provide physiological benefits, but also positive effects on well-being and on socializing with colleagues, which would in turn, contribute to address more potential factors involved in musculoskeletal pain.

For example, as performing high intensity strength training during leisure-time has showed to be strongly associated with lower levels of musculoskeletal pain, specialists should provide guidance on the most favorable intensity of muscle strengthening activities and encourage its practice for preventing and reducing musculoskeletal pain among workers with physically demanding tasks such as PTs. However, since evidence showing that one form of exercise is better than another is not available, recommendations should focus on programs that take individual needs, preferences and capabilities into account in deciding about the type of exercise, relying on evidentiary support. Although no interventions have been conducted targeting muscle strengthening to reduce musculoskeletal pain among PTs, previous studies in other occupational groups support the possibility of successfully intervening in PTs, thereby opening an avenue for future research. Future experimental studies should corroborate the effect of specific physical exercise on musculoskeletal pain in PTs.

CONCLUSIONS

5. Conclusions

Study I: The lack of professional experience, working in private clinics, treating more patients at the same time, working in a seated position, treating more than 30 patients per week, and working more than 45 hour per week were associated with musculoskeletal pain among PTs, especially in specific body areas such as the low back, the shoulders or the neck. The results of this study might be considered for developing clinical guidelines and to develop effective interventions to prevent work-related musculoskeletal pain and better working conditions among PTs.

Study II: Performing 75 or more minutes of vigorous physical activity per week is positively associated with having a lower level of musculoskeletal pain in neck and shoulders among PTs. In contrast, neither vigorous nor moderate physical activity are associated with musculoskeletal pain in arm-hand and back.

Study III: The present study shows that after controlling for potential confounders, the presence of musculoskeletal pain, especially when it occurs at more than one site simultaneously, is strongly associated with lower levels of work ability among PTs. Further research is needed to have a better understanding of the underlying mechanisms involved in the onset and maintenance of pain in this occupational group, as well as the role of coping, social support or psychosocial factors in the work ability of PTs. This would help to design more effective interventions to improve levels of work ability among PTs and to ensure a longer and better working life.

Study IV: Performing high intensity strength training (≥80% RM) during leisure-time is strongly associated with lower levels of musculoskeletal pain in arm-hand, neck-shoulder and back. However, neither frequency nor lower intensities showed associations with musculoskeletal pain in any body part. These findings should provide guidance on the most favorable intensity of muscle strengthening activities and encourage its practice for preventing and reducing musculoskeletal pain among workers with physically demanding tasks such as PTs.

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APPENDIX

VNIVERSITAT
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Vicerectorat
d'Investigació

D. José María Montiel Company, Profesor Contratado Doctor Interino del departamento de Estomatología, y Secretario del Comité Ético de Investigación en Humanos de la Comisión de Ética en Investigación Experimental de la Universitat de València,

CERTIFICA:

Que el Comité Ético de Investigación en Humanos, en la reunión celebrada el día 5 de julio de 2018, una vez estudiado el proyecto de tesis doctoral titulado:
"Salud laboral en fisioterapeutas", número de procedimiento H1530736596718,
cuya responsable es Dña. Yasmin Ezzatvar de Llago, dirigida por D. José Casaña Granell,
ha acordado informar favorablemente el mismo dado que se respetan los principios fundamentales establecidos en la Declaración de Helsinki, en el Convenio del Consejo de Europa relativo a los derechos humanos y cumple los requisitos establecidos en la legislación española en el ámbito de la investigación biomédica, la protección de datos de carácter personal y la bioética.

Y para que conste, se firma el presente certificado en Valencia, a nueve de julio de dos mil dieciocho.

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ORIGINAL ARTICLE

Professional experience, work setting, work posture and workload influence the risk for musculoskeletal pain among physical therapists: a cross-sectional study

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Abstract

Purpose Physical therapists (PTs) have a high risk of developing musculoskeletal pain (MP) due to the physically demanding nature of their work tasks. Experience or the specialty area, have been associated with MP, however, previous studies are few and small. The aim of this study was to investigate the association between work-related factors and MP among PTs.
Methods In this cross-sectional study, we collected information about MP and work-related factors of 1006 PTs using an online questionnaire. Associations between various work-related factors and MP were modelled using logistic regression controlled for various confounders.
Results Neck (57%) and low back pain (49%) were most common. Work-related factors associated with higher risk for having moderate-to-high MP (≥ 3 on a scale of 0–10) were "treating more patients at the same time" [OR 2.14 (95% CI 1.53–2.99)], "working ≥45 h per week" [OR 1.73 (95% CI 1.05–2.84)], and "work in a seated position" [OR 2.04 (95% CI 1.16–3.57)] for the low back. "More years of experience" showed a negative association for elbow pain [OR 0.41 (95% CI 0.21–0.78)] and low back pain [OR 0.48 (95% CI 0.29–0.79)] compared with their less experienced counterparts.
Conclusions The lack of professional experience, working in private clinics, working in a seated position and high workload are associated with the higher risk for MP among PTs. These results add further insight about the relevance of such factors, which might be considered for developing effective interventions to prevent work-related MP and better working conditions among PTs.

Keywords Musculoskeletal · Health care workers · Physical work · Workload

Introduction

Work-related musculoskeletal disorders (WRMDs) are defined as a variety of conditions which can affect the musculoskeletal system and occur in relation to work-related activities (Luttmann et al. 2003). These disabling yet in many cases preventable conditions are a common source of musculoskeletal pain (MP) and workplace absenteeism (Luger et al. 2017), and negatively impact the quality of life, which can lead to a decrease in productivity and associated healthcare costs for workers, employers and healthcare professionals (Bhattacharya 2014).

MP is common among the healthcare workforce, where physical therapists (PTs) are especially at high risk. Actually, according to a recent systematic review, lifetime prevalence of MP in PTs ranged between 53 and 91%, with the low back being the most commonly affected body area, followed by the neck, thumbs, upper back and shoulders (Vieira et al. 2016).

Despite the multifactorial and complex nature of pain (Brodal 2017; Ji et al. 2018), these rates seem to be associated to the physically demanding nature of their work tasks and the exposition to multiple factors (Mansfield et al.

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2018). Indeed, some of these factors are related to the work environment, such as sustained and awkward postures, bending, carrying, repositioning or lifting patients (Devreux et al. 2012). However, the physical and mental demands of this profession can be variable depending on the setting, the specialty, the working position, or the quantity of work (e.g., number of patients and total working hours).

Accordingly, different authors have reported that those therapists who perform manual techniques and treat a large number of patients per day are more prone to be affected by MP in the thumbs, hands or wrists (Caragianis 2002; McMahon et al. 2006; Power and Fleming 2007), whereas other body areas seem to be more commonly affected in other settings. For example, a previous study showed that those working in hospital settings rather than in private clinics were more likely to develop MP, especially in body areas such as the lower back (Bork et al. 1996), as the level of physical dependence of the hospital patients is usually superior than those who attend to private clinics.

Albeit several epidemiological studies have described some work-related factors such as years of working experience, number of patients per week, or the total working hours as contributors of MP (Adegoke et al. 2008; Rozenfeld et al. 2010), few studies have been conducted with the aim of evaluating which of these factors are associated with higher risk for having MP among PTs. Therefore, a better understanding of these specific work-related risk factors is needed. Such knowledge could be used to highlight work-related risk factors that need further attention and to develop effective interventions adequately targeted, for improving working conditions and preventing musculoskeletal disorders among PTs. This could potentially contribute to a longer and healthier working life of this part of the workforce.

Thus, the aim of the present study was to investigate the association between work-related factors and MP in the back, neck and upper extremities among PTs. We hypothesized that work-related factors such as not having enough professional experience, working in public hospital settings, and treating a higher number of patients per week could increase the odds for MP among PTs.

Methods

This cross-sectional study collected data on MP and work-related factors from an online questionnaire sent to PTs in Spain. Potential participants for this study included practicing PTs who were registered in the professional association of PTs of different communities across Spain. Those participants who were retired or were not actively working at the time of the investigation were excluded. The present study was approved by the University of Valencia's Ethical Committee (H1530736596718), in accordance with the principles of the Helsinki Declaration. To ensure comprehensive reporting of the data of this cross-sectional study, the STROBE guidelines were followed (von Elm et al. 2007). The data collection was conducted from January to June 2017.

Procedures

The researchers contacted the main professional associations of PTs of different communities in Spain to ask for permission to invite their members to participate on a voluntary basis. The members received the invitation letter along with the project description via e-mail along with a link to the online questionnaire. By responding to the questionnaire each participant was giving consent to participate in the study and permission for the results to be published. The name and contact information of the researchers were included in the cover letter for solving any doubt or concern of the eligible participants before deciding to participate. The online questionnaire took about 20 min to complete. One month following the original e-mail, a reminder was sent to everyone inviting the PTs to participate if they had not done so previously. Due to the recruiting procedure, the exact number of invited participants was unknown.

Questionnaire content

The questionnaire was designed to collect information about self-reported MP and work-related factors among PTs. Preliminary questions were based on published instruments previously used (Bork et al. 1996; Salik and Özcan 2004; Nordin et al. 2011). To assess the content validity and question clarity of the questionnaire, ten PTs from academic, hospital and private-office settings, reviewed each question and pilot tested the survey. Their feedback was taken into consideration, and some items were reformulated by the researchers to ensure that each question was clear and easy to respond to. Once the questions were reviewed and amended, an online questionnaire was created using the online-tool Google Forms (Google Inc., Mountain View, CA, USA) to collect all responses and storage of the data. Due to data privacy reasons the setting of the survey system was set to "anonymous", i.e. it was not possible to link the individual responses to neither individual emails nor IP-addresses of the participants.

Sample size

According to an online tool (https://www.surveymonkey.com) and considering the estimated number of PTs in our country (i.e., 54,258) and in Europe (i.e., 554,000), a sample size of 783 was appropriate to have a confident level of 95% and a margin of error of 3.5%.

Demographic, lifestyle and work-related questions

The first section of the questionnaire consisted of closed-ended questions about participants demographics, lifestyle and work-related information. Participants provided data about their age, gender, height, weight, alcohol consumption, smoking habits, education and leisure physical activity. Work-related questions comprised years of professional experience, working hours per week in the main physical therapy job, number of patients treated per week, if they treated more than one patient at the same time, primary type of patients, primary type of treatment, if they adjusted the examination table when necessary, work position and practice setting of the main physical therapy job.

Musculoskeletal pain questions

The second section included modified questions from the Nordic Musculoskeletal Questionnaire (Kuorinka et al. 1987) to report the prevalence and severity of MP in the upper extremities and the trunk during the last month. Using a simple body diagram highlighted with specific body areas (neck, shoulders, upper back, low back, elbow/forearm and hand/wrist), subjects reported the presence of MP responding the question "Have you had pain or discomfort during the last month in your [body area]?" with options to answer 'yes' or 'no'. When the answer was 'yes', they were asked to rate pain intensity using a 0–10 analogue scale, where 0 meant "no pain at all" and 10 was considered "pain is as bad as it could possibly be". The Nordic Musculoskeletal Questionnaire has been reported to be a valid screening tool (Kuorinka et al. 1987), with sensitivity ranging between 66 and 92%, and specificity between 71 and 88% (Ohlsson et al. 1994).

Statistical analysis

All statistical analyses were performed using the SAS statistical software for Windows (Proc Logistic, SAS v9.4). Descriptive statistics were used to report the prevalence MP in the upper body, and demographic characteristics (age, height, weight, gender, education, smoking, alcohol units per week and levels of physical activity). Using binary logistic regression, odds ratios (ORs) and 95% confidence intervals (CI) were calculated for having moderate to high MP (≥ 3 on a scale of 0–10, reference category: MP 0–2) in different body areas (dependent variables). The independent variables were work-related factors, such as other works, years of experience, sector, type of employment, working hours per week, number of patients per week, treating more patients at the same time, primary type of patients and treatments, adjusting the examination table when needed and work position as mutually adjusted independent variables.

According to a previous study that compared ORs with effect sizes (Cohen's *d*), ORs of 1.68, 3.47 and 6.71 correspond to small, medium and large effect sizes, respectively (Chen et al. 2010). As we analyzed effects rather than associations, we used the terms 'weak', 'moderate' and 'strong' positive associations for ORs of 1.68, 3.47 and 6.71, respectively. For ORs lower than 1, the reciprocal of the OR should be considered, that is, ORs of 0.60, 0.29 and 0.15 correspond to 'weak', 'moderate' and 'strong' negative associations, respectively.

Results

Of the 1006 questionnaires which were returned by registered PTs, 25 questionnaires with missing information on self-reported pain or on work-related factors were excluded from the analysis. Thus, data from the remaining 981 questionnaires were analyzed.

Participant characteristics are described in Table 1. The study population of PTs had a mean age of 34.3 ± 8.0 years, 29.4% were male and 70.6% were female, whom on average had a BMI of 23.3 ± 3.4 kg/m^2. The prevalence of MP (≥ 3 on a scale of 0–10) in the upper body areas is also shown in Table 1. Neck pain was the most commonly reported MP

Table 1 Demographics, lifestyle and pain intensity

	N	Mean	SD	%
Gender				
Men	288			29.4
Women	693			70.6
Education				
Bachelor (3-year)	479			48.8
Bachelor (4-year)	236			24.1
Master	258			26.3
PhD	8			0.8
Smoking				
No	852			86.9
Yes	129			13.2
Age (years)	981	34.3	8.0	
BMI (kg.m/2)	981	23.3	3.4	
Alcohol (units per week)	981	2.2	2.3	
Vigorous physical activity (min/week)	981	81	207	
Moderate physical activity (min/week)	981	301	445	
Pain intensity (0–10 mean SD and % ≥ 3)				
Neck	981	3.4	2.7	57.0
Shoulders	981	1.9	2.5	33.8
Upper back	980	2.1	2.6	36.1
Low back	981	3.0	2.8	49.4
Elbow/forearm	981	1.0	2.0	16.7
Hand/wrist	981	2.1	2.6	32.7

(57.0% of the participants reported to have experienced this symptom during the last month), followed by low-back pain (49.4%), upper-back pain (36.1%) and shoulder pain (33.8%).

Table 2 shows ORs for having moderate to high MP (≥ 3 on a scale of 0–10) in upper body areas (neck, shoulders, upper back, low-back, elbow/forearm and hand/wrist) in relation to different work-related factors. Of all the factors of the present study, those which presented higher risk for having low back pain were "treating more patients at the same time", "working more than 45 h per week" and "work in a seated position".

With the public sector as a reference, the private sector indicated a positive weak to moderate association with neck and shoulder pain. For the therapists that were working both in the public and private sector, there was a stronger positive association with pain in the shoulders, being still a weak to moderate association.

Working more than 45 h per week showed a positive association with upper back and low back pain, considering less than 35 h per week as reference. These associations were weak to moderate. For the number of patients per week, there was a weak to moderate positive association between "30 and 50 patients per week" and "more than 50 patients per week", and shoulder pain, in comparison to "less than 30 patients per week".

For the years of experience, with 0–5 years of work experience as reference, years that ranged between 6 and 15 years, were negatively associated (lower odds) with shoulders, low back and elbow/forearm pain. In PTs with more than 15 years of experience, there were negative weak to moderate associations with the aforementioned body areas, and neck pain, respectively.

PTs who use physical exercise as the primary type of treatment tend to have lower rates of neck pain compared with those who use manual therapy. In contrast, when the main type of treatment is the use of machines, PTs consistently report higher rates of upper back pain.

However, for other work-related factors like the type of employment, adjusting the stretcher when necessary or having more jobs, the association appeared to be less pronounced.

Discussion

The main findings of the present study suggest that several work-related factors are associated with MP among PTs. Partially supporting our hypothesis, the lack of professional experience was associated with upper limb, and low back pain and working in private clinics showed associations with neck and shoulder pain. Treating more patients at the same time and working in a seated position was associated with low back pain, treating more than 30 patients per week with shoulder pain, and working more than 45 h per week showed associations with both upper and low back pain.

These results are consistent with a recent systematic review which suggested that the high prevalence rates of MP in PTs with fewer years of professional experience could be explained due to the lack of patient management skills and the dearth of practice about how to reduce the risk of developing MP (Vieira et al. 2016). As a matter of fact, one previous study (Nyland and Anne 2003), reported that even undergraduate physiotherapy students have a higher likelihood of developing low back pain during their training, suggesting that new PTs may be entering the workforce with existing low back pain. Other studies suggested that the low prevalence of MP in older therapists might be related with the development of injury-prevention strategies for coping with the physical demands of their jobs, such as modification of treatment techniques or increasing the use of support staff when required (Bork et al. 1996). The healthy workers effect may also be at play, i.e. therapists who do not adopt preventive strategies may leave the profession earlier or change their job, being a possible explanation of the low prevalence rates of MP in this age group (Bork et al. 1996). It could be also plausible that less experienced PTs are less familiarized with the physical demands from their workplace while more experienced PTs developed a higher pain threshold due to a higher work volume.

Contrariwise, the study of Grooten et al. revealed that more than half of the PTs with more than 15 years of experience (53.5%) were affected by MP (Grooten et al. 2011), and similarly, the study of Darragh et al. reported that age equal or greater than 55 years was a risk factor for MP among occupational therapists, finding that the odds of having MP were 3.46 times as high among those being 55 years or older (95% CI = 1.14, 10.49) (Darragh et al. 2009). However, these results should be interpreted carefully because, according to the authors of the study, sample size was small (131 subjects), and only trade union members were invited to participate. Thus, the previous study did not perform compare other subgroups of participants with less experience (Grooten et al. 2011). In the study of Darragh et al. the odds of having MP were 1.49 times higher among occupational therapists than PTs. Thus, it seems that the factors involved in MP among occupational therapists are not equivalent to those affecting to PTs (Darragh et al. 2009). Nevertheless, both professions appeared to be at particularly high risk of developing MP in more experienced individuals. Considering these results, future studies should investigate in more detail the age-related aspects of MP in PTs. It could be speculated that the risk decreases after the first years due to better working routines and practice and that the risk then increases again after many years of exposing the body to physically strenuous working conditions.

