Abstract

Aim: To investigate the prevalence of low back pain (LBP) in people with incomplete Spinal Cord Injury (iSCI) and compare these characteristics among three countries.

Method: A cross-sectional, primarily internet based survey, was conducted in the USA, UK and Greece. The Short Form McGill Pain Questionnaire (SF-MPQ) was the main measure used. In addition data were collected on the presence, onset, duration and frequency of LBP.

Findings: Two hundred and nineteen (219) questionnaires were included in the analysis. Anytime LBP was 74% (95% CI 67, 79) and current LBP 66% (95% CI 59, 72). People with paraplegia were 2.75 times more likely to report LBP anytime post iSCI than people with tetraplegia (95% CI 1.38, 5.47). Thirty-three percent of participants reported LBP onset immediately post iSCI and 44% reported daily LBP with UK reporting the highest percentage (59%). The more LBP days felt in a month the worse its quality and intensity. LBP is described as "discomforting" with moderate intensity and people from the UK reported the worst LBP. Finally, people from Greece reported better results for the sensory component of their LBP.

Conclusion: Despite some differences in profile and injury characteristics of the groups from the three nations, LBP presence in iSCI is reported highly for all people in the countries investigated.

Keywords: Spinal cord injury, incomplete, low back pain, prevalence, cross-national.

Introduction

SCI is one of the conditions that have a high impact on the individual's life and a great economical cost to the society (Ma et al 2014). The prevalence of pain in Spinal Cord Injury is very common and can range from 26% to 96% (Dijkers et al 2012). Its influence on the lives of people living with pain is well documented for causing distress, stress, anxiety (Cruz-Almeida et al 2005, Rintala et al 1998), affecting mood and relating to depression (Ataoglu et al 2013). Pain has also been found to interfere with sleep (Cruz-Almeida et al 2005) or activities (Ströud et al 2006) and decrease quality of life (QoL) (Nicholson et al 2009).

In a previous publication (Michailidou et al 2014) we discussed the importance of examining in more detail specific pain locations, like low back pain (LBP) which is also recommended by the International SCI Basic Data Set (ISCIPDS) (Widerström-Noga et al 2014). The prevalence of LBP in people with SCI was found to be 37% (95% CI: 33-42%) (Michailidou et al 2014), suggesting that this can be a major problem for people living with a SCI. Research on this topic is gradually emerging (Miró et al 2014).

The fundamental difference between a complete and an incomplete SCI (iSCI) is that the former results in motor and sensory loss below the level of injury whereas in the latter sensory function is maintained (ASIA 2000). As such, all people with iSCI are able to feel pain in areas including the lower back when the injury is above that level which is not the case with a complete injury. Furthermore, studies have shown that life expectancy and pain characteristics can differ in people with complete and incomplete SCI (Felix et al 2007, Mannion et al 2001). Despite this, most studies pool together in their statistical analysis people with complete and incomplete injuries (Miró et al 2014, Ullrich et al 2008, Widerström-Noga et al 2001). In addition, there are fewer studies in people with iSCI

compared with complete SCI. We conducted a generic online search using the terms "complete SCI" and "incomplete SCI" and the number of papers returned for "complete SCI" were about 10 times more than those for "incomplete SCI". If pain presence is more frequent for people with iSCI than those with compete SCI then, by pooling their data together, the actual problem may be masked impacting this way on awareness and affecting rehabilitation.

Most of the studies examining pain in SCI are conducted in only one country, though often comparisons of different cultural backgrounds of people living in one country are made (Ullrich et al 2008, Felix et al 2007, Markogiannakis et al 2006, Ströud et al 2006, Turner et al 2001). The importance and the need to conduct cross-national research have been discussed in the literature (Kohn 1987). Some cross-national studies examining pain in the general population exist and some are emerging in the SCI population (Baron et al 2017, Divanoglou et al 2010, Breivik et al 2006). There is a lot of work conducted on SCI in both the USA and UK whereas on the other hand, there is little done in Greece.

The present study intents to investigate, in detail, a troubling and common pain location for the general population, that of the lower back, and aims to examine how substantial this problem may be for people living with an iSCI. At the same time it aims to examine similarities or differences across three countries. In more details, the main aims are to:

1) investigate the prevalence, and general characteristics of LBP in people with incomplete SCI who participated in this study,
2) examine the injury and demographic characteristics of people with LBP and iSCI,
3) explore how people with iSCI describe their LBP and
4) compare the findings between the participants from the three countries: Greece, UK and USA.