Table 2 Odds ratios and 95% CI for having moderate to high pain (≥ 3 on a scale of 0–10) in the different body regions in relation to different work factors

				Neck	Shoulders	Upper back	Low back	Elbow/fore-arm	Hand/wrist
Question	Response	*N*	%	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Other work	No	896	89.2	1	1	1	1	1	1
	Yes	109	10.9	1.38 (0.87–2.18)	1.54 (0.98–2.41)	1.00 (0.62–1.60)	1.12 (0.72–1.74)	0.68 (0.36–1.29)	0.76 (0.47–1.23)
Experience	0–5 years	256	25.5	1	1	1	1	1	1
	6–15 years	495	49.3	0.86 (0.58–1.27)	**0.62 (0.41–0.92)**	1.06 (0.72–1.58)	**0.63 (0.43–0.93)**	**0.58 (0.35–0.94)**	1.15 (0.77–1.72)
	> 15 years	254	25.3	**0.57 (0.35–0.94)**	**0.51 (0.30–0.85)**	0.87 (0.52–1.46)	**0.48 (0.29–0.79)**	**0.41 (0.21–0.78)**	0.90 (0.53–1.52)
Sector	Public	276	27.5	1	1	1	1	1	1
	Publ. and priv.	44	4.4	1.95 (0.91–4.17)	**2.80 (1.34–5.82)**	1.08 (0.51–2.32)	0.94 (0.45–1.93)	0.97 (0.39–2.44)	1.57 (0.76–3.24)
	Private	685	68.2	**1.54 (1.07–2.21)**	**1.49 (1.01–2.20)**	1.41 (0.97–2.06)	1.20 (0.84–1.72)	0.83 (0.51–1.34)	0.97 (0.66–1.43)
Type of employment	Contract	644	64.1	1	1	1	1	1	1
	Self-employed	361	35.9	1.31 (0.92–1.84)	1.32 (0.93–1.88)	0.97 (0.69–1.37)	1.04 (0.74–1.45)	1.02 (0.65–1.59)	1.41 (0.99–2.00)
Working hours per week	< 35	317	31.5	1	1	1	1	1	1
	35–45	568	56.5	0.91 (0.65–1.26)	1.24 (0.88–1.75)	1.37 (0.98–1.93)	1.31 (0.95–1.82)	0.81 (0.53–1.24)	0.84 (0.60–1.18)
	> 45	120	11.9	1.37 (0.82–2.31)	1.18 (0.70–2.00)	**2.10 (1.25–3.50)**	**1.73 (1.05–2.84)**	1.64 (0.89–3.02)	1.31 (0.79–2.16)
Number of patients per week	< 30	357	35.6	1	1	1	1	1	1
	30–50	319	31.8	1.06 (0.75–1.49)	**1.57 (1.09–2.25)**	1.05 (0.74–1.48)	0.79 (0.56–1.11)	1.15 (0.73–1.81)	0.94 (0.65–1.34)
	> 50	328	32.7	1.27 (0.84–1.91)	**1.86 (1.21–2.86)**	**0.65 (0.42–0.98)**	0.70 (0.47–1.05)	1.12 (0.66–1.90)	1.10 (0.72–1.67)
Treating more patients at same time	No	523	52.0	1	1	1	1	1	1
	Yes	482	48.0	1.28 (0.91–1.80)	0.84 (0.59–1.19)	1.16 (0.82–1.63)	**2.14 (1.53–2.99)**	1.26 (0.82–1.95)	1.19 (0.84–1.69)
Primary type of patients	Musculoskel-etal	800	79.6	1	1	1	1	1	1
	Neurological	171	17.0	1.09 (0.74–1.60)	1.28 (0.86–1.91)	1.28 (0.87–1.88)	1.29 (0.88–1.88)	0.62 (0.35–1.08)	0.99 (0.66–1.49)
	Other	34	3.4	1.26 (0.57–2.77)	1.11 (0.49–2.53)	**0.51 (0.19–1.33)**	**0.40 (0.17–0.94)**	1.43 (0.54–3.76)	0.71 (0.29–1.75)
Primary type of treatment	Manual therapy	783	77.9	1	1	1	1	1	1
	Physical exercise	176	17.5	**0.66 (0.46–0.95)**	1.06 (0.72–1.55)	0.97 (0.66–1.42)	0.89 (0.62–1.28)	0.83 (0.51–1.35)	0.73 (0.49–1.08)
	Machines	31	3.1	0.95 (0.43–2.07)	0.51 (0.19–1.41)	**3.02 (1.37–6.64)**	0.61 (0.28–1.37)	1.04 (0.38–2.90)	0.82 (0.35–1.94)
	Other	15	1.5	1.82 (0.50–6.56)	1.11 (0.33–3.72)	1.41 (0.45–4.45)	0.96 (0.30–3.10)	0.96 (0.19–4.87)	**0.36 (0.08–1.70)**
Adjusting stretcher when neces-sary	No	96	9.6	1	1	1	1	1	1
	Yes	909	90.5	1.40 (0.88–2.21)	0.69 (0.43–1.09)	1.10 (0.68–1.77)	0.96 (0.61–1.51)	1.35 (0.70–2.60)	1.47 (0.89–2.43)

Table 2 (continued)

				Neck	Shoulders	Upper back	Low back	Elbow/fore-arm	Hand/wrist
Question	Response	*N*	%	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Work position	Standing	610	60.7	1	1	1	1	1	1
	Stand. and seat.	325	32.3	1.10 (0.82 – 1.47)	1.15 (0.85 – 1.56)	0.93 (0.69 – 1.26)	0.78 (0.58 – 1.04)	1.32 (0.90 – 1.92)	0.94 (0.69 – 1.28)
	Seated	70	7.0	1.40 (0.80 – 2.46)	0.90 (0.50 – 1.61)	1.36 (0.78 – 2.35)	**2.04 (1.16 – 3.57)**	1.35 (0.66 – 2.74)	0.99 (0.56 – 1.78)

Bold values denote a statistically significant result ($p < 0.05$)

The type of treatment seems to play an important role too in the prevalence of MP. Our results showed a positive association for having MP when manual therapy is the primary type of treatment. We found that there was a weak to moderate positive association for having moderate to high pain (≥ 3 on a scale of 0–10) in the hand/wrist and in the neck when comparing with other types of primary treatments such as physical exercise, which showed a negative association with neck pain. As reported previously, procedures such as joint mobilization, manual traction and/or orthopedic manual therapy techniques, were associated with MP in the hand/wrist (Bork et al. 1996; Cromie et al. 2000; Grooten et al. 2011). Indeed, Bork et al. reported that those PTs who habitually performed manual therapy were 3.5 times more prone to have wrist or hand symptoms than those who did not perform such techniques, suggesting that manual therapy techniques could increase mechanical stress on specific anatomical areas, being a major source of upper limb MP (Bork et al. 1996).

The significant association between those who were treating a higher number of patients per week and shoulder pain was not surprising. This could be explained by their primary role in the movement of the upper limbs and, therefore, be more prone to exhaustion after higher workloads. In fact, repetition and monotony have been reported as contributor factors for developing shoulder pain (Buckle and Devereux 2002). Interestingly, negative associations were found for upper back pain and treating more than 50 patients per week, in comparison to those PTs who treated less patients. Upper back muscles have a stabilizing function, so probably this musculature may be better adapted to higher work demands, and consequently, might play some role as a protective mechanism for MP. However, associations were weak, so further studies are needed to corroborate this assumption.

PTs who work more hours per week are also at greater risk for low back pain than those who work less. In line with our results, previous investigations have reported a strong relationship between working more hours per week and risk of injury among health professionals (Trinkoff et al. 2003), and more specifically among PTs (Cromie et al. 2000). Accordingly, a previous study found weak to moderate associations between the number of weekly hours performing rehabilitation treatments and an increased risk of MP in shoulder/elbow, as well as an increased risk in the wrist/thumb for those PTs who work more hours and perform manual treatments (Rozenfeld et al. 2010). However, these results should be interpreted with caution, as different risk factors can coexist in combination with others, and when two or more are present together, it may increase the odds for developing MP, especially when these professionals have excessive workload, prolonged duration of work, insufficient rest periods or monotonous work without task variations (Yassi 1997).

Although previous investigations have reported the association between working in public hospitals and a higher prevalence of MP compared with their non-hospital-based counterparts (Bork et al. 1996; Alrowayeh et al. 2010), the present study found opposite results. PTs who worked in the private sector (i.e., private clinic), compared with those who worked in public hospitals were more likely to report MP, especially in the neck and shoulders. These associations were even more pronounced in those PTs who were working in both public and private sectors. A possible explanation of these findings could be the nature of the physical therapy profession in Spain, as PTs that work in the private sector tend to have longer journeys compared with those who work in public settings, who have a fixed working day length of 7 h. During this time, they have several breaks, which allows them to move and walk. However, in private settings, working time may be variable, including more hours and less breaks, especially when the salary depends on the volume of treatments. In addition, PTs in private clinics usually have a more limited space than in hospitals, having a lower possibility to move (which can also determine the type of treatment used). According to a previous study (Liao et al. 2016), private physiotherapy clinics may have not adequate equipment and less undergraduate students to undertake primary care. In this sense, alternating work "which allows breaks in otherwise repetitive or maintained activities" is essential in the prevention of such musculoskeletal complaints (Cromie et al. 2000), being a possible explanation for the lower rates of MP among PTs working in public hospitals.

Our findings suggest that working mainly in a seated position increases the odds for developing MP, especially in the lower back. These results are in concordance with a previous study among a general working population, which reported that these associations could be produced by a possible relation between prolonged sitting and continuous static load on the musculoskeletal system (Andersen et al. 2007).

Several attempts have been promoted as preventive strategies for decreasing the high prevalence rates of MP among healthcare professionals. However, single strategy ergonomic interventions, such as the implementation of assistive devices and aids has not resulted effective for reducing musculoskeletal complaints in this part of the workforce. Overall, keeping an appropriate level of physical condition is considered the most reported current strategy used by healthcare workers to enable them continue working (McPhail and Waite 2014). In fact, in workers with physically demanding jobs, high-intensity physical activity during leisure time is associated in a dose-response manner with work ability (Calatayud et al. 2015). Therefore, physical training may be an interesting tool for keeping PTs healthy and to enable them to perform their tasks efficiently. By increasing their physical capacity, the relative workload may decrease, reducing MP.

Strengths and limitations

To our knowledge, our study not only provides data about the association between different work-related factors with MP among PTs but also adds further insight about the relevance of such factors for this working group. However, the cross-sectional nature of this study is a limitation because the exposure and outcome were simultaneously assessed. Prospective cohort studies are needed to corroborate the associations between factors that cause MP among PTs. Furthermore, because the exact number of invited participants was unknown, we have not been able to provide the response percentage.

Conclusions

The findings of the present study suggest that several work-related factors are associated with MP among PTs. The lack of professional experience, working in private clinics, treating more patients at the same time, working in a seated position, treating more than 30 patients per week, and working more than 45 h per week were associated with MP among PTs, especially in specific body areas such as the low back, the shoulders or the neck. The results of this study might be considered for developing clinical guidelines and to develop effective interventions to prevent work-related MP and better working conditions among PTs.

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Compliance with ethical standards

Conflict of interest The authors of this study declare that they have any conflict of interest

Ethical approval This study received ethical approval by the University of Valencia's Ethical Committee (H1530736596718), and has been performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

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Are Moderate and Vigorous Leisure-Time Physical Activity Associated With Musculoskeletal Pain? A Cross-Sectional Study Among 981 Physical Therapists

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Abstract

Purpose: Musculoskeletal pain (MP) is common among workers, especially for health-care professionals. Paradoxically, many of those rehabilitating patients for pain—that is, physical therapists (PTs)—also have pain. Adequate levels of physical activity are recommended for cardiovascular and musculoskeletal health. However, the association between physical activity and MP among PTs remains unknown. This study aims to determine the association between moderate and vigorous leisure-time physical activity levels and MP in PTs.

Design: Cross-sectional study.

Setting: Workplace.

Participants: Nine hundred eighty-one PTs.

Measures: Data on MP and leisure-time physical activity were collected using an online survey.

Analysis: The odds for having lower level of MP as a function of physical activity were estimated using binary logistic regression controlled for various confounders.

Results: Performing ≥75 min/week of vigorous leisure-time physical activity increased the odds of experiencing lower levels of neck–shoulder pain (odds ratio = 1.43, 95% confidence interval, 1.05-1.94). No association was found neither between vigorous nor between moderate leisure-time physical activity and MP in the arm-hand or back.

Conclusion: Performing ≥75 min/week of vigorous leisure-time physical activity is associated with lower levels of MP in neck and shoulders among PTs. No associations were found between vigorous or moderate leisure-time physical activity and MP in arm-hand and back.

Keywords

musculoskeletal disorders, occupational health, exercise, workplace, lifestyle

Purpose

Numerous studies have reported that health-care professionals have high risk of musculoskeletal pain (MP), due to the physically demanding nature of their tasks.[1,2] For instance, physical therapists (PTs), who are typical specialists for MP management, deal with different risk factors for having MP themselves. However, few studies have been focused on the modifiable factors associated with MP among this occupational group.

Lifestyle factors are considered an interesting target to promote health interventions. Among these, regular physical activity has shown to provide numerous health benefits, including the reduction in risk factors and the prevention of chronic health problems. In this regard, vigorous exercise is much more efficient than moderate exercise to increase physical capacity, for example, in terms of cardiorespiratory fitness.[3] However, while interventions with vigorous levels of physical exercise have found positive results in terms of reduction in pain in

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chronic low back pain patients[4] or among workers,[5,6] there are no studies evaluating the association between physical activity and MP among PTs.

This study aims to analyze the association between moderate and vigorous physical activity and MP in PTs. We hypothesized that higher levels of both vigorous and moderate physical activity would have a protective effect for MP, in comparison to those PTs less physically active.

Methods

Design

This cross-sectional study was conducted in 2017 as part of a larger research study investigating the working environment among PTs. An online questionnaire was sent to the registered PTs from different professional associations. Ethical approval was granted by the institution's review board of the University of Valencia in accordance with the principles of the Declaration of Helsinki. All data of the study were treated anonymously.

Sample

Analyses are based on data from 981 PTs. Participants already retired or not actively working at the time of the investigation were excluded.

Measures

The questionnaire was designed to collect information about self-reported MP and moderate/vigorous physical activity during leisure time among PTs.

Self-reported level of leisure-time physical activity was reported according the Global Physical Activity Questionnaire.[7] A categorical score of low, moderate, and vigorous leisure-time physical activity was allocated and recoded, resulting in a binary variable indicating moderate and vigorous leisure-time physical activity. Moderate physical activity was defined as "activities that require moderate physical effort and cause small increases in breathing or heart rate," and vigorous physical activity referred to "activities that require hard physical effort and cause large increases in breathing or heart rate." Each of these variables was categorized according to the sum of minutes recommended during a normal week (0, 0-149 minutes, or >150 minutes of moderate physical activity, or 0, 0-74, or >75 minutes of vigorous physical activity).[8]

To report the prevalence and pain intensity in neck–shoulder, arm–hand, and back during the last month, a modified Nordic Musculoskeletal Questionnaire[9] was used. Using a simple body diagram, participants were asked to rate pain intensity using a 0 to 10 analogue scale, where 0 meant "no pain at all" and 10 was considered "pain is as bad as it could possibly be."

Statistical Analysis

All statistical analyses were performed using the SAS statistical software for Windows (Proc Logistic, SAS version 9.4).

Table 1. Demographics, Lifestyle, and Pain.

	N	Mean	SD	%
Gender				
Men	288			29.4
Women	693			70.6
Education				
Bachelor (3-year)	479			48.8
Bachelor (4-year)	236			24.1
Master	258			26.3
PhD	8			0.8
Smoking				
No	852			86.9
Yes	129			13.2
Age, years	981	34.3	8.0	
BMI, kg/m^2	981	23.3	3.4	
Alcohol, units per week	981	2.2	2.3	
Pain intensity (0-10 mean SD and % ≥3)				
Neck–shoulder	981	2.6	2.2	43.4
Arm–hand	981	1.5	1.9	23.9
Back	980	2.5	2.2	42.1

Abbreviations: SD, standard deviation; BMI, body mass index.

Descriptive statistics were used to report demographic characteristics of the participants, including age, body mass index, gender, education, smoking, alcohol units per week, and pain intensity (≥3 on a scale of 0-10 in the back, neck/shoulders, and arm/hand). Using binary logistic regression, odds ratios (ORs) and 95% confidence intervals (CIs) were calculated for having low MP (<3 on a scale of 0-10) in different body areas (dependent variables) in function of the total amount of vigorous leisure-time physical activity (0, 1-74, and ≥75 min/week) and moderate leisure-time physical activity (0, 1-149, and ≥150 min/week) as mutually adjusted independent variables (reference category: 0 min/week), after adjusting for confounding factors (gender, education, experience, working hours, setting, type of treatment, number of patients per week, and work position). As an exposure variable, total physical activity was evaluated by multiplying vigorous physical activity minutes by 2 and adding that value to the reported minutes of moderate physical activity.

Results

In all, 1006 PTs replied to the questionnaire. Twenty-five questionnaires were excluded because of missing data for at least one of the main variables of the study, obtaining a final sample size of 981 patients. Demographic data and pain intensity of the participants are summarized in Table 1.

The odds for experiencing lower levels of pain in neck–shoulder were higher in those PTs performing ≥75 min/week of vigorous leisure-time physical activity, with 0 min/week of vigorous physical activity as a reference (OR = 1.43, 95% CI, 1.05-1.94; Table 2). However, the analysis did not reveal any significant difference between vigorous leisure-time physical activity and pain in the arm–hand (OR = 0.84, 95% CI,

Table 2. Odds Ratios (95% Confidence Intervals) for Having a Low Level of Musculoskeletal Pain (<3 on a Scale of 0-10) in the Neck–Shoulder, Arm–Hand, and Back From Different Durations of Moderate and Vigorous Physical Activity During Leisure.

	Min/Week	N	%	Neck–Shoulder Pain OR (95% CI)	Arm–Hand Pain OR (95% CI)	Back Pain OR (95% CI)
Moderate physical activity	0	256	25.5	1	1	1
	1-149	360	35.8	1.15 (0.80-1.66)	1.17 (0.77-1.76)	1.13 (0.79-1.62)
	150 or more	389	38.7	0.80 (0.56-1.15)	1.07 (0.72-1.61)	0.98 (0.69-1.39)
Vigorous physical activity	0	409	40.7	1	1	1
	1-74	104	10.4	0.92 (0.57-1.48)	0.71 (0.41-1.21)	0.72 (0.45-1.15)
	75 or more	492	49.0	**1.43 (1.05-1.94)**	0.84 (0.59-1.19)	1.20 (0.89-1.63)

Abbreviations: CI, confidence interval; OR, odds ratio.
Bold values denote a statistically significant result ($p < 0.05$).

0.59-1.19) or back (OR = 1.20, 95% CI, 0.89-1.63). The odds for having lower levels of pain were not significantly lower in those PTs performing moderate leisure-time physical activity. Additionally, a positive significant association was found with having MP in the neck–shoulders in those PTs who performed <150 min/week of total physical activity (OR = 1.58, 95% CI: 0.98-2.54). However, no associations were found with MP in the arm–hand (OR = 1.38, 95% CI: 0.79-2.42) or in the back (OR = 1.12, 95% CI: 0.70-1.79).

Discussion

Summary

The main findings of the present study are that ≥75 min/week of leisure-time vigorous physical activity are associated with lower levels of MP in the neck–shoulders among PTs. However, a similar intensity seems to not confer the same benefit in the back or in the arm–hand. Moderate leisure-time physical activity did not show any significant association with MP, partially confirming our hypothesis.

According to the current physical activity guidelines for health, adults should do at least 150 min/week of moderate physical activity, or 75 min/week of vigorous intensity physical activity, or an equivalent combination of both.[10] Contrariwise, over 25% of those surveyed reported not to perform any moderate physical activity, and almost 40% reported not to do any vigorous physical activity during leisure time. These rates might alert us that physical activity does not receive enough attention among PTs.

Thereby, the association found between vigorous physical activity and MP would suggest that increasing the total amount of vigorous leisure-time physical activity might be effective in preventing and/or reducing neck–shoulder pain among PTs. One possible explanation for this finding might be that by increasing the physical capacity of the worker, the relative workload might be reduced. Furthermore, physical exercise may improve the oxygenation of distant tissues of the body, by increasing the blood flow in both working and nonworking muscles,[11,12] due to an improved endothelium-dependent vasodilation.[13] However, the intensity should be high enough to improve the oxygenation of these tissues, being moderate physical activity not enough intense to produce this effect. Regardless, the analysis revealed that those respondents who did not meet the current physical activity guidelines (including the combination of the total amount of vigorous and moderate physical activity) had higher odds for having MP in the neck–shoulders. Thus, it could be that for preventing or reducing MP in this body area, a minimum amount of total physical activity might be required. However, further longitudinal studies are needed to corroborate this assumption.

Our analysis did not show significant associations between vigorous and moderate physical activity with lower levels of MP in the back or the arm–hand nor with those PTs who met the current physical activity guidelines. An explanation for this may be that these body areas are not painful due to prolonged static muscle activity as the neck–shoulder muscles are.[14] Thus, other approaches might be more effective for reducing MP. Particularly, high-intensity strength training seems especially effective in reducing MP.[14,15] Therefore, implementing workplace interventions could be an effective strategy to enhance physical activity levels among PTs and reduce MP. Besides the physiological benefits, other positive effects on well-being and on socializing with colleagues would contribute to address more potential factors involved in MP.[15]

Limitations

The main limitation of the present study is its cross-sectional design, as it cannot determine causality. Thus, it may be that those with high pain levels avoided doing vigorous activity due to pain. Furthermore, self-reported data could have been influenced by the recall bias, as patients with pain tend to underestimate their self-reported physical activity levels.

Significance

Performing ≥75 min/week of vigorous leisure-time physical activity is positively associated with having lower levels of MP in neck and shoulders among PTs. Moderate leisure-time physical activity did not show any association with lower levels of MP in neck and shoulders. In addition, neither vigorous nor moderate leisure-time physical activity is associated with MP in arm–hand and back.

SO WHAT?

What is Already Known on This Topic?

Leisure-time physical activity is associated with numerous health benefits, including the reduction of musculoskeletal pain (MP) among working populations, as it can increase physical capacity and therefore reduce the relative workload.

What Does This Article Add?

This study provides novel data regarding the potential effect of vigorous leisure-time physical activity on decreasing neck–shoulder MP among physical therapists (PTs), while moderate physical activity showed no association.

What are the Implications for Health Promotion Practice or Research?

These results suggest that promotion of leisure-time vigorous physical activity should be encouraged to PTs to reduce neck–shoulder MP.

Declaration of Conflicting Interests

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ORIGINAL ARTICLE

Dose–response association between multi-site musculoskeletal pain and work ability in physical therapists: a cross-sectional study

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Abstract

Purpose Multi-site musculoskeletal pain (MP) is common among health care professionals and is considered a threat to work ability and thereby a long and healthy working life. However, literature is scarce regarding these associations among physical therapists (PTs). This study aims to quantify the prevalence of local and multi-site MP among PTs, to investigate the associations between pain intensity and number of pain sites, respectively, with the level of work ability.

Methods We conducted a survey among 1006 PTs about pain the previous month in different body areas and work ability. Work ability was measured using the Work Ability Index (WAI) including its seven categories. The odds of having lower level of work ability as a function of pain intensity (0–10) and multi-site pain were determined using binary logistic regression controlled for relevant confounders.

Results The neck (36.3%) and the low back (32.3%) were the most commonly affected body areas. Furthermore, a dose–response relationship was observed between the number of pain sites and lower work ability (trend test, $p < 0.001$). With low pain intensity as reference, a moderate to strong association existed for lower levels of work ability in PTs who reported pain intensity of > 5 in one to two body regions (OR 2.14, 95% CI 1.27–3.60). This association was stronger when participants reported pain in three to four sites (OR 4.02, 95% CI 2.36–6.82) and even stronger when pain was experienced in five or more sites (OR 6.13, 95% CI 3.31–11.38).

Conclusions Multi-site MP is strongly associated—in a dose–response fashion—with lower levels of work ability among PTs.

Keywords Work capacity evaluation · Physical activity · Physical therapists · Occupational health · Workplace

Introduction

Musculoskeletal pain (MP) is common in the population and experienced by individuals of all ages. Moderate-to-severe pain is estimated to affect approximately 80 Mio. adults in Europe alone (Reid et al. 2011). Among workers, MP is considered the leading cause of disability, early retirement (Brooks 2006) and a significant threat to work ability (Miranda et al. 2010), at short and long term (Kapteyn et al. 2008; Neupane et al. 2013).

While most epidemiological studies have been focused on single-site pain, a number of studies show that people with localized pain commonly have co-existing complaints in other body areas (Macfarlane et al. 2000; IJzelenberg and Burdorf 2004; Hagen et al. 2006). In fact, experiencing pain in just one body part has been shown to increase the risk of developing pain in other/multiple body regions a year later (Andersen et al. 2012b). Multi-site MP seems to have a worse prognosis than single-site pain (Øverland et al. 2012; Haukka et al. 2013), and experiencing MP in multiple body areas has been suggested to increase the likelihood of developing chronic pain (Croft et al. 2006). This may be related to a central sensitization of pain perception in conditions of chronic MP (Sluka and Clauw 2016).

Multi-site MP has shown to be highly prevalent in health-care professionals (Solidaki et al. 2010; Freimann

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et al. 2013). In this working population, a dose–response association between intensity of pain and risk of future sickness absence exists (Andersen et al. 2012a), and the pain can even spread from one body region to another and thereby increase the risk for multi-site pain (Andersen et al. 2012b). Health-care professionals represent a substantial part of the total workforce. In fact, in Europe, physical therapists (PTs) constitute 8.21% of the total health-care workforce (including nurses, physicians, dentists, pharmacists and PTs) (Eurostat 2018), while in Spain, PTs represent 7.4% of the total health-care workforce (Instituto Nacional de Estadística 2018). Actually, Spain is one of the European countries with more PTs, accounting for almost 10% of the total amount of PTs in Europe.

PTs have long work hours, work in a range of different settings, and apply different types of techniques to a broad variety of patients. For instance, in Spain PTs that work in the private sector usually have longer journeys compared with those who work in public settings, who have a fixed working schedule. As the salary of PTs in private clinics typically depends on the volume of treatments, their working time is more variable, and normally their journey involves more hours and less breaks, being more likely to report MP compared with PTs who work in public settings (Ezzatvar et al. 2019a). Following this, the physical demands of their inherent job tasks (e.g., lifting and transferring patients) may increase the prevalence of MP (Campo et al. 2008; Darragh et al. 2009; Nordin et al. 2011), as well as individual factors such as medical conditions, psychosocial factors or mental disorders, which could have a considerable impact on their work ability levels (Miranda et al. 2010). However, despite the high prevalence of MP in this occupation, studies evaluating the association with work ability are limited. Whereas several studies have examined the associations between pain and work ability among general individuals and working population (Kamaleri et al. 2008; Miranda et al. 2010; Neupane et al. 2011), much remains unclear to which extent the presence of single- and multi-site MP influence work ability among PTs. Considering that poor work ability is a strong predictor of future work disability (Ilmarinen et al. 1997) and early retirement (Chiu et al. 2007), it is necessary to understand the contribution of local and multi-site MP and its potential power for predicting lower work ability levels among PTs, especially because the possibility of having a better and longer working life is strongly dependent on work ability (Ilmarinen 2001).

Thus, the aims of the present study are to investigate in PTs (i) the prevalence of local and multi-site pain, (ii) the association between pain intensity and levels of work ability, and (iii) the association between the number of pain sites and work ability. We hypothesize that high levels of perceived pain intensity are associated with lower work ability among PTs, and that this association increases in a dose–response fashion with multiple pain sites.

Methods

The present study applied a cross-sectional design to study MP and work ability among PTs, as part of a larger research study investigating the working environment among PTs and described elsewhere (Ezzatvar et al. 2019a, b). Potential participants for this study included actively working PTs who were registered in professional associations of PTs from Spain. PTs already retired or not actively working at the time of the investigation were excluded. The present study was approved by the University of Valencia's Ethical Committee (H1530736596718), in accordance with the principles of the Helsinki Declaration. This study was written following the STROBE guidelines, to ensure comprehensive reporting of the data (von Elm et al. 2007). All data of the study were treated anonymously.

Procedures

The researchers contacted the main professional associations of PTs of different communities in Spain, who subsequently sent an e-mail invitation to their members inviting to voluntarily participate. The invitation described the aim of the study, along with a link to the online questionnaire. By responding to the questionnaire, each participant was giving consent to participate in the study and permission for the results to be published. The name and contact information of the researchers were included in the cover letter for solving any doubt or concern of the eligible participants before deciding to participate. One month following the original e-mail, a reminder was sent inviting PTs to participate if they had not done already.

Questionnaire content

As part of the study preparation, ten PTs from different settings reviewed each question and pilot tested the survey. Their feedback was considered, and some items were amended by the researchers to ensure that each question was clear and easy to respond. Once the questions were reviewed and modified when necessary, an online questionnaire was constructed using the online tool Google Forms (Google Inc., Mountain View, CA, USA) for the response collection and data storage. Due to data privacy reasons, the setting of the survey system was set to "anonymous", i.e., it was not possible to link the individual responses to the individual e-mails of the participants.

The questionnaire was designed to collect information about self-reported MP and work ability among PTs.

Preliminary questions about MP and demographic factors were based on published instruments previously used in PTs (Bork et al. 1996; Salik and Özcan 2004; Nordin et al. 2011). Work ability was assessed using the Work Ability Index (WAI). From the questionnaire, information on gender, age, body mass index (BMI), education and substance use were extracted.

Work Ability Index (WAI)

Participants' self-reported work ability was measured using the WAI questionnaire. This instrument consists of the following seven categories: current work ability in comparison to lifetime best, work ability in relation to the physical and mental demands of the job, number of current diseases diagnosed by a physician, estimated work impairment due to diseases, sick leaves during the past year, own prognosis of work ability 2 years from the present, and mental resources. The final score is calculated by summing up the estimated points for each item (Ilmarinen 2007). The WAI score ranges from 7 to 49 points, distinguishing four different categories: poor WAI (7–27 points), moderate WAI (28–36), good WAI (37–43) and excellent WAI (44–49 points). The internal validity of this instrument has been previously described, finding a satisfactory relationship between the subjective results of the index in comparison with more objective assessments (Eskelinen et al. 1991; Nygård et al. 1991), as well as a satisfactory test–retest reliability (De Zwart et al. 2002).

Musculoskeletal pain assessment

A modified Nordic Questionnaire for musculoskeletal symptoms was used for assessing pain. This questionnaire includes a body diagram with nine body regions clearly highlighted (neck, shoulder, upper back, elbow/forearm, hand/wrist, hip/leg, knee ankle/feet and low back), for which the presence of pain may be indicated with a "yes" or "no", with the question "During the past month, have you had pain or discomfort in the [body area] shown in the diagram?" for each one of the body areas. If yes, the participants were asked to rate the intensity of pain on a numeric rating scale of 0 to 10, considering 0 as "no pain", and 10 as "worst possible pain". The option of choosing 1-month prevalence from the Nordic questionnaire was an attempt to overcome recall bias.

This questionnaire has shown to have an acceptable validity to be used as a screening tool (Kuorinka et al. 1987), and when compared with clinical examination it has shown sensitivity ranging between 66 and 92% and specificity between 71 and 88% (Ohlsson et al. 1994). It is also highly predictive in relation to the risk of future long-term sickness absence (Andersen et al. 2012c).

Statistical analysis

The odds of having lower level of work ability as a function of pain intensity and multi-site pain were determined using binary logistic regression (Proc Logistic of SAS version 9.4), where the ORs express the odds for having poor to fair work ability (reference: good to excellent work ability). Analyses were performed for the combined work ability score, which includes work ability in relation to the current work ability compared with lifetime best, with work ability in relation to the demands of the job, the number of current diseases diagnosed by a physician, the estimated work impairment due to diseases, sick leave during the past year, own prognosis of work ability 2 years from now, and mental resources and overall. Odds ratios (ORs) and 95% confidence intervals (95% CI) were calculated with work ability as the dependent variable and the different variables as independent variables. Potential confounders were adjusted into two different models: model 1 controlled for age and gender; model 2 controlled for age, gender, education, and work-related factors (including years of experience, working hours, setting, type of treatment, number of patients per week and work position).

Results

A total of 1006 PTs replied to the questionnaire. However, 25 questionnaires were excluded from analysis because of missing data for at least one of the main variables of the study. Thus, the final sample size was 986 subjects with the majority of respondents being women (70.6%). The mean age of the participants was 34.3 ± 8.0 (SD) years. Nearly 73% of respondents were reported to have an education level of bachelor's degree, 26.3% had a master's degree, and 0.8% had a PhD. Relevant characteristics of the participants of the study are described in Table 1.

Table 2 shows the prevalence of pain intensity categorized into low (<2), moderate (2–5) and high (5–10) levels of self-reported pain in nine different body regions during the last month.

The most commonly rated painful body part was the neck (36.3%), followed by the low back (32.3%), upper back (21.9%) and hand/wrist (21.6%). One-third of the respondents reported moderate pain intensity in the neck, followed by the low back (25.9%), upper back (22.4%) and hand/wrist (20.9%).

In both models, when adjusted for age and gender (Model 1) and when adjusted for age, gender, education and work-related factors (Model 2), a strong association was found between pain intensity and levels of work ability, with low pain as a reference. In fact, an association between high pain intensity and low levels of work ability was found in all

Table 1 Demographics and lifestyle

	N	Mean	SD	%
Gender				
Men	288			29.4
Women	693			70.6
Age (years)	981	34.3	8.0	
Education				
Bachelor's (3 years)	479			48.8
Bachelor's (4 years)	236			24.1
Master's	258			26.3
PhD	8			0.8
Smoking				
No	852			86.9
Yes	129			13.2
BMI ($kg·m^{-2}$)	981	23.3	3.4	
Alcohol (units per week)	981	2.2	2.3	
Experience				
0–5 years	256			25.5
6–15 years	495			49.3
> 15 years	254			25.3
Working hours per week				
< 35 h	317			31.5
35–45 h	568			56.5
> 45 h	120			11.9

nine body regions. The strongest associations were found between high pain intensity in the low back and lower levels of work ability, followed by moderate to strong associations with high pain intensity in the knee, the hip/leg and the shoulder. For moderate pain intensity, the strongest associations were found for the ankle/feet, followed by the shoulder and the hip/leg.

Table 3 shows the odds ratio for lower levels of work ability in relation to the number of pain sites of at least five on a scale of 0–10. The prevalence of high pain intensity in 0, 1–2, 3–4 and > 5 body parts was 39.3%, 32.5%, 19.4% and 8.8%, respectively.

With low pain intensity as reference, a moderate to strong association for lower levels of work ability in PTs who reported pain of > 5 in one to two body regions was found. This association was stronger when participants reported pain in three to four regions and even stronger when pain was experienced in five or more sites.

Discussion

As hypothesized, the intensity of pain in different body areas is associated with lower work ability among actively working PT's. Likewise, a strong dose–response association was evident between the number of pain sites and lower work ability.

Our findings showed that nearly one-third of participants reported high levels of neck and low-back pain (36.3% and 32.3%, respectively) within the previous month. In accordance with our results, several studies conducted among PTs have reported a high prevalence of MP in the low back, neck, upper back, shoulders and thumbs (Adegoke et al. 2008; Darragh et al. 2009; Vieira et al. 2016). Following this, our results are also in agreement with longitudinal studies showing 1-year incidence rates in any body region up to 20.7% among PTs (Campo et al. 2008), and 6.6% in the low-back region.

Interestingly, low-back pain was not only one of the most prevalent body areas affected with MP, but also was strongly associated with lower levels of work ability. Participants who reported high levels of low-back pain had more than four times increased risk for lower levels of work ability compared to those who rated their pain intensity with scores lower than 2. Conversely, a 4-year prospective study found that low-back pain predicted long-term work disability, but only when low-back pain was present in subjects with widespread pain and not as localized pain (Natvig et al. 2002). The discrepancies between their study and our findings might be attributed to the characteristics of the study population, as they did not specify the job description of the respondents. Another possible explanation for these contradictory findings may be that the intensity of low-back pain was not assessed.

Pain in the hands or in any other part of the upper extremity may significantly affect the work ability of PTs, as manual techniques in one way or another are an inherent part of the physical therapy profession. However, we found that only high pain intensity—and not moderate—in the elbow/forearm and hand/wrist was associated with lower levels of work ability. One possible explanation would be that PTs develop coping strategies to continue working despite the presence of moderate pain, by performing other techniques in which the upper extremity might not be involved, or using protective measures such as thumb splints, mobilization wedges or soft tissue devices (Campo et al. 2008). Therefore, a decrease of manual therapy techniques would explain the reduction in the risk for wrist and hand disorders. Accordingly, the results of our study suggest that most of those PTs, who had moderate MP in their hands/wrists or elbows, might not perform manual therapy techniques as frequently as those who reported high pain intensity. Consequently, they do not present a significant risk for lower levels of work ability, compared with their manual therapists' counterparts.

In line with our findings, the literature seems to be consistent with the presence of MP and its negative impact on work ability. For instance, a previous study revealed that both MP and increased stress are independently associated

Table 2 Odds ratios (95% confidence intervals) for lower levels of work ability in relation to pain intensity in different body regions

Body region	Pain intensity (0–10)	*N*	%	Model 1 OR (95% CI)	Model 2 OR (95% CI)
Neck	Low (< 2)	312	31.0	1	1
	Mod. (2–5)	328	32.6	1.67 (1.00–2.79)	1.72 (1.01–2.94)
	High (5–10)	365	36.3	2.43 (1.50–3.96)	2.59 (1.55–4.33)
Shoulder	Low (< 2)	602	59.9	1	1
	Mod. (2–5)	195	19.4	2.69 (1.71–4.23)	2.93 (1.81–4.73)
	High (5–10)	208	20.7	2.66 (1.71–4.15)	2.96 (1.83–4.78)
Upper back	Low (< 2)	560	55.8	1	1
	Mod. (2–5)	224	22.3	1.65 (1.05–2.60)	1.70 (1.05–2.74)
	High (5–10)	220	21.9	1.73 (1.11–2.71)	1.94 (1.20–3.14)
Elbow/forearm	Low (< 2)	780	77.6	1	1
	Mod. (2–5)	133	13.2	1.54 (0.93–2.54)	1.50 (0.88–2.55)
	High (5–10)	92	9.2	2.45 (1.45–4.15)	2.91 (1.63–5.20)
Hand/wrist	Low (< 2)	578	57.5	1	1
	Mod. (2–5)	210	20.9	1.33 (0.81–2.17)	1.46 (0.87–2.47)
	High (5–10)	217	21.6	2.61 (1.72–3.98)	2.95 (1.88–4.63)
Hip/leg	Low (< 2)	831	82.7	1	1
	Mod. (2–5)	83	8.3	2.51 (1.44–4.37)	2.54 (1.41–4.58)
	High (5–10)	91	9.1	2.68 (1.58–4.53)	2.62 (1.50–4.59)
Knee	Low (< 2)	801	79.7	1	1
	Mod. (2–5)	112	11.1	2.60 (1.58–4.27)	2.44 (1.43–4.14)
	High (5–10)	92	9.2	3.71 (2.22–6.20)	3.94 (2.27–6.83)
Ankle/feet	Low (< 2)	908	90.4	1	1
	Mod. (2–5)	54	5.4	4.14 (2.24–7.68)	4.24 (2.19–8.20)
	High (5–10)	43	4.3	2.58 (1.24–5.34)	2.51 (1.13–5.59)
Low back	Low (< 2)	420	41.8	1	1
	Mod. (2–5)	260	25.9	2.27 (1.33–3.88)	2.29 (1.31–4.01)
	High (5–10)	325	32.3	4.58 (2.85–7.35)	4.73 (2.88–7.77)

Model 1 Adjusted for age and gender

Model 2 Adjusted for age, gender, education and work-related factors

Table 3 Odds ratios (95% confidence intervals) for lower levels of work ability in relation to number of pain sites of at least five on a scale of 0–10

Number of pain sites > 5 on a scale of 0–10	*N*	%	Model 1 OR (95% CI)	Model 2 OR (95% CI)
0	395	39.3	1	1
1–2	326	32.5	2.14 (1.27–3.60)	2.28 (1.33–3.90)
3–4	195	19.4	4.02 (2.36–6.82)	4.30 (2.45–7.52)
5 or more	88	8.8	6.13 (3.31–11.38)	7.07 (3.63–13.75)

Model 1 Adjusted for age and gender

Model 2 Adjusted for age, gender, education and work-related factors

with lower work ability in another occupation also relying on upper-extremity work during large parts of the working day, namely female laboratory technicians (Jay et al. 2015). As the WAI includes seven different categories, it could be suggested that its second and seventh subscale (work ability in relation to the physical and mental demands of the job, and mental resources) could be lower in those PTs with high workload or those who are treating more patients per week, resulting in higher levels of MP through, for example, an increased muscle tension. One of the issues that emerges from this assumption is if the presence of pain is what leads to lower work ability or if having lower work ability increases the odds for having MP. However, previous studies suggest that the directional nature is from pain to work ability and not vice versa (Miranda et al. 2010; Lindegård et al. 2014). Furthermore, other authors found that workers who reported having pain in two or more sites had lower levels of health-related functioning compared to those who only reported having pain in one site (Saastamoinen et al. 2006; Kamaleri et al. 2008). Our study demonstrated that multi-site pain in PTs has a strong association with lower levels of work ability. In those PTs who presented high pain intensity in one to two regions, the odds for lowering levels of work ability was more than twice, compared to those with low pain intensity. When the number of pain sites was three to four, the risk was more than four times as high, and in those PTs with pain in five or more body sites, the risk was six times higher after adjustment for age and gender, and more than seven times higher when adjusted for age, gender, education and work-related factors. Unfortunately, the majority of literature investigating multi-site pain as a predictor of poor work ability used workers of the general working population (Miranda et al. 2010; Neupane et al. 2011). Because physical and psychosocial exposures vary largely between job groups, performing analyses on specific occupations is necessary. Among the few studies that included health-care professionals, only one study included PTs, albeit only representing 5.1% of the total number of participants (Phongamwong and Deema 2015). In the aforementioned study, the authors found that the probability of developing poor work ability was three times higher when participants experienced multiple pain sites vs. no pain. Experiencing multiple pain sites has shown to predict early disability retirement (Haukka et al. 2015) and has a strong association with the risk of long-term work disability as well as with a declining psychological health, educational levels and sleep quality (Kamaleri et al. 2008). However, the underlying mechanisms behind these associations are not yet established.