Methods

Design

A cross-sectional, primarily internet based survey, was conducted in the USA, UK and Greece. The study was advertised in various websites including the Spinal Injury Association (SIA), the National Spinal Cord Injury Association (NSCIA) and "Disability Now". In addition data were collected via screening the medical records of patients in two hospitals in Greece and eligible participants were invited to complete the questionnaire. Questionnaires were also distributed at a medical centre in Greece. The study took place in 2008-2009. Participants had the choice of completing the questionnaire online or on paper with anonymity being secured irrespectively. For the online data collection a web-based survey was used. The same questionnaire was put online separately for each of the 3 countries adjusting for language differences. All questionnaires were piloted for language accuracies and the Greek questionnaire was translated following international translation procedures including forward and backwards translation (Michailidou 2012). Questionnaires were placed on all web sites/hospitals/clinic that were approached and approved of the study.

Completion and return of the questionnaire was considered as giving informed consent. Pre-study sample size calculation required a total number of 185 participants.

Participants' selection

Completed questionnaires were included in the study if they fitted the following inclusion criteria were (1) participants to be at least 18 years old, (2) to live in the UK, USA or Greece, and (3) to report a diagnosis of iSCI.

The completeness of the injury was based on each participant's response on the following options given: 1) complete paraplegia, 2) incomplete paraplegia, 3) complete tetraplegia, 4) incomplete tetraplegia, 5) I do not know. Only people who answered either incomplete tetraplegia or incomplete paraplegia were included.

Measures

Pain related data

Information gathered on LBP included presence, onset, duration and frequency. The presence of LBP was established for four time periods: 1) at any time post injury, 2) at the time of completing the questionnaire (current prevalence of sample), 3) over the last month and 4) over the last three months

Short Form McGill Pain Questionnaire (SF-MPQ)

The MPQ is a widely used measure to assess pain (Melzack et al 1992), which has been translated into many languages (Melzack et al 1992) including Greek (Mystakidou et al 2002, Georgoudis et al 2001). Both the MPQ and the SF-MPQ have been used in studies to assess self-reported pain in adults with SCI (Burke et al 2017, Cardenas et al 2002, Turner et al 2001, Rintala et al 1998). The SF-MPQ has a component called Pain Rating Index (PRI), which gives information on the affective dimension of pain (how the respondent feels) and the sensory dimension (which is the sensation the respondent has). Each of the 15 descriptors on the PRI is scored from 0-3 and they were added to give a total score for each category (sensory, affective and total). These items describe LBP quality and hereafter the PRI results will be referred to as the "LBP quality" results. The SF-MPQ also has a Present Pain Intensity (PPI) numeric rating scale to measure current pain. We included a question about the usual LBP intensity. Due to a technical error, some data on the intensity of LBP using the Numeric Rating Scale (NRS) (0-100) was not collected. However, the total number of responses collected for the intensity of LBP still formed a large enough group for analysis (ranging from 121 to 124).

Statistical Analysis

Analysis was conducted using Stata version 13 (StataCorp 2013). Demographic, injury and pain characteristics were analysed descriptively, with between country statistical tests utilising chi square or one way ANOVA, as appropriate. Modelling the association between prevalence of LBP and demographic and injury related factors was carried out using logistic regression, mutually adjusting for all variables in Table 3. Linear regression was carried out on the scores and indices that came from the SF-MPQ. Unadjusted and adjusted coefficients are shown for LBP quality and intensity in relation to demographic factors (Tables 4 and 5). Relationships between LBP quality and timing of pain onset and pain days are presented unadjusted only (Table 6). Only data from the UK and USA were included in the intensity models because of the large amount of missing data from the Greek sample.

Ethical approval

The School of Health Science and Social Care (SHSSC) Research Ethics Committee, Brunel University, UK, provided ethical approval to conduct the study in the UK, USA and Greece. Local approvals were also given by the two participating hospitals and the medical centre in the cities of Thessaloniki and Kavala (regions of Macedonia, Greece) and the various websites where the study was advertised; including the Spinal Injury Association (SIA), the National Spinal Cord Injury Association (NSCIA) and "Disability Now".

Results

Two hundred and eighty two (282) completed questionnaires were returned and 219 (78%) were included in the analysis. Of the 63 questionnaires excluded, 28 were from people with

complete SCI, 20 from people who did not know the type of their injury, 10 from people from countries other than the three involved in the study (6 from Canada, and one from each of Australia, Hungary, Namibia and Zimbabwe), 2 from people who did not have SCI and 3 had more than 50% of data missing which was the pre-set acceptable level of missing data for a questionnaire to enter data analysis. Per country the excluded questionnaires were; 28 from the USA, 13 from Greece, 12 from the UK.

Of the 219 questionnaires that were analysed, 122 were respondents from the USA (56%), 52 were from the UK (24%) and 45 were from Greece (21%). The total group consisted mainly of males (62%), with a mean age of 50 (SD 14) years. Mean time since injury was 12 (SD 11) years and the main cause of injury was traumatic (71%). People from the UK had the highest level of education above high school (74%). Just above half of the participants (55%) remained in work or education with people from the USA showing the significantly highest percentage (62%). People from the Greek group were significantly older than those from the other two groups. The Greek group were injured at an older age and had a higher percentage of non-traumatic cause of injury (Table 1).

[Insert Table 1 about here]

LBP presence

In our sample, the prevalence of LBP at any time post iSCI was 74%, (95% CI 67, 79). The prevalence of current LBP was 66% (95% CI 59, 72), over the last month was 66% (95% CI 60, 72) and over the last three months was 67% (95% CI 60, 73). There were no significant differences between countries (Table 2). There were no gender differences in the presence of LBP for the total group or between countries. Among people who reported having LBP at any

time after their iSCI, the percentage of current LBP was 88% (95% CI 82, 92), LBP over the last month was 88% (95% CI 71, 83) and over the last three months was 90% (95% CI 84, 94).

[Insert Table 2 about here]

Thirty-three percent of participants reported onset of their LBP immediately post-iSCI and 44% between a month and a year post injury. Greeks reported a slightly lower percentage of LBP onset immediately post iSCI, but 90% of Greeks had LBP within one year of injury (Table 2). Nearly half of respondents (44%) reported daily LBP with 59% of participants from the UK reporting daily LBP (Table 2). LBP was persistent; 39% of people never had a LBP free week, with those from the UK reporting the highest percentage of constant LBP (52%). It was found that, the earlier the onset of LBP the more the days with LBP in the month ($p=0.002$) and this was particularly the case for the USA group ($p=0.001$).

People with a non-traumatic injury and females tended to have LBP more often but these results did not reach statistical significance. People with paraplegia, however, were significantly more likely to report LBP post iSCI at all time points measured compared to people with tetraplegia (Table 3).

[Insert Table 3 about here]

LBP description

Respondents used all 15 SF-MPQ descriptors to portray their LBP. The most infrequently used descriptor was "splitting" (30%) and the most frequently used was "aching" (76%). "Aching" was most commonly ranked as moderate severity (by 36% of respondents), followed by "tiring-exhausting", which was also rated primarily as moderate severity (by

27% of respondents). Forty-one percent of people from the UK described their pain as severe. People from Greece reported "gnawing" as the most frequent type of pain (65%), which was commonly described as mild pain (42%). People from the UK used the most LBP descriptors followed by those from the USA.

People with paraplegia reported significantly higher adjusted mean scores on the sensory dimension of their LBP quality by 4.58 points (95% CI 2.09, 7.07) and the total LBP quality by 4.74 (95% CI 1.27, 8.22) compared to those with tetraplegia (Table 4). People from Greece, in general, reported better LBP quality and in the case of the sensory LBP this was significantly better than people from the USA (-3.66, 95% CI -6.75, -0.56) unadjusted, though this was not sustained when adjusted for other demographic and injury factors (Table 4). People with paraplegia reported significantly higher adjusted levels of LBP intensity for current LBP (Coefficient 13.46, 95% CI 2.16, 24.76), LBP over last month (Coefficient 15.15, 95% CI 4.70, 25.61) and over the last 3 months (Coefficient 16.66, 95% CI 6.29, 27.03) compared to those with tetraplegia (Table 5). Increased number of LBP days per month was significantly related with worse LBP quality (Table 6). The more frequent the LBP, the significantly worse the LBP quality particularly for the sensory dimension and total quality (Table 6). The intensity of LBP, for all time periods, was of moderate level and mainly described as discomforting. There were no significant differences between the USA and UK with regard to LBP intensity. Similar to the results for the quality of LBP, the more LBP days felt in a month the significantly worse the LBP intensity.