Biomechanical factors such as mechanical stress and awkward body positions are commonly reported as the main causes and/or risk factors for MP. Nevertheless, biomechanical factors are not linearly related to the prevalence rates of MP. Thus, because the nature of pain is multifactorial, other factors should be taken into account to understand which are the potential contributors of MP. For instance, the results of the World Mental Health Surveys, a study which involved 17 countries and included more than 85,000 participants, showed noteworthy differences in the prevalence rates of chronic back and neck pain, ranging from 9.7% and 42.1%. These differences are too wide to be justified by mechanical stress, suggesting that other factors such as mental disorders (e.g., depression or anxiety) could play an important role (Demyttenaere et al. 2007). However, the aforementioned study only analyzed chronic pain conditions, and its cross-sectional nature cannot determine if the presence of mental disorders is a cause or a consequence for experiencing pain. A previous study found that psychological distress and psychosocial factors such as job demands, poor support from colleagues and work dissatisfaction do predict future reported pain in cohorts of newly employed workers (Nahit et al. 2003). Furthermore, a longitudinal study of Spanish nurses and office workers found that poor mental health and somatizing tendency predicted the incidence of low-back pain (Vargas-Prada et al. 2013). Other occupational groups from Spain (i.e., podiatrists) have also showed a significant prevalence of MP in the low back, upper back and neck during the previous 7 days (33.02%, 21.85% and 21.62%, respectively) (Losa et al. 2011). The authors of this study found that younger age groups, women and married podiatrists had higher prevalence of MP, suggesting that individual factors might play an important role in these rates too. However, their role in the onset and maintenance of MP among PTs still remains poorly understood. In addition, autoimmune rheumatic diseases (e.g., rheumatoid arthritis, systemic lupus erythematosus, scleroderma or systemic vasculitides) among others can manifest muscle symptoms as generalized myalgia (Goldblatt and O'Neill 2013), which could partially explain the high prevalence rates of multi-site MP and the associations found with lower levels of work ability. However, taking aside specific cases of actual pathology, other variables might be considered to understand the implications that multi-site pain have in PTs.

Consistent evidence regarding the harmful influence of negative perceptions and beliefs about pain is present in the literature (Bishop et al. 2008; Casey et al. 2008). Misperceptions about pain are common among health-care practitioners, including PTs (Bishop et al. 2008; Buchbinder et al. 2009). This raises concerns for the potential risk that their own profession produces on themselves, as the confluence of previously reported misperceptions found among PTs, such as anatomic/structural vulnerability or conferring more importance on the tissue damage than in the level of pain or functional disability, might trigger an unfortunate cycle of pain and negative beliefs that aggravate pain. This would lead to undesirable consequences on different spheres of life, including work. However, further research is needed to corroborate these assumptions.

Based on the progressively growing body of research in modern pain science, it seems to be clear that the complexity of pain is highly underestimated in the biomedical approach to pain, as it is influenced by a myriad of factors that make treatment a challenging task (Hua and Cabot 2014). Therefore, more effective approaches are substantially needed to prevent and manage pain to maintain a healthy workforce, to lower the burden of pain among specific subgroups and to enable the working population to maintain high levels of work ability throughout their work life.

Strengths and limitations

One of the strengths of our study was that the analyses were controlled for various confounding factors that might influence work ability (e.g., age, gender, work-related factors and education). By including only one job group which were actively working, we reduced the influence of bias from socioeconomic and education factors. On the other hand, our study has some limitations too. Firstly, the cross-sectional nature of the present study cannot establish causality between the presence of pain and work ability; however based on previous studies, it seems that the directional nature is from pain to work ability and not vice versa. Secondly, as we invited potential participants to complete the online questionnaire using e-mails and newsletters, the participation rate was not possible, and we could therefore not perform a non-response analysis. In addition, the prevalence of pain might have been underestimated due to the healthy-worker effect, as those PTs severely affected by MP may not have been actively working during the investigation and, consequently, excluded from the study.

Conclusions

The present study shows that after controlling for potential confounders, the presence of MP, especially when it occurs at more than one site simultaneously, is strongly associated with lower levels of work ability among PTs. Further research is needed to have a better understanding of the underlying mechanisms involved in the onset and maintenance of pain in this occupational group, as well as the role of coping, social support or psychosocial factors in the work ability of PTs. This would help to design more effective interventions to improve the levels of work ability among PTs and to ensure a longer and better working life.

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Compliance with ethical standards

Conflict of interest The authors of this study declare that they have no conflict of interest and no funding or grant from any commercial source was involved in this study. The authors thank the participants for their contribution to the study. By responding to the questionnaire, each participant was giving consent to participate in the study and permission for the results to be published.

Ethical approval This study received ethical approval by the University of Valencia's Ethical Committee (H1530736596718) and has been performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

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Human Kinetics
ORIGINAL RESEARCH

Importance of Frequency and Intensity of Strength Training for Reduced Musculoskeletal Pain in the Back, Neck–Shoulder, and Arm–Hand Among Physical Therapists

Yasmín Ezzatvar, Joaquín Calatayud, Lars L. Andersen, and José Casaña

Background: Musculoskeletal pain (MP) is common among health care professionals, including physical therapists (PTs). The physically demanding nature of their work might contribute to increase MP rates. Strength training has a positive effect on musculoskeletal health and MP. However, no studies have evaluated the association of strength training during leisure time on MP among PTs. This study aims to analyze the association between frequency and intensity of strength training during leisure time and MP in the back, neck–shoulder, and arm–hand among PTs. **Methods**: Data on MP and intensity and frequency of strength training were obtained using a questionnaire responded by 1006 PTs. The odds for having lower level of MP as a function of intensity or frequency of the strength training were estimated using binary logistic regression. **Results**: High-intensity strength training showed strong associations with lower intensity of MP in neck–shoulder (odds ratio = 5.08; 95% confidence interval, 1.36–18.92), arm–hand (odds ratio = 5.22; 95% confidence interval, 1.11–24.51), and back (odds ratio = 5.22; 95% confidence interval, 1.41–19.28). However, frequency and lower intensities were not significantly associated with MP in any body part. **Conclusions**: High-intensity strength training is strongly associated with lower levels of MP in arm–hand, neck–shoulder, and back, whereas no association was found with frequency or lower intensities.

Keywords: exercise training, health promotion, musculoskeletal health, physical fitness, resistance training

Musculoskeletal disorders are the second cause of disability globally,[1] with low back and neck pain as the most common complaints among working populations. The prevalence of these conditions has increased significantly during the last decades and will likely increase as the population ages.[2] This causes huge direct and indirect economic losses in terms of health care costs, reduced productivity, and lost time at work that affects workers, employers, and society.

Particularly, health care professionals have been associated with a higher risk for developing musculoskeletal pain (MP),[3] which is considered as a distressing experience associated with actual or potential tissue damage, and influenced by physical, psychological, and social factors. Among these professionals, physical therapists (PTs), who represent a substantial part of the health care workforce—only in Europe, the number of PTs was estimated to be 554,000 in 2016[4]—are particularly vulnerable because of the physical nature of their profession. In this context, a complex array of risk factors including awkward positions, dealing with dependent patients, repetitive moments, high mental demands, stress, and individual lifestyle factors may contribute to MP. In fact, the lifetime prevalence of MP among PTs has been reported to range between 53% and 91%,[5] which can adversely worsen the quality of patient care or lead to absenteeism. Given the potential impact that MP entails, preventive strategies are needed. However, few studies have been focused on the modifiable factors associated with MP among this occupational group.

There is a growing body of literature that recognizes strength training as a cornerstone for the management and prevention of several health disorders. Strength training can prevent and/or decrease the risks associated with chronic diseases, as it is linked to a reduced risk of all-cause mortality,[6–8] a significant reduction in type 2 diabetes or cardiovascular disease,[9] as well as in the treatment of several chronic disorders.[10] However, the effects of strength training on MP among working populations seem less clear, albeit promising. Workplace interventions based on strength training have been shown to reduce MP in workers from different settings, including industrial workers,[11] health care personnel,[12] or office workers.[13] However, despite the potential effects of strength training for reducing MP, no previous studies have examined the associations between leisure-time strength training and MP.

According to the current general guidelines[14] for an adequate musculoskeletal health, individuals should perform strengthening activities 2 to 3 times per week. However, these guidelines are for healthy adult population, and it remains unclear if workers may prevent or reduce MP by following them.

New studies are needed to examine associations between MP and strength training in specific populations and conditions, so more effective exercise recommendations can be provided, for example, in terms of the number of training sessions that a worker should perform per week (frequency), or the magnitude of the effort while training (intensity). The key challenges as this field of occupational health moves forward are to best identify the most appropriate strength training recommendations for working populations. As well as dose magnitude requires to be prescribed with precision in drugs, a similar level of accuracy to prescription of strength training is needed to obtain optimal results. Unluckily, little is known about optimal intensity and

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frequency of strength training for effective management of MP among working populations.

Thus, to bridge these gaps in the current literature, this study sought to analyze the association between frequency and intensity of strength training and MP in the back, neck–shoulder, and arm–hand among PTs. It was hypothesized that performing high-intensity strength training, that is, >80% of the repetition maximum (RM), >3 times per week would reduce MP rather than lower intensities. The findings of this study could eventually contribute to design effective prevention and intervention strategies, aimed to reduce MP rates among PTs.

Methods

This cross-sectional study was conducted in 2017, as part of a larger research study investigating the working environment among PTs. Registered PTs from different professional associations were invited to participate in the study. PTs already retired or not actively working at the time of the investigation were excluded. The present study received ethical approval from the University of Valencia's Ethical Committee (H1530736596718) in accordance with the principles of the Declaration of Helsinki and was designed and reported according to the Strengthening the Reporting of Observational studies in Epidemiology guidelines, to ensure comprehensive reporting of the data.[15] All data of the study were treated anonymously.

Procedures

An e-mail invitation was sent to the members of different professional PT associations in Spain inviting them to voluntarily participate in the study. The e-mail explained the aim of the study, including a link to the online questionnaire. A reminder e-mail was sent after 1 month, inviting PTs to participate if they had not done already.

Questionnaire Content

The questionnaire was pilot tested by 10 PTs from different settings, who reviewed each question. Once the questions were revised and modified when necessary, an online questionnaire was made using the online tool "Google Forms" (Google Inc, Mountain View, CA) for the response compilation and the data storage. Due to data privacy reasons, the setting of the survey system was set to "anonymous"; that is, it was not possible to link the individual responses to the individual e-mails of the participants.

The questionnaire was designed to collect information about self-reported MP and strength training intensity and frequency during leisure time among PTs. From the questionnaire, information on gender, age, body mass index, education, and substance use were extracted.

MP Assessment

To report the prevalence and pain intensity in the neck–shoulder, arm–hand, and back during the last month, a modified Nordic Musculoskeletal Questionnaire[16] was used. Using a simple body diagram highlighted with specific body areas (neck–shoulder, arm–hand, and back), subjects reported the presence of MP responding the question "Have you had trouble (ache, pain, discomfort) in any of the following body areas for at least 24 hours during the last month?" with "yes" or "no" as possible options. When the answer was "yes," they were asked to rate pain intensity using a 0 to 10 numeric rating scale, where 0 meant "no pain at all" and 10 meant "pain is as bad as it could possibly be."

The Nordic Musculoskeletal Questionnaire has been reported to be a valid screening tool,[16] with sensitivity ranging between 66% and 92%, and specificity between 71% and 88%.[17]

Self-Reported Levels of Strength Training During Leisure Time

Participants reported their involvement in strength training by answering the following questions: "During a typical week, do you do any physical activity at your leisure time specifically designed to strengthen your muscles, such as weight lifting, elastic-band training, push-ups . . . ?" Those who answered "yes" were then asked about training frequency and intensity. Frequency was defined as the number of training sessions per week and was categorized as 0, 1 to 2, or ≥3 times per week. Intensity was defined as the magnitude of the effort while training in reference of their RM, allowing for 3 possible responses: ≤50% 1RM, 51% to 79% 1RM, or ≥80% 1RM. These cut points were established according to current general strength training guidelines.[14]

Statistical Analysis

All statistical analyses were performed using SAS statistical software for Windows (version 9.4; SAS Institute Inc, Cary, NC). Descriptive statistics were used to report demographic characteristics of the participants, including age, body mass index, gender, education, smoking, alcohol units per week, and pain intensity (≥3 on a scale of 0–10 in the back, neck–shoulder, and arm–hand). Using binary logistic regression, odds ratios (ORs) and 95% confidence intervals were calculated for having low MP (<3 on a scale of 0–10) in different body areas (dependent variables) in function of the frequency (0, 1–2, and ≥3 times/wk, respectively) and intensity (≤50% 1RM, 51%–79% 1RM, and ≥80% 1RM, respectively) of strength training as mutually adjusted independent variables (reference category: 0 min/wk for the frequency and ≤50% for the intensity), after adjusting for confounding factors (gender, education, experience, and work factors).

According to a previous study that compared ORs with effect sizes (Cohen *d*), ORs of 1.68, 3.47, and 6.71 correspond to small, medium, and large effect sizes, respectively.[18] Because we evaluated effects rather than associations, we decided to use the terms "weak," "moderate," and "strong" positive associations for ORs of 1.68, 3.47, and 6.71, respectively. For ORs of <1, the reciprocal of the OR should be considered; that is, ORs of 0.60, 0.29, and 0.15 correspond to weak, moderate, and strong negative associations, respectively.

Results

A total of 1006 PTs replied to the questionnaire. Twenty-five questionnaires were excluded from analysis because of missing data for at least one of the main variables of the study. Thus, the final sample size was 981 subjects. Relevant characteristics of the participants of the study are summarized in Table 1, including demographic data and pain intensity (≥3 on a scale of 0–10 in the back, neck–shoulder, and arm–hand). The prevalence of MP in the neck–shoulder, arm–hand, and back was 43.4%, 23.9% and 42.1%, respectively.

The OR estimates for experiencing a lower level of pain (<3 on a scale of 0–10) in the neck–shoulder, arm–hand, and back as a function of leisure-time strength training frequency and intensity are detailed in Table 2. Strong associations for having lower levels of pain in all the studied body areas were found in those PTs who reported performing high-intensity strength training (≥80% 1RM). However, the odds for having lower pain levels were not significantly higher among PTs performing lower intensities (≤50% 1RM and 51%–79% 1RM) in any body part. As shown in Table 2, the analysis did not show any significant association between strength training frequency and lower levels of pain in any body part.

Discussion

The importance and originality of this study are that it explores the associations of leisure-time strength training variables such as frequency and intensity with MP among PTs. Therefore, this study makes a major contribution to research on MP in occupational settings, by demonstrating that high-intensity strength training (≥80% 1RM) is strongly associated with lower levels of MP in neck–shoulder, arm–hand, and back among PTs. However, the number of sessions of strength training per week (frequency) and lower intensities were not significantly associated with MP in any body part.

As hypothesized, performing high-intensity strength training during leisure time (≥80% 1RM) is strongly associated with lower levels of MP among PTs. Overall, current evidence recognize that high intensities in strength training are more effective than low intensities to improve muscle strength,[19] neural adaptations,[20] and seem to be more effective in the treatment of chronic musculoskeletal disorders.[10,21–23] Thus, PTs performing high-intensity muscle strengthening activities during leisure time may be better prepared to face the inherent physical challenges of their profession, likely decreasing the relative exposure during strenuous work activities. This could, in turn, reduce work-related disorders and MP. Supporting this assumption, previous studies using workplace interventions in other occupational groups have reported comparable results. For instance, 20 weeks of high-intensity strength training at the workplace reduced neck and shoulder pain among laboratory technicians,[11] and reduced neck–shoulder pain and headache among office workers.[24]

Interestingly, our analysis did not reveal any association between frequency and MP, so our hypothesis is partially confirmed. Thus, strength training frequency might not be determinant for achieving pain reductions, whereas other parameters such as intensity or volume may play a more important role. In fact, it could be plausible that under intensity and volume-equated conditions, higher frequencies would help avoid the accumulation of fatigue within training sessions, which would consequently contribute to reduce MP. However, the lack of associations of our results is consistent with previous research. For example, Andersen et al[25] compared 3 different strength training programs among office workers with neck and shoulder pain, finding that 1 hour per week of specific strength training was enough to produce reductions in neck pain in spite of the time combination (1 session of 60 min, 3 sessions of 20 min, and 9 sessions of 7 min, respectively). Moreover, in a recent study among resistance-trained men, no hypertrophy or muscular endurance differences were found between training 3 and 6 times per week when volume was equated.[26] In the same vein, a recent systematic review with

Table 1 Demographics, Lifestyle, and Pain

Characteristics	n	Mean	SD	%
Gender				
Men	288			29.4
Women	693			70.6
Education				
Bachelor, 3 y	479			48.8
Bachelor, 4 y	236			24.1
Master	258			26.3
PhD	8			0.8
Smoking				
No	852			86.9
Yes	129			13.2
Age, y	981	34.3	8.0	
Body mass index, kg·m^{-2}	981	23.3	3.4	
Alcohol, units per week	981	2.2	2.3	
Pain intensity, 0–10 mean (SD) and % ≥3				
Neck–shoulder	981	2.6	2.2	43.38
Arm–hand	981	1.5	1.9	23.88
Back	980	2.5	2.2	42.09

Table 2 ORs (95% CIs) for Having a Low Level of Musculoskeletal Pain (<3 on a Scale of 0–10) in the Neck–Shoulder, Arm–Hand, and Back From Frequency and Intensity of Strength Training

Parameters	n	%	Neck–shoulder pain OR (95% CI)	Arm–hand pain OR (95% CI)	Back pain OR (95% CI)
Strength training frequency, wk^{-1}					
0	611	61.0	1	1	1
1–2	213	21.3	0.91 (0.65–1.27)	0.88 (0.60–1.29)	1.09 (0.77–1.53)
≥3	178	17.8	0.97 (0.68–1.39)	1.00 (0.66–1.52)	1.01 (0.71–1.45)
Strength training intensity, %					
<50	143	36.7	1	1	1
60–70	220	56.4	0.95 (0.59–1.55)	1.20 (0.70–2.09)	0.98 (0.60–1.60)
>80	27	6.9	**5.08 (1.36–18.92)**	**5.22 (1.11–24.51)**	**5.22 (1.41–19.28)**

Abbreviations: CI, confidence interval; OR, odds ratio. Note: Bold indicates statistical significance ($P < .05$).

meta-analysis found no differences on muscle strength gains after different volume-equated strength training frequencies.[27]

Evidence supports the notion that exercise is protective for numerous health disorders through multiple pathways.[28] However, the biological mechanisms by which strength training can reduce MP remain poorly understood. Previous studies have suggested that increased muscle strength could reduce the relative workload during daily activities,[29] correct movement patterns,[30] and it could also be influenced by the additional supply of oxygen-rich blood to the region being trained.[31] Other suggested mechanism is the increase in circulating blood levels of endocannabinoids and the activation of the endogenous opioid system during exercise, leading to exercise-induced hypoalgesia, which is the typical response to an acute bout of exercise (including aerobic and resistance exercise) in healthy pain-free subjects.[32] In addition, inflammation has been associated with the development and persistence of various pathological pain states.[33] Therefore, the anti-inflammatory response of strength training might have influenced the lower levels of MP in our study population. It has been shown that among young adults, protocols using high intensities have a more favorable response in low-grade inflammation than low intensities, for example, by reducing C-reactive protein or interleukine-6.[34] Besides the potential effect in reducing MP, strength training interventions may also have the ability to elicit additional benefits in terms of mental and physical health. Thus, a dual effect is realized for PTs performing strength training activities, including improved quality of life and cognitive function,[35] which from a biopsychosocial standpoint, may contribute to address more potential risk factors associated with MP.