[Insert Tables 4, 5 and 6 about here]

Discussion

Using a cross-sectional study, mainly conducted online, the prevalence and characteristics of LBP in people with iSCI who participated in this study, for the total sample and between countries, was investigated. Some differences in the demographic profiles between countries existed for current age, age at injury, employment status and educational attainment. Most people had a traumatic iSCI. The prevalence of LBP following an iSCI, in the group participating in this study, was very high at all time points and similar across nations. Anytime post iSCI prevalence, among the total group of participants, was 74% and current prevalence was 66%. These percentages are higher than those found in our previously published systematic literature review (Michailidou et al 2014) where the prevalence of chronic LBP was found to be 37% (95% CI 33-42%) increasing to 49% (95% CI: 44-55%) among people with SCI and pain in general. One factor that may have affected this is that only people with incomplete SCI participated in our study. Previous studies on LBP in SCI (Molton et al 2008, Ullrich et al 2008, Raissi et al 2007) reported lower LBP prevalence but pooled data from people with complete and incomplete injuries. This cannot be conclusive, but it may have contributed to the difference found in the presence of LBP. The completeness of injury is one of the SCI features that needs to be considered when studying pain in SCI as it could be of importance for health professionals when planning treatment and setting targets for rehabilitation. Other factors which we did not directly examine may have contributed to the higher presence of LBP in our study. For example, the presence of lordosis or scoliosis, which can be found in iSCI (Parent et al 2011, Bergström et al 1999) and they are known to contribute to LBP (Sato et al 2011, Roussouly 2002). No significant differences in the prevalence of LBP between the three participating countries were found.

The nature of LBP cannot be identified from our results though most people described their pain as “aching” which is one of the factors to imply a musculoskeletal pain according to the

updated International Spinal Cord Injury Pain Classification (Bryce et al 2012). The literature has shown that people with SCI have conditions that can be risk factors for mechanical LBP (Parent et al 2011, Ravenscroft et al 2000) suggesting that pain in the lower back could be of musculoskeletal origin. Future studies should investigate the nature of LBP as described by people with iSCI as it can affect pain (Cardenas et al 2006) and response to treatment (Widerström-Noga 2001), which can differ if pain is of neuropathic or nociceptive origin.

We followed recommendations and conducted comparisons between males and females when examining pain (Greenspan et al 2007) but we did not find any gender difference in the presence of LBP for the total group or between countries. People with paraplegia were significantly more likely to report LBP than people with tetraplegia. The presence of pain by the level of injury has been a matter of debate in the literature as, on the one hand, people with lower-level injuries have an increased risk of pain (Rintala et al 1998) but, on the other hand, no such differences have been found (Turner et al 2001). We report, to our knowledge, the first findings about the presence of LBP by the reported level of injury in iSCI alone.

Participants reported a moderate intensity of LBP, which remained relatively stable over three months and was characterised as "discomforting". This finding confirms a previous report on LBP intensity in SCI (Ullrich et al 2008). Another study found a little lower LBP intensity in SCI (Miró et al 2014). People from the UK reported slightly higher LBP intensity than people from the USA, but this was not significantly different. For people with paraplegia the intensity of LBP was significantly higher for all time points measured, which is in agreement with Ullrich et al (Ullrich et al 2008). It is important to study the intensity of pain when managing SCI (Miró et al 2014) as it helps health professionals understand what type of treatment may be needed and if it is likely to be effective (Bryce and Dijkers 2006).

Though there are no other studies describing LBP quality in iSCI alone, the mean PRI (which measures LBP quality) did not differ much from that found by Cardenas et a (Cardenas et al 2002) for mechanical spinal pain in SCI. Likewise, it did not differ from the LBP description in the general population (Norris and Matthews 2008). Participants in the current study primarily used the word "aching", a sensory descriptor, followed by "tiring-exhausting", an affective descriptor. These are the most frequently used descriptors for mechanical spinal pain (Cardenas et al 2002). Using verbal descriptors helps classify pain and "aching" is often used when describing back pain (Roussouly 2002) or musculoskeletal pain (Burke et al 2017, Widerström-Noga et al 2001) in SCI or LBP in the general population (Boissonnault and Fabio 1996).

Our findings show that people with iSCI describe LBP similarly despite sociocultural differences; thus similar clinical pathways for rehabilitation could be implemented across nations. However, two differences may be worth noting; respondents from the UK reported slightly worse LBP quality and intensity, and Greeks used fewer words to describe similar LBP quality. The latter may be affected by cultural influences as Greeks were found elsewhere to use fewer descriptors to portray their pain (Mystakidou et al 2002).

There were no significant differences between countries for the time of onset of LBP following iSCI. Generally, there is an early LBP onset after iSCI and the earlier the onset the more persistent LBP and this was a significant result for the total group and the USA group individually. These findings agree with reports on the persistence of pain in SCI (Cruz-Almeida et al 2005, Widerström-Noga et al 2001) or early pain onset (Modirian et al 2010, Barrett et al 2003). It is important for clinicians to know that LBP may start early post iSCI in order to assess it, consider LBP prevention and management techniques, including patient

education, early in treatment. Future studies should include the examination of potential risk factors for the onset of LBP following iSCI, such as pain in other body areas or psychosocial factors.

This study showed that, the level of injury and possibly the completeness of injury are iSCI-related characteristics that need to be taken into consideration when addressing LBP in iSCI. To be able to generalise this result, future studies should include physical examination of the participants. In the literature, LBP has often been attributed to be musculoskeletal in nature and more studies are required to verify this finding in iSCI. LBP in iSCI is of moderate intensity which increases with more persistent LBP. The general similarities across nations in sensory, affective and cognitive dimensions may be an indication that there is a biological or biopsychological mechanism (Greenspan et al 2007) of developing LBP in iSCI that needs further investigation.

iSCi is expected to rise among new SCIs (DeVivo 2012), thus, there is a need for a multi-disciplinary approach to early diagnosis and treatment. We agree that prevention and early treatment (Finnerup 2013) are important, therefore clinicians should aim for more efficient and faster rehabilitation, a multidimensional assessment and a well-established treatment plan. As pain intensity in the lower back is found to be associated with pain interference and psychological functioning (Miró et al 2014) the multi-disciplinary team should include doctors using medication, pain specialists or CBT therapists addressing the cognitive dimension of pain and physiotherapists working on, for example, strengthening of the postural muscles, stiffness or instability (Siddall & Middleton 2015).

There are a number of limitations to this study, which need to be considered. Firstly, no random selection of participants was made, therefore it is possible that those who took part were more interested in the subject and/ or were more amenable to research. However, the sex distribution is similar to the population of people with SCI (Molton et al 2008, Turner er al 2001). In addition, the groups from UK and Greece were smaller than the group from the USA, which may have accounted for some results not reaching significance. Whether there were any pain risk factors prior to iSCI that may have affected pain presence after iSCI, like the presence of lordosis, was not investigated. Finally, the level and the completeness of injury were, in most of the cases, based on the reports given by the respondents themselves and no physical or medical record examination was made except for the cases from the Greek group were the hospital medical records were looked at.

Conclusion

In conclusion, this is the first study, to our knowledge, to examine the presence of LBP in people with iSCI alone and to compare findings across three nations. Pain is a subjective experience and despite this current study not being able to or intending to discuss causality of LBP, it can confirm its high presence. The fact that the reported LBP prevalence in the current group is higher than that found in the general population (Breivik et al 2006, Ross MH, Homer 1976) could be because there is greater risk of developing LBP in incomplete SCI, a topic that requires further examination. Future studies should include physical examination of their participants and examine the nature and risk factors of LBP in iSCI. Investigating for any biological or biopsychological mechanisms in the presence of LBP in iSCI could help both its prevention and its treatment. Future qualitative study designs could also help examine in-depth the personal experience of living with iSCI and LBP.

Ethical approval: The School of Health Science and Social Care (SHSSC) Research Ethics Committee, Brunel University, UK, provided ethical approval to conduct the study in the UK, USA and Greece. Local approvals were also given by the two participating hospitals and the medical centre in the cities of Thessaloniki and Kavala (regions of Macedonia, Greece) and the various websites where the study was advertised; including the Spinal Injury Association (SIA), the National Spinal Cord Injury Association (NSCIA) and "Disability Now".

Conflict of interest: None

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References

American Spinal Injury Association (ASIA) (2000) International Standards for Neurological Classification of Spinal Cord Injury. Revised.

Ataog˘lu E, Tiftik T, Kara M, Tunc H, Ersoz H and Akkus S (2013) Effects of chronic pain on quality of life and depression in patients with spinal cord injury. Spinal Cord (2013) 51, 23–26.