There are inherent challenges in defining the optimal dose for reducing and/or preventing MP among specific occupational groups. Foremost, it is difficult to separate the impact of one training variable from the others. However, based on our results, promotion of strength training to reduce MP should emphasize the use of high intensities, while frequency seems less relevant. Despite the optimal training intensity for targeting MP has yet to be determined, it seems that to obtain health benefits in terms of reduction of MP, strength training has to be of sufficient intensity to cause adaptive changes in the neuromuscular system. Supporting this assumption, our results suggest that the most beneficial intensity of strength training to target MP among PTs in arm–hand, shoulder–neck, and back is ≥80% 1RM. In addition, the previous physical fitness level of a subject can drastically determine the physiological response of strength training. For instance, greater and faster neural adaptations (eg, motor unit recruiting and firing patterns) can be expected in untrained subjects[36] as well as longer elevated protein synthesis.[37,38] It could be hypothesized that these differences in muscle adaptations could also affect the potential for achieving MP reductions, but new studies are needed to confirm it. Thus, general recommendations may serve as a guide, but because of the considerable interindividual variability in muscle strength responses, individualization might be imperative to achieve optimal results.

As stated previously, it can be challenging to ascertain the optimal dose of strength training to reduce MP among a working population, while still aligning with their work demands. However, it is feasible by studying the habits of specific occupational groups. Although no interventions have been conducted targeting muscle strengthening to reduce MP among PTs, previous studies in other occupational groups support the possibility of successfully intervening in PTs, thereby opening an avenue for future research.

The main limitation of the present study is its cross-sectional design, as it cannot determine causality. Thus, it may be that PTs with high pain levels avoided using high-intensity workouts due to the pain. In addition, because the questionnaire was online, younger participants might have been more disposed to participate as they tend to spend more time online than their older counterparts, and therefore, it could have limited the generalization of our results. Another limitation was the physical activity measurement that was self-reported, so the total amount of physical activity could have been underestimated or overestimated by the social desirability or overcall bias. However, the questionnaire used facilitates its administration to a large number of populations. Furthermore, as we reported frequency as the number of training days per week, those participants who trained more than once a day may have been represented inadequately. Importantly, our study enhances the current understanding of the contributing factors involved in MP among PTs, providing novel data.

Conclusions

Performing high-intensity strength training (≥80% 1RM) during leisure time is strongly associated with lower levels of MP in arm–hand, neck–shoulder, and back. However, neither frequency nor lower intensities showed associations with MP in any body part. These findings should provide guidance on the most favorable intensity of muscle strengthening activities and encourage its practice for preventing and reducing MP among workers with physically demanding tasks, such as PTs.

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VERSIÓ EN VALENCIÀ

Introducció

1. Introducció

Els trastorns múscul-esquelètics relacionats amb el treball són una afecció comuna amb un impacte considerable en la vida d'un individu i és una àrea de gran interés en el camp de la salut ocupacional. Estes condicions incapacitantes, encara que en molts casos prevenibles, són una causa freqüent d'ausentismo en el lloc de treball, causant un impacte significatiu en la qualitat de vida, la qual cosa pot conduir a una disminució de la productivitat així com augmentar els costos d'atenció mèdica per als treballadors, ocupadors i professionals de la salut. No obstant això, este terme i altres com trastornos múscul-esquelètics, ;dolor múscul-esquelètic; lesiones musculoesqueléticas; sovint s'usen indistintament, la qual cosa porta a confusió terminològica. Per a ser consistent i homogeni, al llarg d'este manuscrit, s'utilitzarà el terme dolor múscul-esquelètic.

El dolor múscul-esquelètic és comú entre els professionals de la salut, inclosos els fisioterapeutes, a causa de la naturalesa físicament exigent dels seus treballs. Açò és molt rellevant, ja que els fisioterapeutes constituïxen el 8.21% del total de la força laboral europea d'atenció sanitària (incloses les infermeres, els metges, els dentistes, els farmacèutics i els fisioterapeutes) , amb més de 500,000 professionals treballant en els 28 països europeus. Més específicament, els fisioterapeutes espanyols representen el 7,4% del total de la força laboral sanitària. En realitat, Espanya és un dels països europeus amb més fisioterapeutes, representant quasi el 10% de la quantitat total de fisioterapeutes a Europa. En este context, la fisioteràpia és una professió establida i regulada que brinda servicis a individus i poblacions en circumstàncies on el moviment i la funció estan amenaçats per l'envelliment, lesions, malalties o factors ambientals.

No obstant això, els factors abans mencionats que normalment estan presents en aquells pacients que necessiten fisioteràpia, paradoxalment, també poden afectar la professió de la fisioteràpia. Encara que els fisioterapeutes són especialistes en biomecànica i prevenció de lesions, una complexa varietat de factors de risc pot contribuir al desenrotllament del dolor múscul-esquelètic. Per exemple, com a part del seu treball, els fisioterapeutes estan exposats a alçaments o moviments repetits, postures sostingudes i incòmodes, acatxar-se, carregar, reposicionar o alçar pacients, altes demandes mentals, estrès i també factors d'estil de vida individuals. Estos factors poden empitjorar negativament la qualitat de l'atenció al pacient o conduir a l'absentisme. Dins d'este context, el dolor representa un problema ocupacional significatiu entre els fisioterapeutes; no obstant això, el seu desenrotllament és complex, ja que està influenciat per una immensitat de factors.

De fet, d'acord amb una revisió sistemàtica recent, la prevalença de dolor múscul-esquelètic en fisioterapeutes en el transcurs de la vida va oscil·lar entre 53 i 91%, sent la zona lumbar més comunament afectada, seguida pel coll, els polzes, la part superior de l'esquena i els muscles. No obstant això, estes taxes poden variar segons els diferents factors relacionats amb l'entorn de treball. Per exemple, a causa del grau de dependència física sovint característic dels pacients hospitalitzats, els fisioterapeutes que treballen en hospitals tenen més probabilitats d'alçar i realitzar transferències de pacients, mentres que els fisioterapeutes en ubicacions no hospitalàries tenen una major freqüència d'usar tècniques manuals en compte d'alçar càrregues pesats o traslladar pacients dependents.

En realitat, els fisioterapeutes que realitzen tècniques manuals i tracten a un gran nombre de pacients per dia són més propensos a tindre dolor en els polzes, les mans o el canyell, mentres que altres àrees del cos, com la part superior de l'esquena, l'esquena baixa, el coll, el maluc i el genoll, són més prevalents en altres entorns com la rehabilitació neurològica o la pediatria. Finalment, altres factors que poden augmentar el risc de desenrotllar dolor múscul-esquelètic en els fisioterapeutes són l'augment de l'edat; la qual cosa pareix un tema de preocupació per als fisioterapeutes menors de 30 anys o menys experimentats, treballar en clíniques en compte de en llocs públics o ser del sexe femení. Per tant, millorar el nostre coneixement sobre el dolor múscul-esquelètic i els factors relacionats amb el treball entre els fisioterapeutes pot ser rellevant per a mantindre a esta professió en una condició saludable.

No obstant això, el dolor múscul-esquelètic és particularment difícil de discutir en termes absoluts, la qual cosa suggerix que el treball només contribuïx en part a l'aparició del dolor múscul-esquelètic. A pesar que els factors biomecànics, com l'alta exposició física, les posicions corporals, etc., es reporten freqüentment com a causes principals i / o factors de risc per a tindre dolor múscul-esquelètic, estos no estan relacionats linealment amb les taxes de prevalença del dolor múscul-esquelètic descrites en la literatura. Açò justifica la necessitat d'analitzar altres variables que podrien influir en el dolor múscul-esquelètic entre estos professionals. Per exemple, estudis previs han mostrat que, entre els treballadors, el dolor múscul-esquelètic es considera la principal causa de discapacitat i jubilació anticipada i representa una amenaça significativa per a la capacitat laboral, a curt i llarg termini.

De fet, si bé la majoria dels estudis observacionals s'han centrat en el dolor en un sol lloc, està ben establert que les persones amb dolor localitzat freqüentment tenen queixes coexistents en altres àrees del cos. En realitat, experimentar dolor en una sola part del cos ha demostrat que augmenta el risc de desenrotllar dolor en altres / múltiples regions del cos un any després. El dolor en múltiples llocs pareix tindre un pitjor pronòstic que el dolor en un sol lloc, i s'ha suggerit que experimentar dolor múscul-esquelètic en múltiples àrees del cos augmenta la probabilitat de desenrotllar dolor crònic. Açò pot estar relacionat amb una sensibilització central de la percepció del dolor en condicions de dolor crònic. A pesar del gran nombre d'estudis que han trobat associacions entre la presència de dolor i la capacitat laboral entre els treballadors de diferents grups ocupacionals, encara hi ha molta incertesa sota aquesta relació en fisioterapeutes.

Açò planteja la pregunta de fins a quin punt la presència de dolor múscul-esquelètic en un sol lloc o en múltiples llocs pot influir en la capacitat de treballar en els fisioterapeutes. Tenint en compte que la baixa capacitat laboral és un fort predictor de la discapacitat laboral futura i la jubilació anticipada, i el seu declivi podria desafiar a la professió i al seu tracte de pacients, és necessari comprendre la contribució del dolor múscul-esquelètic en un sol lloc i en múltiples llocs i el seu potencial associació amb menors nivells de capacitat laboral entre els fisioterapeutes. Especialment perquè la possibilitat de tindre una vida laboral millor i més llarga depèn en gran manera de la capacitat laboral.

Per esta raó, comprendre com el dolor en un sol lloc i en múltiples llocs pot influir en la capacitat de treball dels fisioterapeutes i altres factors modificables com l'activitat física i els nivells d'entrenament de força durant el temps lliure també podrien ajudar a disminuir les altes taxes de prevalença trobades en esta professió. En este context, l'activitat física regular ha demostrat proporcionar nombrosos beneficis per a la salut, inclosa la millora de la qualitat de vida, el funcionament físic i la reducció del risc de mortalitat. De la mateixa manera, els estudis observacionals han trobat que l'exercici físic s'associa positivament amb el dolor múscul-esquelètic en poblacions treballadores.

Un mecanisme proposat per a justificar aquestos efectes és que al millorar la capacitat física, la càrrega de treball física relativa pot disminuir. Per tant, els treballadors podrien estar més preparats per a enfrontar els desafius físics inherents a les seues tasques laborals. A més, hi ha un creixent cos de literatura que reconeix l'entrenament de força com a pedra angular per al maneig i la prevenció de diversos trastorns de salut. L'entrenament de força pot previndre i / o disminuir els riscos associats amb malalties cròniques, ja que està relacionat amb un menor risc de mortalitat per totes les causes, una reducció significativa en la diabetis tipus 2 o malaltia cardiovascular, entre altres.

No obstant això, els efectes de l'entrenament de força sobre el dolor múscul-esquelètic entre les poblacions treballadores pareixen menys clars, encara que prometedors. De la mateixa manera que la magnitud de la dosi requereix ser prescrita amb precisió en medicaments, es necessita un nivell de precisió semblant al de la prescripció d'entrenament de força per a obtindre resultats òptims. Desafortunadament, se sap poc sobre la intensitat òptima i la freqüència de l'entrenament de força per al maneig efectiu del dolor múscul-esquelètic entre les poblacions treballadores.

Comprendre el vincle entre tals variables i el dolor múscul-esquelètic ajudarà a adaptar les intervencions específiques, així com a proporcionar recomanacions per a mantindre un sistema múscul-esquelètic saludable entre els fisioterapeutes. No obstant això, abans de realitzar tals intervencions entre els fisioterapeutes, és important conèixer les seues demandes de treball i estudiar els hàbits i l'entorn laboral específic d'este grup ocupacional específic.

1.1. Objectius i hipòtesis

Este estudi va formular com a objectius:

- Investigar l'associació entre els factors relacionats amb el treball i el dolor múscul-esquelètic en l'esquena, el coll i les extremitats superiors entre els fisioterapeutes: plantegem la hipòtesi que els factors relacionats amb el treball, com no tindre prou experiència professional, treballar en hospitals públics, i el tractament d'un nombre més gran de pacients per setmana podria augmentar les probabilitats de dolor múscul-esquelètic entre els fisioterapeutes;

- Analitzar l'associació entre la pràctica d’activitat física moderada i vigorosa en el temps lliure i el dolor múscul-esquelètic en els fisioterapeutes;

- Investigar la prevalença del dolor local i multi-lloc entre els fisioterapeutes, l'associació entre la intensitat del dolor i els nivells de capacitat de treball, i l'associació entre el nombre de llocs de dolor i la capacitat de treball: plantegem la hipòtesi que els alts nivells d'intensitat de dolor percebuda estan associats amb menor capacitat de treball entre els fisioterapeutes, i que esta associació augmenta de forma dosi-resposta amb múltiples llocs de dolor;

- Analitzar l'associació entre la freqüència i la intensitat de l'entrenament de força i el dolor múscul-esquelètic en l'esquena, el coll, el muscle i la mà del braç entre els fisioterapeutes: plantegem la hipòtesi que realitzar un entrenament de força d'alta intensitat; és a dir, > 80% de la repetició màxima (RM), més de 3 vegades per setmana reduiria el dolor múscul-esquelètic més que les intensitats més baixes.

Mètodes

2. Mètodes

2.1. General

El disseny d'esta investigació va ser de tipus transversal. Abans de dur a terme la investigació, es va obtindre l'aprovació ètica del Comité d'Ètica de la Universitat de València. El qüestionari va ser dissenyat per a recopilar informació sobre les característiques dels fisioterapeutes i el seu entorn de treball, seguint les recomanacions de les guies STROBE (von Elm et al., 2007). La col·lecció d'nformació va ser realitzada des de Gener fins a Juny de 2017.

2.2. Participants

Entre els possibles participants es trobaven fisioterapeutes treballant activament que estigueren registrats en associacions professionals de fisioterapeutes de diferents comunitats autònomes de tota Espanya.

2.3. Grandària de la mostra

D'acord amb una eina online (https://www.surveymonkey.com) i considerant el nombre estimat de fisioterapeutes en Espanya (54,258) i en Europa (554,000), una mostra de 783 participants va ser considerada apropiada per a tindre un nivell de confiança del 95% i un marge d'error del 3.5%.

2.4. Procediments

Abans de dur a terme la investigació, es va obtindre l'aprovació ètica del Comité d'Ètica de la Universitat de València (H1530736596718), d'acord amb les normes étiques de la Declaració de Helsinki en 1964. Una vegada el projecte va estar aprovat, els investigadors van contactar amb les principals associacions professionals de fisioterapeutes espanyoles per a demanar permís per a invitar els seus membres a participar de forma voluntària. Previament es va realitzar una prova pilot del qüestionari per a assegurar-se de que cada pregunta fora clara. El qüestionari es va enviar junt amb una carta que incloïa la descripció del projecte.

2.5. Contingut del Qüestionari

El qüestionari va ser dissenyat per a recopilar informació sobre les característiques dels fisioterapeutes i el seu entorn de treball, i va incloure:

1. Demografia, estil de vida i preguntes relacionades amb el treball;
2. Preguntes sobre la presència i intensitat del dolor múscul-esquelètic en 9 àrees corporals diferents;
3. índex de capacitat laboral (amb les seues 7 subescales);
4. Activitat física durant el temps lliure
5. Entrenament de força durant el temps lliure.

2.5.1. Demografia, estil de vida i preguntes relacionades amb el treball

La primera secció del qüestionari va consistir en preguntes tancades sobre la demografia, l'estil de vida i la informació relacionada amb el treball dels participants. Els participants van proporcionar dades sobre la seua edat, sexe, altura, pes, consum d'alcohol, hàbits de fumar, educació i activitat física d'oci. Les preguntes relacionades amb el treball van incloure: anys d'experiència professional, hores de treball per setmana en el treball principal de fisioteràpia, nombre de pacients tractats per setmana, si van tractar a més d'un pacient al mateix temps, tipus primari de pacients, tipus primari de tractament, si van ajustar la taula d'exploració quan va ser necessari, la posició de treball i l'entorn de pràctica del treball principal de fisioteràpia.

2.5.2. Dolor múscul-esquelètic

Per a evaluar el dolor múscul-esquelètic, es van incloure preguntes sobre la presència i intensitat de dolor múscul-esquelètic en 9 àrees corporals diferents (utilitzant el Nordic Musculoskeletal Questionnaire, els subjectes van informar la presència de dolor múscul-esquelètic responent a la pregunta "Ha tingut dolor o molèsties durant almenys 24 hores en l'últim mes en els següents àrees del cos?"; amb opcions de resposta "sí" o "no").

2.5.3. Capacitat laboral

La capacitat de treball autoinformada dels participants es va mesurar utilitzant l'Índex de capacitat de treball (WAI). Este instrument consta de les següents set categories: 1) Capacitat laboral actual en comparació amb la millor de tota la vida, 2) Capacitat laboral en relació amb les demandes físiques i mentals del treball, 3) Nombre de malalties actuals diagnosticades per un metge, 4) Estimació discapacitat laboral per malalties, 5) baixa per malaltia durant l'últim any, 6) pronòstic propi de la capacitat per a treballar d'ací a dos anys, i 7) recursos mentals. La puntuació final es calcula sumant els punts estimats per a cada ítem (J. Ilmarinen, 2007) . La puntuació WAI varia de 7 a 49 punts, distingint quatre categories diferents: WAI pobre (7-27 punts) , WAI moderat (28-36) , WAI bo (37- 43) i WAI excel·lent (44-49 punts). La validesa interna d'aquest instrument ha sigut descrita prèviament, trobant-se una relació satisfactòria amb altres proves més objectives (Eskelinen et al., 1991; Nygård et al., 1991).

2.5.4. Activitat física durant el temps lliure

El nivell d'activitat física durant el temps lliure es va evaluar d'acord amb el Qüestionari Global d'Activitat Física (GPAQ) (Armstrong i Bull, 2006). Es van codificar les categories d'activitat física baixa, moderada i vigorosa, que van resultar en una variable binària amb dos valors: activitat física moderada i vigorosa. L'activitat física moderada es va definir com "activitats que requerixen un esforç físic moderat i provoquen xicotets augments de la freqüència respiratòria o cardíaca", i l'activitat física vigorosa es va denominar "activitats que requerixen un gran esforç físic i provoquen grans augments de la freqüència respiratòria o cardíaca". Cada una d'estes variables es va categoritzar segons la suma de minuts recomanats durant una setmana normal (0, 0-149 min o> 150 min d'activitat física moderada, o 0, 0-74 o> 75 min d'activitat física vigorosa) (Garber et al., 2011).

2.5.5. Entrenament de força durant el temps lliure

Els nivells d'entrenament de força en el temps lliure van ser evaluats mitjançant les preguntes següents: "Durant una setmana típica, realitza alguna activitat física en el seu temps lliure específicament dissenyada per a enfortir els seus músculs, com per exemple alçament de pesos, entrenament amb banda elàstica, flexions...?" i preguntes sobre la freqüència i la intensitat de l'entrenament.

2.6. Anàlisis estadístiques

Totes les anàlisis estadístiques es van realitzar amb el programari estadístic SAS per a Windows (Proc Logistic, SAS v9.4). Es va fer estadística descriptiva per a descriure la prevalença de dolor múscul-esquelètic local i multi-lloc, intensitat del dolor (>3 en una escala de 0-10 en l'esquena, coll / muscles i braç / mà) , factors relacionats amb el treball (tindre altres treballs, anys d'experiència, sector, tipus d'ocupació, hores de treball per setmana, nombre de pacients per setmana, tractar a més pacients al mateix temps, tipus principal de pacients, tipus principal de tractaments, ajust de la taula d'exploració quan siga necessari i posició de treball), nivells d'activitat física durant el temps lliure, entrenament de força durant el temps lliure i característiques demogràfiques (edat, altura, pes, sexe, educació, tabaquisme o unitats d'alcohol per setmana). Mitjançant regressió logística binària, es van calcular els *odds ratios* (OR) i els intervals de confiança (IC) del 95% per a examinar les associacions entre:

Estudi I: dolor múscul-esquelètic moderat a alt (> 3 en una escala de 0-10, categoria de referència: dolor 0-2) en diferents parts del cos i factors relacionats amb el treball;

Estudi II: tindre menor nivell de dolor múscul-esquelètic i realitzar activitat física moderada en el temps lliure (0, 1-149 y >150 minuts per setmana) com variables independents mútuament ajustades (categoria de referència: 0 minuts per setmana);

Estudi III: menor nivell de capacitat de treball i la seua associació amb la intensitat del dolor i el dolor en múltiples llocs;

Estudi IV: tindre menors nivells de dolor múscul-esquelètic (<3 en una escala de 0-10) en diferents parts del cos (variables dependents) en funció de la freqüencia (0, 1-2 i més de 3 vegades per setmana, respectivament) e intensitat (≤50% RM, 51-79% RM i >80% RM, respectivament) de l'entrenament de força durant el temps lliure. Els punts de tall es van establir d'acord amb les pautes generals actuals d'entrenament de força. Els possibles factors de confusió es van ajustar en dos models diferents: el

Model 1 controlat per edat i sexe; model 2 controlat per edat, sexe, educació i factors relacionats amb el treball (inclosos anys d'experiència, hores de treball, entorn, tipus de tractament, nombre de pacients per setmana i lloc de treball).

RESULTATS

3. Resultats

Dels 1006 qüestionaris que van ser contestats pels fisioterapeutes, 25 qüestionaris amb mancança d'informació en les principals variables de l'estudi van ser exclosos de l'anàlisi. Per tant, es van analitzar les dades dels 981 qüestionaris restants.

La població de fisioterapeutes d'estudi tenia una edat mitjana de 34,3 ± 8,0 anys, el 29,4% eren homes i el 70,6% dones, i com a mitjana tenien un IMC de 23,3 ± 3,4 kg / m^2 (**Taula 1**).

Taula 1. Característiques dels participants.

	N	Mitja	SD	%
Sexe				
Home	288			29.4
Dona	693			70.6
Educació				
Diplomat (3-anys)	479			48.8
Graduat (4-anys)	236			24.1
Master	258			26.3
PhD	8			0.8
Fuma				
No	852			86.9
Sí	129			13.2
Edat (anys)	981	34.3	8.0	
IMC (kg/m^2)	981	23.3	3.4	
Alcohol (unitats per setmana)	981	2.2	2.3	

Abreviatures: N= mostra; SD= Desviació estàndar; IMC= Índex de masa corporal; PhD=Doctorat

3.1. Factors relacionats amb el treball i dolor múscul-esquelètic (Estudi I)

Els resultats de les anàlisis de regressió logística binària (**Taula 2**) van mostrar que els factors relacionats amb el treball associats amb una major probabilitat de tindre dolor moderat a alt (>3 en una escala de 0-10) en les àrees superiors del cos van ser; tractar a més pacients al mateix temps; (OR 2.14 [IC 95%, 1.53-2.99]) , treballar més de 45 hores per setmana; [OR, 1.73 (IC 95%, 1.05-2.84)], i treballar assegut; [OR, 2.04 (IC 95%, 1.16-3.57)].

"Més anys d'experiència" va mostrar una associació negativa per al dolor en el colze [OR, 0,41 (IC del 95%, 0,21 - 0,78)] i dolor lumbar [OR, 0,48 (IC del 95%, 0,29 - 0,79)] en comparació amb fisioterapeutes amb menys experiència.

Table 2. Odds ratios i 95% CI per a tindre dolor múscul-esquelètic (≥ 3 en una escala de 0-10) en different parts del cos en relació a diversos factors relacionats amb el treball.

				Coll	Muscle	Esquena alta	Lumbar	Colze	Mà/canell
Pregunta	Resposta	N	%	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Altre treball	No	896	89.2	1	1	1	1	1	1
	Si	109	10.9	1.38 (0.87 - 2.18)	1.54 (0.98 - 2.41)	1.00 (0.62 - 1.60)	1.12 (0.72 - 1.74)	0.68 (0.36 - 1.29)	0.76 (0.47 - 1.23)
Experiència	0-5 yrs	256	25.5	1	1	1	1	1	1
	6-15 yrs	495	49.3	0.86 (0.58 - 1.27)	**0.62 (0.41 - 0.92)**	1.06 (0.72 - 1.58)	**0.63 (0.43 - 0.93)**	**0.58 (0.35 - 0.94)**	1.15 (0.77 - 1.72)
	> 15 yrs	254	25.3	**0.57 (0.35 - 0.94)**	**0.51 (0.30 - 0.85)**	0.87 (0.52 - 1.46)	**0.48 (0.29 - 0.79)**	**0.41 (0.21 - 0.78)**	0.90 (0.53 - 1.52)
Sector	Públic	276	27.5	1	1	1	1	1	1
	Píblic i privat	44	4.4	1.95 (0.91 - 4.17)	**2.80 (1.34 - 5.82)**	1.08 (0.51 - 2.32)	0.94 (0.45 - 1.93)	0.97 (0.39 - 2.44)	1.57 (0.76 - 3.24)
	Privat	685	68.2	**1.54 (1.07 - 2.21)**	**1.49 (1.01 - 2.20)**	1.41 (0.97 - 2.06)	1.20 (0.84 - 1.72)	0.83 (0.51 - 1.34)	0.97 (0.66 - 1.43)
Tipus de treball	Contractat	644	64.1	1	1	1	1	1	1
	Autònom	361	35.9	1.31 (0.92 - 1.84)	1.32 (0.93 - 1.88)	0.97 (0.69 - 1.37)	1.04 (0.74 - 1.45)	1.02 (0.65 - 1.59)	1.41 (0.99 - 2.00)
Hores per setmana de treball	< 35	317	31.5	1	1	1	1	1	1
	35-45	568	56.5	0.91 (0.65 - 1.26)	1.24 (0.88 - 1.75)	1.37 (0.98 - 1.93)	1.31 (0.95 - 1.82)	0.81 (0.53 - 1.24)	0.84 (0.60 - 1.18)
	>45	120	11.9	1.37 (0.82 - 2.31)	1.18 (0.70 - 2.00)	**2.10 (1.25 - 3.50)**	**1.73 (1.05 - 2.84)**	1.64 (0.89 - 3.02)	1.31 (0.79 - 2.16)
Nombre de pacients per setmana	<30	357	35.6	1	1	1	1	1	1
	30-50	319	31.8	1.06 (0.75 - 1.49)	**1.57 (1.09 - 2.25)**	1.05 (0.74 - 1.48)	0.79 (0.56 - 1.11)	1.15 (0.73 - 1.81)	0.94 (0.65 - 1.34)
	>50	328	32.7	1.27 (0.84 - 1.91)	**1.86 (1.21 - 2.86)**	**0.65 (0.42 - 0.98)**	0.70 (0.47 - 1.05)	1.12 (0.66 - 1.90)	1.10 (0.72 - 1.67)
Tractar a més pacients simultàniament	No	523	52.0	1	1	1	1	1	1
	Si	482	48.0	1.28 (0.91 - 1.80)	0.84 (0.59 - 1.19)	1.16 (0.82 - 1.63)	**2.14 (1.53 - 2.99)**	1.26 (0.82 - 1.95)	1.19 (0.84 - 1.69)
Tipus principal de pacients	Musculoskeletal	800	79.6	1	1	1	1	1	1
	Neurological	171	17.0	1.09 (0.74 - 1.60)	1.28 (0.86 - 1.91)	1.28 (0.87 - 1.88)	1.29 (0.88 - 1.88)	0.62 (0.35 - 1.08)	0.99 (0.66 - 1.49)
	Other	34	3.4	1.26 (0.57 - 2.77)	1.11 (0.49 - 2.53)	**0.51 (0.19 - 1.33)**	**0.40 (0.17 - 0.94)**	1.43 (0.54 - 3.76)	0.71 (0.29 - 1.75)
Tipus principal de tractaments	Teràpia manual	783	77.9	1	1	1	1	1	1
	Exercici físic	176	17.5	**0.66 (0.46 - 0.95)**	1.06 (0.72 - 1.55)	0.97 (0.66 - 1.42)	0.89 (0.62 - 1.28)	0.83 (0.51 - 1.35)	0.73 (0.49 - 1.08)
	Electroteràpia	31	3.1	0.95 (0.43 - 2.07)	0.51 (0.19 - 1.41)	**3.02 (1.37 - 6.64)**	0.61 (0.28 - 1.37)	1.04 (0.38 - 2.90)	0.82 (0.35 - 1.94)
	Altres	15	1.5	1.82 (0.50 - 6.56)	1.11 (0.33 - 3.72)	1.41 (0.45 - 4.45)	0.96 (0.30 - 3.10)	0.96 (0.19 - 4.87)	**0.36 (0.08 - 1.70)**
Adjustament de la taula d'exploració	No	96	9.6	1	1	1	1	1	1
	Yes	909	90.5	1.40 (0.88 - 2.21)	0.69 (0.43 - 1.09)	1.10 (0.68 - 1.77)	0.96 (0.61 - 1.51)	1.35 (0.70 - 2.60)	1.47 (0.89 - 2.43)
Posició al treballar	De peu	610	60.7	1	1	1	1	1	1
	De peu i assegut	325	32.3	1.10 (0.82 - 1.47)	1.15 (0.85 - 1.56)	0.93 (0.69 - 1.26)	0.78 (0.58 - 1.04)	1.32 (0.90 - 1.92)	0.94 (0.69 - 1.28)
	Assegut	70	7.0	1.40 (0.80 - 2.46)	0.90 (0.50 - 1.61)	1.36 (0.78 - 2.35)	**2.04 (1.16 - 3.57)**	1.35 (0.66 - 2.74)	0.99 (0.56 - 1.78)

Abreviatures: N= mostra; CI= Interval de confiança

3.2. Activitat física al temps lliure i dolor múscul-esquelètic (Estudi II)

Respecte a l'activitat física en el temps lliure, les probabilitats d'experimentar nivells més baixos de dolor en el coll i el muscle van ser majors en els fisioterapeutes que realitzaven 75 minuts o més d'activitat física recreativa vigorosa per setmana (OR 1.43; IC 95%: 1.05-1.94), amb 0 minuts per setmana d'activitat física vigorosa com a referència (**Taula 3**).

No obstant això, l'anàlisi no va revelar cap diferència significativa entre l'activitat física recreativa vigorosa i el dolor en el braç, la mà o l'esquena. Les probabilitats de tindre nivells més baixos de dolor no van ser significativament menors en aquells fisioterapeutes que realitzen activitat física moderada en el temps lliure (Estudi 2). La part del cos amb dolor més comunment afectada va ser el coll (36.3%), seguit de la part baixa de l'esquena (32.3%), la part superior de l'esquena (21.9%) i la mà / canell (21.6%). Un terç dels enquestats va informar una intensitat moderada del dolor en el coll, seguit de la part baixa de l'esquena (25.9%), la part superior de l'esquena (22.4%) i la mà / canell (20.9%).

Taula 3. Odds ratios (95% confidence intervals) per a tindre menys dolor múscul-esquelètic (<3 en una escala de 0-10) en coll-muscle, braç-mà i esquena segons diferent duracions d'activitat física moderada i vigorosa durant el temps lliure.

	Min/setmana	N	%	Dolor de coll-muscle OR (95% CI)	Dolor de braç-mà OR (95% CI)	Dolor d'esquena OR (95% CI)
	0	256	25.5	1	1	1
AF Moderada	1-149	360	35.8	1.15 (0.80 - 1.66)	1.17 (0.77 - 1.76)	1.13 (0.79 - 1.62)
	150 or more	389	38.7	0.80 (0.56 - 1.15)	1.07 (0.72 - 1.61)	0.98 (0.69 - 1.39)
	0	409	40.7	1	1	1
AF Vigorosa	1-74	104	10.4	0.92 (0.57 - 1.48)	0.71 (0.41 - 1.21)	0.72 (0.45 - 1.15)
	75 o més	492	49.0	**1.43 (1.05 - 1.94)**	0.84 (0.59 - 1.19)	1.20 (0.89 - 1.63)

Abreviatures: AF= Activitat física; OR= Odds Ratio; CI= Interval de confiança

3.3. Dolor local o multi-lloc i capacitat laboral (Estudi III)

La prevalença d'alta intensitat del dolor en 0, 1-2, 3-4 i > 5 parts del cos va ser 39.3%, 32.5%, 19.4% i 8.8% respectivament (**Taula 4**). A més, es va trobar una relació dosi-resposta entre el nombre de llocs de dolor i una menor capacitat de treball, especialment quan el dolor estava present en més d'un lloc simultàniament. Per exemple, amb una intensitat de dolor baixa com a referència, es va trobar una associació moderada-a-fort per a nivells més baixos de capacitat de treball en els fisioterapeutes que van informar dolor de> 5 en 1-2 regions del cos. Esta associació va ser més fort quan els participants van informar dolor en 3-4 regions i inclús més fort quan el dolor es va experimentar en 5 o més llocs (**Taula 5**).

Taula 4. Odds ratios (95% intervals de confiança) per a tindre menor capacitat laboral en relació al dolor en parts diferents del cos.

Part corporal	Intensitat del dolor (0-10)	N	%	Model 1 OR (95% CI)	Model 2 OR (95% CI)
Coll	Baix (<2)	312	31.0	1	1
	Moderat (2-5)	328	32.6	**1.67 (1.00 - 2.79)**	**1.72 (1.01 - 2.94)**
	Alt (5-10)	365	36.3	**2.43 (1.50 - 3.96)**	**2.59 (1.55 - 4.33)**
Muscle	Baix (<2)	602	59.9	1	1
	Moderat (2-5)	195	19.4	**2.69 (1.71 - 4.23)**	**2.93 (1.81 - 4.73)**
	Alt (5-10)	208	20.7	**2.66 (1.71 - 4.15)**	**2.96 (1.83 - 4.78)**
Esquena alta	Baix (<2)	560	55.8	1	1
	Moderat (2-5)	224	22.3	**1.65 (1.05 - 2.60)**	**1.70 (1.05 - 2.74)**
	Alt (5-10)	220	21.9	**1.73 (1.11 - 2.71)**	**1.94 (1.20 - 3.14)**
Colze	Baix (<2)	780	77.6	1	1
	Moderat (2-5)	133	13.2	1.54 (0.93 - 2.54)	1.50 (0.88 - 2.55)
	Alt (5-10)	92	9.2	**2.45 (1.45 - 4.15)**	**2.91 (1.63 - 5.20)**
Mà/canell	Baix (<2)	578	57.5	1	1
	Moderat (2-5)	210	20.9	1.33 (0.81 - 2.17)	1.46 (0.87 - 2.47)
	Alt (5-10)	217	21.6	**2.61 (1.72 - 3.98)**	**2.95 (1.88 - 4.63)**
Maluc/cama	Baix (<2)	831	82.7	1	1
	Moderat (2-5)	83	8.3	**2.51 (1.44 - 4.37)**	**2.54 (1.41 - 4.58)**
	Alt (5-10)	91	9.1	**2.68 (1.58 - 4.53)**	**2.62 (1.50 - 4.59)**
Genoll	Baix (<2)	801	79.7	1	1
	Moderat (2-5)	112	11.1	**2.60 (1.58 - 4.27)**	**2.44 (1.43 - 4.14)**
	Alt (5-10)	92	9.2	**3.71 (2.22 - 6.20)**	**3.94 (2.27 - 6.83)**
Peu/turmell	Baix (<2)	908	90.4	1	1
	Moderat (2-5)	54	5.4	**4.14 (2.24 - 7.68)**	**4.24 (2.19 - 8.20)**
	Alt (5-10)	43	4.3	**2.58 (1.24 - 5.34)**	**2.51 (1.13 - 5.59)**
Lumbar	Baix (<2)	420	41.8	1	1
	Moderat (2-5)	260	25.9	**2.27 (1.33 - 3.88)**	**2.29 (1.31 - 4.01)**
	Alt (5-10)	325	32.3	**4.58 (2.85 - 7.35)**	**4.73 (2.88 - 7.77)**

Model 1: Ajustat per edat i sexe

Model 2: Ajustat per edat, sexe, educació i factors relacionats amb el treball

Taula 5. Odds ratios (95% intervals de confiança) per a tindre menor capacitat laboral en relació al nombre de llocs de dolor amb al menys 5 punts en una escala de 0-10.

Nombre de llocs amb dolor > 5 en una escala de 0-10	N	%	Model 1 OR (95% CI)	Model 2 OR (95% CI)
0	395	39.3	1	1
1-2	326	32.5	**2.14 (1.27 - 3.60)**	**2.28 (1.33 - 3.90)**
3-4	195	19.4	**4.02 (2.36 - 6.82)**	**4.30 (2.45 - 7.52)**
5 o més	88	8.8	**6.13 (3.31 - 11.38)**	**7.07 (3.63 - 13.75)**

Model 1: Ajustat per edat i sexe

Model 2: Ajustat per edat, sexe, educació i factors relacionats amb el treball

3.4. Variables de l'entrenament de força i dolor múscul-esquelètic (Estudi IV)

Es van trobar fortes associacions per a tindre nivells més baixos de dolor en totes les àrees corporals estudiades en aquells PT que van informar haver realitzat un entrenament de força d'alta intensitat (>80% RM). No obstant això, les probabilitats de tindre nivells de dolor més baixos no van ser significativament més altes entre els fisioterapeutes que realitzen intensitats més baixes (≤50% RM i 51-79% RM) en qualsevol part del cos. L'anàlisi no va mostrar cap associació significativa entre la freqüència de l'entrenament de força i menors nivells de dolor en cap part del cos (**Taula 6**).

Taula 6. Odds ratios (95% intervals de confiança) per a tindre menor nivell de dolor múscul-esquelètic (<3 en una escala de 0-10) in coll-muscle, braç-mà i esquena respecte a la freqüència i intensitat de l'entrenament de força.

Freqüència de l'entrenament de força	N	%	Dolor coll-muscle OR (95% CI)	Dolor braç-mà OR (95% CI)	Dolor esquena OR (95% CI)
$0 \cdot setmana^{-1}$	611	61.0	1	1	1
$1\text{-}2 \cdot setmana^{-1}$	213	21.3	0.91 (0.65 - 1.27)	0.88 (0.60 - 1.29)	1.09 (0.77 - 1.53)
$\geq 3 \cdot setmana^{-1}$	178	17.8	0.97 (0.68 - 1.39)	1.00 (0.66 - 1.52)	1.01 (0.71 - 1.45)
Intensitat de l'entrenament de força					
≤ 50%	143	36.7	1	1	1
51-79%	220	56.4	0.95 (0.59 - 1.55)	1.20 (0.70 - 2.09)	0.98 (0.60 - 1.60)
≥80%	27	6.9	**5.08 (1.36 - 18.92)**	**5.22 (1.11 - 24.51)**	**5.22 (1.41 - 19.28)**

Discussió

4. Discussió

El present estudi va ser dissenyat per a explorar els factors associats amb el dolor múscul-esquelètic entre els PT, inclosos els relacionats amb el treball en si (abordat en l'Estudi I) , l'activitat física (Estudis II i IV) i l'associació del dolor múscul-esquelètic en múltiples llocs amb la capacitat laboral dels fisioterapeutes (Estudi III).

Com un intent de brindar una discussió fàcil de llegir dels principals resultats d'aquest estudi amb la literatura científica, esta secció es dividirà en sis subseccions, abordant cada un dels temes principals en què s'ha enfocat la present investigació, i dos seccions finals que aborden les fortaleses i limitacions, i les aplicacions pràctiques.

4.1. Factors relacionats amb el treball i dolor múscul-esquelètic (Estudi I)

Respecte a la primera pregunta d'investigació, es va trobar que factors relacionats amb el treball com la falta d'experiència professional, treballar en clíniques privades, treballar en posició assentada i alta càrrega de treball es van associar amb major risc d'experimentar dolor múscul-esquelètic entre els PT. Estos resultats són consistents amb una revisió sistemàtica recent que va suggerir que les altes taxes de prevalença de dolor múscul-esquelètic en fisioterapeutes amb menys anys d'experiència professional podrien explicar-se a causa de la falta d'habilitats per al maneig de pacients i l'escassetat de pràctica per a reduir el risc de tindre dolor múscul-esquelètic (Vieira et al., 2016) .