Baron R, Maier C, Attal N, Binder A, Bouhassira D, Cruccu G et al, (2017) Peripheral neuropathic pain: a mechanism-related organizing principle based on sensory profiles. Pain. 2017 Feb; 158(2): 261–272.

Barrett H, McClelland JM, Rutkowski SB, Siddall PJ (2003) Pain characteristics in patients admitted to hospital with complications after spinal cord injury. Arch Phys Med Rehabil 84(6):789-795.

Bergström EM, Short DJ, Frankel HL, Henderson NJ, Jones PR (1999) The effect of childhood spinal cord injury on skeletal development: a retrospective study. Spinal Cord 37 (12):838-846.

Boissonnault W and Fabio RP (1996) Pain profile of patients with low back pain referred to physical therapy. J Orthop Sports Phys Ther 24(4):180-191.

Breivik H, Collett B, Ventafridda V, Cohen R, Gallacher D (2006) Survey of chronic pain in Europe: prevalence, impact on daily life, and treatment. Eur J Pain 10(4):287-333.

Bryce T.N, Biering-Sørensen F, Finnerup N.B, Cardenas D.D, Defrin R, Lundeberg T et al (2012). International Spinal Cord Injury Pain Classification: part I. Background and description. Spinal Cord 50, 413–417.

Bryce TN, Dijkers MPJM (2006) Assessment of Pain After SCI in Clinical Trials. Top Spinal Cord Inj Rehabil 11(3):50-68.

Burke D, Fullen B.M, Lennon O (2017): Pain profiles in a community dwelling population following spinal cord injury: a national survey, The Journal of Spinal Cord Medicine, DOI: 10.1080/10790268.2017.1351051.

Cardenas DD, Jensen MP (2006) Treatments for Chronic Pain in Persons with Spinal Cord Injury: A Survey Study. J Spinal Cord Med 29(109):117.

Cardenas DD, Turner JA, Warms CA, Marshall HM (2002) Classification of chronic pain associated with spinal cord injuries. Arch Phys Med Rehabil 83(12):1708-1714.

Cruz-Almeida Y, Martinez-Arizala A, Widerström-Noga EG (2005) Chronicity of pain associated with spinal cord injury: A longitudinal analysis. J Rehabil Res Dev 42(5):585-594.

DeVivo M.J (2012) Epidemiology of traumatic spinal cord injury: trends and future implications. Spinal Cord (2012) 50, 365–372.

Divanoglou A, Westgren N, Bjelak S, Levi R (2010) Medical conditions and outcomes at 1 year after acute traumatic spinal cord injury in a Greek and a Swedish region: a prospective, population-based study. Spinal Cord 48(6):470-476.

Felix ER, Cruz-Almeida Y, Widerstrom-Noga EG (2007) Chronic pain after spinal cord injury: what characteristics make some pains more disturbing than others? J Rehabil Res Dev 44(5):703-715.

Finnerup N.B (2013) Pain in patients with spinal cord injury. PAIN 154, S71–S76.

Georgoudis G, Oldham JA, Watson PJ (2001) Reliability and sensitivity measures of the Greek version of the short form of the McGill Pain Questionnaire. Eur J Pain 5(2):109-118.

Greenspan JD, Craft RM, LeResche L, Arendt-Nielsen L, Berkley KJ, Fillingim RB, et al (2007) Studying sex and gender differences in pain and analgesia: a consensus report. Pain 132 Suppl 1:S26-45.

Kohn ML (1987) Cross-national research as an analytic strategy. American Sociological Association, 1987 Presidential address. American Sociological Review 52:713-731.

Ma V.Y, Chan L and Carruthers K.J, (2014) Incidence, Prevalence, Costs, and Impact on Disability of Common Conditions Requiring Rehabilitation in the United States: Stroke, Spinal Cord Injury, Traumatic Brain Injury, Multiple Sclerosis, Osteoarthritis, Rheumatoid Arthritis, Limb Loss, and Back Pain. Archives of Physical Medicine and Rehabilitation 95:986-95.

Mannion AF, Taimela S, Muntener M, Dvorak J (2001) Active therapy for chronic low back pain part 1. Effects on back muscle activation, fatigability, and strength. Spine 26(8):897-908.

Markogiannakis H, Sanidas E, Messaris E, et al (2006) Motor vehicle trauma: analysis of injury profiles by road-user category. Emerg Med J 23(27):31.

Melzack R and Katz J. The McGill Pain Questionnaire: Appraisal and current status. In: Turk DC, editor; Melzack R, editor (1992) Handbook of pain assessment.New York: The Guilford Press; 152–168.