De fet, un estudi anterior (Nyland i Anne, 2003) va informar que inclús els estudiants de fisioteràpia de pregrau tenen una major probabilitat de desenrotllar dolor lumbar durant el seu entrenament, la qual cosa suggereix que els nous fisioterapeutes poden estar ingressant a la força laboral amb dolor lumbar existent. Altres estudis van suggerir que la baixa prevalença de dolor múscul-esquelètic en terapeutes majors podria estar relacionada amb el desenrotllament d'estratègies de prevenció de lesions per a fer front a les demandes físiques dels seus treballs, com la modificació de les tècniques de tractament o l'augment de l'ús de personal de suport quan siga necessari (Bork i col., 1996) .

L'efecte *healthy workers* (treballador sa) també pot estar en joc, és a dir, els fisioterapeutes que no adopten estratègies preventives poden deixar la professió abans o canviar de treball, sent una possible explicació de les baixes taxes de prevalença de dolor múscul-esquelètic en aquest grup d'edat (Bork et al., 1996). També podria ser plausible que els fisioterapeutes amb menys experiència estiguen menys familiaritzats amb les demandes físiques del seu lloc de treball, mentres que els fisioterapeutes amb més experiència van desenrotllar una tolerancia al dolor més alta a causa d'un major volum de treball. Tenint en compte estos resultats, estudis futurs haurien d'investigar amb més detall els aspectes relacionats amb l'edat del dolor múscul-esquelètic en fisioterapeutes. Es podria especular que el risc disminueix després dels primers anys degut a millors rutines de treball i pràctica i que el risc augmenta novament després de molts anys d'exposar el cos a condicions laborals físicament extenuants.

El tipus de tractament també pareix jugar un paper important en la prevalença del dolor múscul-esquelètic en els fisioterapeutes. Els nostres resultats van mostrar una associació positiva amb el dolor quan la teràpia manual és el tipus principal de tractament. Així mateix, es va observar que existia una associació positiva débil a moderada per a tindre dolor moderat a alt (>3 en una escala de 0-10) en la mà / canell i en el coll, al comparar-ho amb altres tipus de tractaments primaris com l'exercici físic , que va mostrar una associació negativa amb el dolor de coll. Com es va informar anteriorment, procediments com la mobilització articular, la tracció manual i / o les tècniques de teràpia manual ortopèdica es van associar amb dolor en la mà / canell (Bork et al., 1996; Cromie et al., 2000; Grooten et al., 2011). De fet, Bork et al., 1996 van informar que els fisioterapeutes que habitualment realitzaven teràpia manual eren 3,5 vegades més propensos a tindre símptomes en el canell o la mà que els que no realitzaven tals tècniques, la qual cosa suggereix que les tècniques de teràpia manual podrien augmentar l'estrés mecànic en àrees anatòmiques específiques, sent una font important de dolor en les extremitats superiors dolor (Bork et al., 1996). L'associació significativa entre els que tractaven a un nombre més gran de pacients per setmana i el dolor de muscle no va ser sorprenent. Açò podria explicar-se pel seu paper principal en el moviment de les extremitats superiors i, per tant, per ser més propensos a l'esgotament després de majors càrregues de treball. De fet, s'ha vist que la repetició i la monotonia són factors que contribueixen a l’aparició de dolor de muscle (Buckle & Devereux, 2002).

Curiosament, es van trobar associacions negatives per al dolor d'esquena superior i el tractament de més de 50 pacients per setmana, en comparació amb els fisioterapeutes que van tractar a menys pacients. Els músculs de la part superior de l'esquena tenen una funció estabilitzadora, per la qual cosa probablement esta musculatura puga adaptar-se millor a les demandes laborals més altes i, en conseqüència, podria exercir algun paper com a mecanisme protector del dolor múscul-esquelètic. No obstant això, les associacions van ser dèbils, per la qual cosa es necessiten més estudis per a corroborar esta suposició.

Els fisioterapeutes que treballen més hores a la setmana també tenen un major risc de dolor lumbar que els que treballen menys. D'acord amb els nostres resultats, investigacions prèvies han reportat una forta relació entre treballar més hores a la setmana i risc de lesions entre els professionals de la salut (Trinkoff et al., 2003), i més específicament entre els fisioterapeutes (Cromie et al., 2000). En conseqüència, un estudi anterior va trobar associacions dèbils a moderades entre el nombre d'hores setmanals que realitzen tractaments de rehabilitació i un major risc de dolor múscul-esquelètic en el muscle / colze, així com un major risc en el canell / polze per a aquells fisioterapeutes que treballen més hores i realitzar tractaments manuals (Rozenfeld et al., 2010).

No obstant això, aquestos resultats han d'interpretar-se amb cautela, ja que diferents factors de risc poden coexistir en combinació amb altres, i quan dos o més estan presents junts, pot augmentar les probabilitats de desenrotllar dolor múscul-esquelètic, especialment quan estos professionals tenen una càrrega de treball excessiva, duració prolongada de treball, períodes de descans insuficients o treball monòton sense variacions de tasques (Yassi, 1997).

Encara que investigacions anteriors han informat de l'associació entre treballar en hospitals públics i una major prevalença de dolor múscul-esquelètic en comparació amb fisioterapeutes que treballen en llocs no relacionats amb hospitals (Alrowayeh et al., 2010; Bork et al., 1996), el present estudi va trobar resultats oposats. Els fisioterapeutes que treballaven en el sector privat (és a dir, una clínica privada), en comparació amb els que treballaven en hospitals públics, tenien més probabilitats de tindre nivells més alts de dolor múscul-esquelètic, especialment en el coll i els muscles. Estes associacions van ser encara més pronunciades en els fisioterapeutes que treballaven tant en el sector públic com en el privat.

Una possible explicació per als presents resultats podria ser la naturalesa de la professió de fisioteràpia a Espanya, ja que els fisioterapeutes que treballen en el sector privat tendeixen a tindre jornades més llargues en comparació amb què treballen en entorns públics, que tenen una jornada laboral fixa de 7 hores. Durant aquest temps, tenen diversos descansos, la qual cosa els permet moure's i caminar. No obstant això, en entorns privats, el temps de treball pot ser variable, incloent més hores i menys descansos, especialment quan el salari depén del volum de tractaments. A més, els fisioterapeutes en les clíniques privades solen tindre un espai més limitat que en els hospitals, tenint una menor possibilitat de desplaçament (el que també pot determinar el tipus de tractament utilitzat). Segons un estudi previ (Liao et al., 2016), les clíniques privades de fisioteràpia poden no tindre l'equip adequat i menys estudiants de Fisioteràpia per a realitzar feines bàsiques.

En este sentit, el treball altern; que permet pauses en activitats que d'una altra manera serien repetitives o mantingudes; és essencial en la prevenció de dolor múscul-esquelètic (Cromie et al., 2000), sent una possible explicació de les menors taxes de dolor múscul-esquelètic entre els fisioterapeutes que treballen en hospitals públics.

Els nostres resultats suggereixen que treballar principalment en una posició assentada augmenta les probabilitats de patir dolor múscul-esquelètic, especialment en la zona lumbar. Estos resultats estan en concordança amb un estudi previ entre una població treballadora general, que va mostrar que estes associacions podrien ser produïdes per una possible relació entre estar assentat durant molt de temps i la càrrega estàtica contínua sobre el sistema múscul-esquelètic (Andersen et al., 2007).

4.2. Activitat física en el temps lliure i dolor múscul-esquelètic (Estudi II)

Per a aclarir el paper que té l'activitat física en el temps lliure sobre el dolor múscul-esquelètic, varem analitzar aquestes associacions en els fisioterapeutes. Els principals resultats van ser que realitzar 75 o més minuts d'activitat física vigorosa per setmana es va associar amb nivells més baixos de dolor de coll i muscles entre els fisioterapeutes. No obstant això, el mateix nivell d'activitat física vigorosa pareixia no conferir el mateix benefici en l'esquena o en el braç-mà, motiu pel qual la nostra hipòtesi es va confirmar parcialment. L'activitat física moderada durant el temps lliure no va mostrar cap associació significativa amb el dolor múscul-esquelètic entre els fisioterapeutes.

En el nostre estudi, la prevalença de dolor (intensitat > 3 en una escala de 0 a 10) en coll-muscle i esquena va ser del 43,4% i 42,1% respectivament. S'han descrit prèviament taxes semblants entre els fisioterapeutes (Vieira et al., 2016) en termes de prevalença al llarg de la vida. La naturalesa físicament exigent del treball dels fisioterapeutes podria ser una possible explicació d'aquestos resultats, assumint que pot sobrepassar la capacitat física del treballador. En conseqüència, l'associació trobada entre l'activitat física vigorosa i el dolor múscul-esquelètic suggeriria que l'augment de la quantitat total d'activitat física recreativa vigorosa podria ser eficaç per a previndre i / o reduir el dolor de coll-muscle entre els fisioterapeutes. Els nostres resultats són consistents amb estudis previs entre professionals de la salut, que també van trobar una associació entre l'activitat física en el temps lliure i el dolor (Barbosa et al., 2013).

En eixe estudi, els participants van incloure metges, infermeres, dentistes, terapeutes ocupacionals i fisioterapeutes, entre altres, no obstant això, els autors no van distingir entre activitat física vigorosa o moderada. D'altra banda, estos resultats no descarten la influència d'altres factors, ja que el dolor està influenciat per una diversitat de molts factors que fa que el seu maneig siga una tasca complexa (Hua & Cabot, 2014).

Si bé l'exercici físic és un tractament recomanat per al maneig en atenció primària del dolor lumbar agut i crònic (Foster et al., 2018), les associacions entre l'activitat física i el dolor lumbar es caracteritzen per resultats contradictoris. Seguint la mateixa tendència que els nostres resultats, dos revisions sistemàtiques anteriors no van poder establir una relació entre l'activitat física i el dolor lumbar inespecífic (Hendrick et al., 2011; Sitthipornvorakul et al., 2011). Esta aparent falta d'associació podria atribuir-se a la naturalesa multifactorial del dolor lumbar. Al contrari, una revisió sistemàtica recent va concloure que l'activitat física en el temps lliure pot tindre un efecte protector modest que redueix el risc de tindre dolor lumbar entre un 11% i un 16% (Shiri & Falah-hassani, 2017). Estos resultats prou contradictoris poden deure's a l'heterogeneïtat i les limitacions dels estudis originals; no obstant això, el paper de l'activitat física en el temps lliure en el dolor lumbar encara és desconegut.

D'acord amb les pautes d'activitat física per a adults de l'Organització Mundial de la Salut, els adults han de fer almenys 150 minuts d'activitat física moderada per setmana, o 75 minuts d'activitat física d'intensitat vigorosa, o una combinació equivalent d'ambdós tipus d'activitat física (World Health

Organization, 2010). Una major quantitat d'activitat física pot proporcionar beneficis addicionals. Al contrari, més del 25% dels enquestats va informar no realitzar cap activitat física moderada setmanalment, i quasi el 40% va informar no realitzar cap activitat física intensa durant el temps lliure. No obstant això, estos resultats han d'interpretar-se amb atenció, ja que els subjectes amb dolor tendeixen a subestimar els seus nivells d'activitat física (Vollenbroek-Hutten & Hermens, 2011) i també poden haver sigut influenciats pel caire de record. Encara així, estes taxes podrien alertar-nos de que l'activitat física no rep suficient atenció per part del fisioterapeutes.

La relació de l'entrenament físic amb el dolor múscul-esquelètic també es pot inferir d'estudis controlats aleatoritzats que investiguen l'efecte d'intervencions d'activitat física en poblacions treballadores. En aquest sentit, s'han realitzat diversos intents per a trobar la dosi i el tipus d'exercici òptims per a obtindre beneficis clínicament rellevants en els nivells de dolor múscul-esquelètic entre els treballadors. Si bé alguns estudis no han trobat majors beneficis de les intervencions d'exercici en el dolor de coll en comparació amb l'activitat ordinària (Viljanen et al., 2003), altres han mostrat reduccions significatives del dolor múscul-esquelètic utilitzant diferents modalitats d'exercici. En particular, l'entrenament de força centrat en les àrees del cos afectades ha demostrat ser eficaç per a reduir el dolor de coll i muscles entre treballadors de diferents entorns.

Per exemple, 20 setmanes d'entrenament de força d'alta intensitat en el lloc de treball van demostrar ser efectives per a reduir el dolor de coll i muscles en tècnics de laboratori (Zebis et al., 2011). Intervencions més curtes també han trobat resultats semblants, per exemple, 10 setmanes d'entrenament de força d'alta intensitat en el lloc de treball en comparació amb un programa en la llar van mostrar efectes positius en la reducció del dolor múscul-esquelètic i la ingesta setmanal d'analgèsics entre les treballadores de la salut (Jakobsen et al., 2015). El comú en estos estudis és que l'exercici es va realitzar de manera vigorosa, és a dir, amb alta intensitat. Combinat amb els resultats del present estudi, açò suggereix que l'exercici o les activitats físiques han de realitzar-se preferiblement de manera vigorosa per a tindre una influència positiva important sobre el dolor múscul-esquelètic.

4.3. Dolor i capacitat de treball en un o més llocs (Estudi III)

Es va trobar que la intensitat del dolor en diferents àrees del cos estava associada amb una menor capacitat de treball entre els fisioterapeutes que treballaven activament. Així mateix, va ser evident una forta associació dosi-resposta entre el nombre de llocs de dolor i una menor capacitat de treball. Curiosament, el dolor lumbar no sols va ser una de les àrees del cos més prevalents afectades pel dolor múscul-esquelètic, sinó que també es va associar fortament amb nivells més baixos de capacitat laboral. Els participants que van informar nivells alts de dolor lumbar tenien un risc més de quatre vegades major de nivells més baixos de capacitat per al treball en comparació amb aquells que van qualificar la intensitat del dolor amb puntuacions <2.

El dolor en les mans o en qualsevol altra part de l'extremitat superior pot afectar significativament la capacitat de treball dels fisioterapeutes, ja que les tècniques manuals d'una forma o una altra són una part inherent de la professió de fisioteràpia. No obstant això, un resultat inesperat va ser que només el dolor d'alta intensitat, i no moderat, en el colze / avantbraç i la mà / canell es va associar amb nivells més baixos de capacitat de treball. Una possible explicació seria que els fisioterapeutes desenvolupen estratègies d'afrontament per a continuar treballant a pesar de la presència de dolor moderat, realitzant altres tècniques en què l'extremitat superior podria no estar compromesa, o utilitzant mesures de protecció com a fèrules per al polze, ajudes per a fer mobilitzacions o dispositius per a teixits blans (Campo et al., 2008).

Per tant, una disminució en la realització de les tècniques de teràpia manual podria explicar la reducció del risc de trastorns múscul-esquelètics del canell i de la mà. En conseqüència, els resultats del nostre estudi suggereixen que la majoria dels fisioterapeutes que tenien dolor moderat en les mans / canells o colzes, podrien no realitzar tècniques de teràpia manual amb tanta freqüència com aquells que van informar una alta intensitat de dolor. En conseqüència, no presenten un risc significatiu de nivells més baixos de capacitat laboral, en comparació amb aquells fisioterapeutes que realitzen principalment tècniques manuals.

D'acord amb els nostres resultats, la literatura pareix consistent amb la presència de dolor múscul-esquelètic i el seu impacte negatiu en la capacitat per al treball. Per exemple, un estudi anterior va revelar que tant el dolor múscul-esquelètic com l'augment de l'estrés s'associen de forma independent amb una menor capacitat de treball en una altra ocupació que també depén del treball de les extremitats superiors durant gran part de la jornada laboral, a saber, les tècniques de laboratori (Jay et al., 2015). Atés que el WAI inclou 7 categories diferents, es podria suggerir que la seua segona i sèptima subescala (capacitat de treball en relació amb les demandes físiques i mentals del lloc i recursos mentals) podria ser menor en aquells fisioterapeutes amb alta càrrega de treball o en aquells que estan tractar a més pacients per setmana, la qual cosa resulta en nivells més alts de dolor degut, per exemple, a un augment de la tensió muscular.

Un dels problemes que sorgeix d'aquesta suposició és si la presència de dolor és el que condueix a una menor capacitat de treball, o si tindre una menor capacitat de treball augmenta les probabilitats de tindre dolor múscul-esquelètic. No obstant això, estudis previs suggereixen que la naturalesa direccional és del dolor a la capacitat de treball i no al revés (Lindegård et al., 2014; Miranda et al., 2010). A més, altres autors van trobar que els treballadors que van informar tindre dolor en dos o més llocs tenien nivells més baixos de funcionalitat en comparació amb aquells que només tenien dolor en un lloc (Kamaleri et al., 2008; Saastamoinen et al., 2006).

El nostre estudi va demostrar que el dolor en múltiples llocs en els fisioterapeutes té una forta associació amb nivells més baixos de capacitat laboral. En aquells fisioterapeutes que van presentar alta intensitat de dolor en 1 o 2 regions, les probabilitats de reduir els nivells de capacitat per al treball van ser més del doble, en comparació amb aquells amb baixa intensitat de dolor. Quan el nombre de llocs de dolor era de 3 a 4, el risc era més de 4 vegades major, i en aquells fisioterapeutes amb dolor en 5 o més llocs del cos, el risc era 6 vegades major deprés d'ajustar l'anàlisi per edat i sexe, i més de 7 vegades major quan es va ajustar per edat, sexe, educació i factors relacionats amb el treball.

Desafortunadament, la majoria de la literatura que investiga el dolor en múltiples llocs com un factor predictiu de mala capacitat laboral utilitza treballadors de la població laboral en general (Miranda et al., 2010; Neupane et al., 2011). Ja que les exposicions físiques i psicosocials varien en gran manera entre els grups de treball, és necessari analitzar factors d'ocupacions específiques. Entre els pocs estudis que van incloure professionals de la salut, només un estudi va incloure fisioterapeutes; encara que només representaven el 5,1% del nombre total de participants. En l'estudi mencionat anteriorment, els autors van trobar que la probabilitat de tindre una capacitat de treball deficient era 3 vegades major quan els participants experimentaven múltiples llocs de dolor en comparació amb cap dolor.

Experimentar múltiples llocs de dolor ha demostrat predir la jubilació anticipada per discapacitat, i té una forta associació amb el risc de discapacitat laboral a llarg termini, així com amb un deteriorament de la salut psicològica, els nivells educatius i la qualitat del son (Haukka et al., 2015). No obstant això, els mecanismes subjacents darrere d'estes associacions encara no estan establits. En aquest sentit, les malalties reumàtiques autoimmunes (per eixemple Artritis reumatoide, lupus eritematós sistèmic, esclerodèrmia o vasculitis sistèmiques) entre altres, poden manifestar símptomes musculars com a miàlgies generalitzades (Goldblatt & O'Neill, 2013), la qual cosa podria explicar parcialment les altes taxes de prevalença de dolor en múltiples llocs i les associacions trobades amb nivells més baixos de capacitat laboral. No obstant això, deixant de costat els casos específics de patologia real, es podrien considerar altres variables per a comprendre les implicacions que té el dolor multi-lloc en els fisioterapeutes.

Per exemple, els resultats de les Enquestes Mundials de Salut Mental (World Mental Health Surveys), un estudi que va involucrar a 17 països i va incloure a més de 85000 participants, van mostrar diferències notables en les taxes de prevalença del dolor crònic d'esquena i coll, que van del 9,7% al 42,1%. Estes diferències són massa àmplies per a ser justificades per l'estrés mecànic, la qual cosa suggereix que altres factors com els trastorns mentals (per exemple, depressió o ansietat) podrien exercir un paper important (Demyttenaere et al., 2007). No obstant això, l'estudi mencionat només va analitzar les condicions de dolor crònic, i la seua naturalesa transversal no pot determinar si la presència de trastorns mentals és una causa o una conseqüència d'experimentar dolor.

Un estudi anterior va trobar que l'angoixa psicològica i els factors psicosocials com les demandes laborals, l'escàs suport dels col·legues i la insatisfacció laboral prediuen el dolor reportat en el futur en cohorts de treballadors acabats d'emprar (Nahit et al., 2003). A més, un estudi longitudinal d'infermeres i oficinistes espanyols va trobar que la mala salut mental i la tendència a somatitzar predeien la incidència de dolor lumbar (Vargas-Prada et al., 2013). Altres grups ocupacionals d'Espanya (és a dir, podòlegs) també han mostrat una prevalença significativa de dolor múscul-esquelètic en la zona lumbar i coll durant els 7 dies previs (33,02%, 21,85% i 21,62% respectivament) (Llosa et al., 2011).

Els autors d'este estudi van trobar que els grups d'edat més joves, les dones i els podòlegs casats tenien una major prevalença de dolor múscul-esquelètic, la qual cosa suggereix que els factors individuals també podrien exercir un paper important en estes taxes. No obstant això, encara es desconeix el seu paper en l'aparició i manteniment del dolor múscul-esquelètic entre els fisioterapeutes. Una altra possible explicació podria estar relacionada amb com els professionals de la salut, i en particular els fisioterapeutes, entenen el dolor. Hi ha evidència consistent en la literatura sobre la influència negativa de les percepcions i creences negatives sobre el dolor (Bishop et al., 2008; Casey et al., 2008). Les percepcions errònies sobre el dolor són comuns entre els professionals de la salut, inclosos els fisioterapeutes (Bishop et al., 2008; Buchbinder et al., 2009).

Açò genera preocupació pel risc potencial que la seua pròpia professió produeix en ells mateixos, com la confluència de percepcions errònies prèviament reportades trobades entre els fisioterapeutes, com la vulnerabilitat anatòmic / estructural o que confereixen més importància al dany tissular que al nivell de dolor o discapacitat funcional, podria desencadenar un cicle desafortunat de dolor i creences negatives que agreugen el dolor, fet que portaria conseqüències indesitjables en diferents esferes de la vida, inclòs el treball. No obstant això, es necessita més investigació per a corroborar aquestes assumpcions. Per esta raó, es necessiten enfocaments més efectius per a previndre i controlar el dolor a fi de mantindre una força laboral saludable, reduir la càrrega de dolor entre subgrups específics i permetre que la població activa mantinga alts nivells de capacitat laboral al llarg de la seua vida laboral.

4.4. Variables de l'entrenament de força i dolor múscul-esquelètic (Estudi IV)

L'entrenament de força d'alta intensitat (>80% RM) va mostrar estar fortament associat amb nivells més baixos de dolor múscul-esquelètic en coll-muscle, braç- mà i esquena entre els fisioterapeutes. No obstant això, el nombre de sessions d'entrenament de força per setmana (freqüència) i les intensitats més baixes no es van associar significativament amb el dolor en cap part del cos.

En general, l'evidència actual reconeix que les intensitats altes en l'entrenament de força són més efectives que les intensitats baixes per a millorar la força muscular (Schoenfeld et al., 2015), les adaptacions neurals (Jenkins et al., 2017) , i pareixen ser més efectives en el tractament de trastorns múscul-esquelètics crònics (Andersen et al., 2014; Ciolac & Rodrigues-da-Silva, 2016; Kristensen & Franklyn-Miller, 2012; Sveaas et al., 2019). Com els fisioterapeutes amb major càrrega de treball (és a dir, treballar més de 45 hores a la setmana o tractar a més pacients al mateix temps) tenen un major risc de tindre dolor múscul-esquelètic (Ezzatvar et al., 2020), aquells que realitzen activitats d'enfortiment muscular d'alta intensitat durant el temps lliure el temps poden estar millor preparats per a enfrontar les demandes físiques inherents a la seua professió, probablement disminuint l'exposició relativa durant les activitats laborals extenuants.

Açò, al seu torn, podria reduir els trastorns relacionats amb el treball i el dolor múscul-esquelètic. Recolzant esta suposició, estudis anteriors que van utilitzar intervencions en el lloc de treball en altres grups ocupacionals han informat resultats comparables. Per exemple, 20 setmanes d'entrenament de força d'alta intensitat en el lloc de treball van reduir el dolor de coll i muscles entre els tècnics de laboratori (Jay et al., 2015), i van reduir el dolor de coll / muscles i el mal de cap entre els treballadors d'oficina (Gram et al., 2014).

Curiosament, la nostra anàlisi no va revelar cap associació entre la freqüència i el dolor múscul-esquelètic, per la qual cosa nostra hipòtesi està parcialment confirmada. Per tant, la freqüència de l'entrenament de força podria no ser determinant per a aconseguir la reducció del dolor, mentres que altres paràmetres com la intensitat o el volum poden jugar un paper més important. De fet, podria ser plausible que en condicions d'intensitat i volum equiparables, freqüències més altes ajudarien a evitar l'acumulació de fatiga dins de les sessions d'entrenament, la qual cosa en conseqüència contribuiria a reduir el dolor múscul-esquelètic. No obstant això, la falta d'associacions dels nostres resultats és consistent amb investigacions prèvies. Per exemple, un estudi anterior va comparar tres programes d'entrenament de força diferents entre treballadors d'oficina amb dolor de coll i muscles, i va trobar que 1 hora per setmana d'entrenament de força era suficient per a produir reduccions en dolor de coll i muscle independentment de la combinació de temps empleada (1 sessió de 60 minuts; 3 sessions de 20 minuts; i 9 sessions de 7 minuts respectivament) (Andersen et al., 2012).

A més, en un estudi recent entre hòmens entrenats en resistència, no es van trobar diferències d'hipertròfia o resistència muscular entre l'entrenament 3 i 6 vegades per setmana quan es va equiparar el volum. En el mateix sentit, una revisió sistemàtica recent amb metanálisis no va trobar diferències en els guanys de força muscular després de diferents freqüències d'entrenament de força equiparades amb el volum. L'evidència és contundent respecte a que l'exercici protegeix nombrosos trastorns de salut a través de múltiples vies. No obstant això, els mecanismes biològics pels quals l'entrenament de força pot reduir el dolor múscul-esquelètic continuen sent poc coneguts. Estudis anteriors han suggerit que l'augment de la força muscular podria reduir la càrrega de treball relativa durant les activitats diàries, corregir els patrons de moviment, i també podria veure's influenciat pel subministrament addicional de sang rica en oxigen a la regió en moviment.

Un altre mecanisme suggerit és l'augment dels nivells sanguinis circulants d'endocannabinoides i l'activació del sistema opioide endògen durant l'exercici, la qual cosa porta a una hipoalgesia induïda per l'exercici, que és la resposta típica a una sèrie aguda d'exercici (inclosos exercicis aeròbics i de resistència) en persones sanes (Rice et al., 2019). A més, la inflamació s'ha associat amb l'aparició i la persistència de diversos estats patològics que cursen amb dolor (Watkins et al., 2003) .

Per tant, la resposta antiinflamatòria de l'entrenament de força podria haver influït en els nivells més baixos de dolor múscul-esquelètic en la nostra població d'estudi. S'ha demostrat que entre els adults joves, els protocols que utilitzen altes intensitats tenen una resposta més favorable en la inflamació de baix grau que les baixes intensitats, per exemple, al reduir la proteïna C reactiva o la interleucina-6. A més de l'efecte potencial en la reducció del dolor múscul-esquelètic, les intervencions d'entrenament de força també poden tindre la capacitat d'obtindre beneficis addicionals en termes de salut física i mental. Per tant, s'obté un doble efecte per als fisioterapeutes que realitzen activitats d'entrenament de força, inclosa una millor qualitat de vida i funció cognitiva, que des d'un punt de vista biopsicosocial, pot contribuir a abordar més factors de risc potencials associats amb el dolor múscul-esquelètic.

Hi ha reptes inherents en la definició de la dosi òptima per a reduir i / o previndre el dolor múscul-esquelètic entre grups ocupacionals específics. Per exemple, és difícil separar l'impacte d'una variable respecte a les altres. No obstant això, segons els nostres resultats, la promoció de l'entrenament de força per a reduir el dolor múscul-esquelètic hauria d'emfatitzar l'ús d'intensitats altes, mentres que la freqüència pareix menys rellevant. A pesar que encara no s'ha determinat la intensitat d'entrenament òptima per a atacar el dolor múscul-esquelètic, pareix que per a obtindre beneficis per a la salut en termes de reducció del dolor, l'entrenament de força ha de ser de suficient intensitat per a causar canvis adaptatius en el sistema neuromuscular.

Recolzant esta suposició, els nostres resultats suggereixen que la intensitat més beneficiosa de l'entrenament de força per a tractar el dolor múscul-esquelètic entre els fisioterapeutes en braç-mà, muscle-coll i esquena és >80% 1RM. A més d'açò, el nivell de condició física prèvia d'un subjecte pot determinar dràsticament la resposta fisiològica de l'entrenament de força. Per exemple, es poden esperar adaptacions neurals majors i més ràpides (per exemple patrons d'activació i reclutament d'unitats motores) en subjectes no entrenats (Gabriel et al., 2006), així com una síntesi de proteïnes elevada més prolongada (Dames et al., 2015; Phillips et al., 1997). Es podria plantejar la hipòtesi que estes diferències en les adaptacions musculars també podrien afectar el potencial per a aconseguir reduccions del dolor múscul-esquelètic, però es necessiten nous estudis per a confirmar-ho.

Per tant, les recomanacions generals poden servir com guia, però a causa de la considerable variabilitat interindividual en les respostes de força muscular, la individualització ha de ser ser imperativa per a aconseguir resultats òptims. Com es va indicar anteriorment, pot ser un desafiu determinar la dosi òptima d'entrenament de força per a reduir el dolor múscul-esquelètic entre una població treballadora, sense deixar d'alinear-se amb les seues demandes laborals. No obstant això, és factible estudiant els hàbits de grups ocupacionals específics.

4.5. Fortaleses i limitacions

Una fortalesa d'esta investigació és que els anàlisis van ser controlats per a diferents factors de confusió que podrien influir en els resultats (per exemple, edat, sexe, factors relacionats amb el treball i educació). A més, al limitar la població d'estudi només als fisioterapeutes que estaven treballant activament, vam reduir la influència de variables de confusió que podrien haver donat lloc a un caire per al nostre estudi, com a factors socioeconòmics o educatius.

D'altra banda, alguns factors poden limitar la generalització dels resultats d'esta investigació. Primer, la naturalesa transversal d'este estudi no permet determinar la causalitat, ja que l'exposició i el resultat es van avaluar en el mateix moment. En el cas de la relació entre la capacitat laboral i el dolor múscul-esquelètic, uns dels dubtes que sorgeix d'este estudi és si la presència de dolor és el que conduïx a una menor capacitat laboral, o si el fet de tindre una menor capacitat laboral augmenta les probabilitats de tindre dolor múscul-esquelètic.

No obstant això, estudis previs suggereixen que la naturalesa direccional és del dolor al treball i no al revés. En segon lloc, no va ser possible calcular la taxa de resposta, ja que vam haver de contactar amb diferents col·legis professionals per a invitar els seus membres a participar en el nostre estudi. Açò va ser una limitació per al càlcul de la taxa de resposta, ja que no totes els col·legis van col·laborar amb nosaltres en la invitació als seus membres, i alguns d'elles van agregar l'enllaç al qüestionari i la carta de presentació en un butlletí, sent difícil calcular el número exacte de fisioterapeutes que realment van rebre la invitació.

A més, els participants inclosos en este estudi eren exclusivament de la força laboral espanyola, la qual cosa a més podria limitar la generalització dels nostres resultats. A més, aquells fisioterapeutes severament afectats pel dolor múscul-esquelètic poden no haver estat treballant activament durant la investigació i, en conseqüència, exclosos de l'estudi, deixant així una força laboral relativament sana, també coneguda com l'efecte del treballador sa (healthy worker effect), que podria limitar la generalització dels nostres resultats.

A més, pel fet que el qüestionari era online, els participants més joves podrien haver estat més disposats a participar, ja que tendeixen a passar més temps en línia que els seus homòlegs majors, i per tant, podria haver limitat la generalització dels nostres resultats. Una altra limitació va ser que les dades utilitzats en esta investigació es van extraure de l'experiència auto-reportada dels fisioterapeutes. Encara que es van utilitzar qüestionaris validats i confiables, les respostes van ser eminentment subjectives. Per exemple, el mesurament de l'activitat física va ser auto-reportada, per la qual cosa la quantitat total d'activitat física podria haver sigut subestimada o sobreestimada per conveniència social.

No obstant això, el qüestionari utilitzat facilita la seua administració a un gran nombre de subjectes. En tot cas, a pesar dels caires inherents a les preguntes auto-reportades, les respostes auto-reportades de la capacitat laboral són menys propenses a este efecte dels beneficis socials existents i, per tant, són més apropiades per a les comparacions entre estudis, en contrast amb les dades de baixa per malaltia o pensió per discapacitat extrets de fonts oficials, que tendeixen a estar vinculades als sistemes actuals de seguretat social utilitzats per països específics.

A més, com considerem la freqüència com el nombre de dies d'entrenament per setmana, els participants que van entrenar més d'una vegada al dia poden haver sigut representats inadequadament. Per aquest motiu, els resultats han d'interpretar-se amb precaució.

4.6. Aplicacions pràctiques

A pesar d'aquestes limitacions, la present investigació suggereix que a causa del risc notable de tindre dolor múscul-esquelètic en aquesta població, són necessàries estratègies preventives per a reduir els trastorns múscul-esquelètics i garantir una millor vida laboral. En general, i d'acord amb els nostres resultats, tindre un nivell apropiat de condició física es considera l'estratègia actual més reportada utilitzada pels professionals sanitaris perquè puguen continuar treballant.

De fet, en els treballadors amb treballs físicament exigents, l'activitat física d'alta intensitat durant el temps lliure s'associa de manera dosi-resposta amb la capacitat laboral. Per tant, augmentar els nivells d'activitat física durant el temps lliure podria ser un enfocament interessant per a aconseguir este objectiu. No obstant això, promoure només un estil de vida més actiu físicament i seguir les recomanacions actuals d'activitat física general podria ser una recomanació massa simple, i encara així no pareix prou per a reduir les altes taxes de dolor múscul-esquelètic en este grup ocupacional.

A més, realitzar activitat física durant el temps lliure depén de diferents factors, com tindre temps lliure, accés a espais d'activitat, factors culturals i individuals, entre altres. Per tant, la implementació d'intervencions en el lloc de treball podria ser una estratègia efectiva per a millorar els nivells d'activitat física entre els fisioterapeutes i, per tant, per a reduir el dolor múscul-esquelètic. Una revisió sistemàtica va trobar proves sòlides de l'efecte positiu dels programes en el lloc de treball sobre l'activitat física i el dolor múscul-esquelètic.

Des d'una perspectiva biopsicosocial, que inclou factors psicològics, biològics, cognitius, afectius, conductuals i socials en la variabilitat en l'experiència del dolor entre individus, les intervencions en el lloc de treball podrien proporcionar beneficis fisiològics, però també efectes positius sobre el benestar i la socialització amb col·legues, la qual cosa al seu torn, contribuiria a abordar més factors potencials involucrats en el dolor múscul-esquelètic.

Per exemple, com l'entrenament de força d'alta intensitat durant el temps lliure ha demostrat estar fortament associat amb nivells més baixos de dolor múscul-esquelètic, els professionals han de brindar orientació sobre la intensitat més favorable de les activitats d'enfortiment muscular i fomentar la seua pràctica per a previndre i reduir el dolor múscul-esquelètic entre treballadors amb tasques físicament exigents com els fisioterapeutes. No obstant això, atés que l'evidència que mostra que una forma d'exercici és millor que una altra no està disponible, les recomanacions han de centrar-se en programes que tinguen en compte les necessitats, preferències i capacitats individuals al decidir sobre el tipus d'exercici, basant-se en l'evidència científica.

Encara que no s'han realitzat intervencions dirigides a l'enfortiment muscular per a reduir el dolor múscul-esquelètic entre els fisioterapeutes, estudis previs en altres grups ocupacionals protegeixen la possibilitat d'intervindre amb èxit en els fisioterapeutes, la qual cosa obri una via per a futures investigacions. Com a exemple, l'entrenament de força enfocat en àrees doloroses del cos, ha demostrat ser efectiu per a reduir el dolor de coll i muscle entre treballadors de diferents entorns. Per exemple, 20 setmanes d'entrenament de força d'alta intensitat en el lloc de treball van demostrar ser efectives per a reduir el dolor de coll i muscle entre els tècnics de laboratori.

Intervencions més curtes també han trobat resultats semblants, per exemple, 10 setmanes d'entrenament de força d'alta intensitat en el lloc de treball en comparació amb un programa en la llar van mostrar efectes positius que redueixen el dolor múscul-esquelètic i la ingesta setmanal d'analgèsics entre les treballadores de la salut. Comú per a estos estudis és que l'exercici es va realitzar vigorosament, és a dir, amb alta intensitat. En combinació amb els resultats del present estudi, açò suggereix que l'exercici físic o les activitats han de realitzar-se de manera vigorosa per a tindre una influència positiva important en el dolor múscul-esquelètic. Els estudis experimentals futurs haurien de corroborar l'efecte de l'exercici físic específic sobre el dolor múscul-esquelètic en els fisioterapeutes.

En tot cas, les recomanacions generals poden servir de guia, però a causa de la considerable variabilitat interindividual en les respostes de força muscular, la individualització pot ser imprescindible per a aconseguir resultats òptims. Com es va indicar anteriorment, pot ser un desafiament determinar la dosi òptima d'entrenament de força per a reduir el dolor múscul-esquelètic en una població activa, sense deixar d'alinear-se amb les seues demandes laborals. No obstant això, és factible estudiant els hàbits de grups ocupacionals específics.

Conclusions

5. Conclusions

Estudi I: Els nostres resultats suggereixen que diferents factors relacionats amb el treball, inclosa la falta d'experiència professional, treballar en clíniques privades, tractar a més pacients al mateix temps, treballar en una posició assentada, tractar a més de 30 pacients per setmana i treballar més de 45 hora per setmana, s'associen amb dolor múscul-esquelètic entre els fisioterapeutes, especialment en àrees específiques del cos com l'esquena baixa, els muscles o el coll. Els resultats d'este estudi podrien considerar-se per a desenrotllar guies clíniques i desenrotllar intervencions efectives per a previndre el dolor múscul-esquelètic relacionat amb el treball i millors condicions laborals entre els fisioterapeutes.

Estudi II: Realitzar 75 o més minuts d'activitat física vigorosa per setmana s'associa positivament de tindre un menor nivell de dolor múscul-esquelètic en el coll i els muscles entre els fisioterapeutes. Al contrari, ni l'activitat física vigorosa ni la moderada s'associen amb dolor múscul-esquelètic en braç i mà.

Estudi III: Després de controlar possibles factors de confusió, la presència de dolor múscul-esquelètic, especialment quan ocorre en més d'un lloc simultàniament, està fortament associada amb nivells més baixos de capacitat de treball entre els fisioterapeutes. No obstant això, es necessita més investigació per a comprendre millor els mecanismes subjacents involucrats en l'aparició i el manteniment del dolor en este grup ocupacional, així com el paper de la superació, el suport social o els factors psicosocials en la capacitat laboral dels fisioterapeutes. Açò ajudaria a dissenyar intervencions més efectives per a millorar els nivells de capacitat laboral entre els fisioterapeutes i per a garantir una vida laboral més llarga i millor.

Estudi IV: realitzar entrenaments de força d'alta intensitat (igual o superior al 80% de RM) durant el temps lliure està fortament associat amb nivells més baixos de dolor múscul-esquelètic en braç, mà, coll, muscle i esquena. No obstant això, ni la freqüència ni les intensitats més baixes van mostrar associacions amb el dolor múscul-esquelètic en cap part del cos. Aquestos resultats haurien de proporcionar orientació sobre la intensitat més favorable de les activitats d'enfortiment muscular i fomentar la seua pràctica per a previndre i reduir el dolor múscul-esquelètic entre els treballadors amb tasques físicament exigents, com els fisioterapeutes.