Michailidou C (2012) Low back pain, quality of life and function in people with incomplete spinal cord injury in USA, UK and Greece. Unpublished PhD Thesis, Brunel University Library. http://bura.brunel.ac.uk/handle/2438/7041

Michailidou C, Marston L, DeSouza L, Sutherland I (2014) A systematic review of the prevalence of musculoskeletal pain, back and low back pain in people with Spinal Cord Injury. Disabil Rehabil, 36(9): 705–715 doi: 10.3109/09638288.2013.808708

Miró J, Gertz K.J, Carter G.T, Jensen M.P (2014) Pain Location and Functioning in Persons With Spinal Cord Injury. American Academy of Physical Medicine and Rehabilitation 6: 690-697.

Modirian E, Soroush M, Karbalaei-Esmaeili S (2010) Original Research Articles Chronic Pain after Spinal Cord Injury: Results of a Long-Term Study. Pain Medicine 11:1037-1043.

Molton IR, Jensen MP, Nielson W, Cardenas D, Ehde DM (2008) A preliminary evaluation of the motivational model of pain self-management in persons with spinal cord injury-related pain. J Pain 9(7):606-612.

Mystakidou K, Parpa E, Tsilika E, et al (2002) Greek McGill Pain Questionnaire: validation and utility in cancer patients. J Pain Symptom Manage 24(4):379-387.

Nicholson PK, Nicholas MK, Middleton J (2009) Spinal cord injury-related pain in rehabilitation: a cross-sectional study of relationships with cognitions, mood and physical function. Eur J Pain 13(5):511-517.

Norris C, Matthews M (2008) The role of an integrated back stability program in patients with chronic low back pain. Complementary Therapies in Clinical Practice 14:255-263.

Parent S, Mac-Thiong J.M, Roy-Beaudry M, Sosa J.F, and Labelle H (2011) Spinal Cord Injury in the Pediatric Population: A Systematic Review of the Literature. J of Neurotrauma 28:1515–1524.

Raissi GR, Mokhtari A, Mansouri K (2007) Reports from spinal cord injury patients: eight months after the 2003 earthquake in Bam, Iran. Am J Phys Med Rehabil 86(11):912-917.

Ravenscroft A, Ahmed YS, Burnside IG (2000) Chronic pain after SCI. A patient survey. Spinal Cord 38(10):611-614.

Rintala DH, Loubser PG, Castro J, Hart KA (1998) Chronic Pain in a Community Based Sample of Men with Spinal Cord Injury: Prevalence, Severity, and Relationship with Impairment, Disability, Handicap, and Subjective Well-Being. Arch Phys Med Rehabil 79:604-614.

Roussouly (2002) Sagittal morphology and equilibrium of pelvis and spine in normals. The Spine Journal 2(47S-128S):61S-62S.

Sato T, Hirano T, Ito T, Morita O, Kikuchi R, Endo N, Tanabe N (2011) Back pain in adolescents with idiopathic scoliosis: epidemiological study for 43,630 pupils in Niigata City, Japan. European Spine Journal 20(2): 274–279.

Siddall P.J & Middleton J.W (2015) Spinal cord injury-induced pain: mechanisms and treatments. Pain Manag. 5(6): 493–507.

StataCorp. 2013. Stata Statistical Software: Release 13. College Station, TX: StataCorp LP

Ströud MW, Turner JA, Jensen MP, Cardenas DD (2006) Partner responses to pain behaviors are associated with depression and activity interference among persons with chronic pain and spinal cord injury. J Pain 7(2):91-99.

Turner JA, Cardenas DD, Warms CA, McClellan CB (2001) Chronic pain associated with spinal cord injuries: a community survey. Arch Phys Med Rehabil 82(4):501-509.

Ullrich PM, Jensen MP, Loeser JD, Cardenas DD (2008) Pain intensity, pain interference and characteristics of spinal cord injury. Spinal Cord 46(6):451-455.

Widerström-Noga E, Biering-Sørensen F, Bryce T, et al (2014) The International Spinal Cord Injury Pain Basic Data Set (version 2.0). Spinal Cord 52, 282–286.

Widerström-Noga EG, Felipe-Cuervo E, Yezierski RP (2001) Relationships among clinical characteristics of chronic pain after spinal cord injury. Arch Phys Med Rehabil 82(9):1191-1197.

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