

# Association between psychosocial factors and mental health symptoms to cervical spine pain with or without radiculopathy on health outcomes

Mansfield, Michael; Spahr, N.; Smith, T.; Stubbs, B.; Haig, L.; Thacker, M.

DOI:

[10.1097/PR9.0000000000000870](https://doi.org/10.1097/PR9.0000000000000870)

License:

Creative Commons: Attribution-NonCommercial-NoDerivs (CC BY-NC-ND)

*Document Version*

Publisher's PDF, also known as Version of record

*Citation for published version (Harvard):*

Mansfield, M, Spahr, N, Smith, T, Stubbs, B, Haig, L & Thacker, M 2021, 'Association between psychosocial factors and mental health symptoms to cervical spine pain with or without radiculopathy on health outcomes: systematic review protocol', *PAIN Reports*, vol. 6, no. 1, e870. <https://doi.org/10.1097/PR9.0000000000000870>

[Link to publication on Research at Birmingham portal](#)

## General rights

Unless a licence is specified above, all rights (including copyright and moral rights) in this document are retained by the authors and/or the copyright holders. The express permission of the copyright holder must be obtained for any use of this material other than for purposes permitted by law.

- Users may freely distribute the URL that is used to identify this publication.
- Users may download and/or print one copy of the publication from the University of Birmingham research portal for the purpose of private study or non-commercial research.
- User may use extracts from the document in line with the concept of 'fair dealing' under the Copyright, Designs and Patents Act 1988 (?)
- Users may not further distribute the material nor use it for the purposes of commercial gain.

Where a licence is displayed above, please note the terms and conditions of the licence govern your use of this document.

When citing, please reference the published version.

## Take down policy

While the University of Birmingham exercises care and attention in making items available there are rare occasions when an item has been uploaded in error or has been deemed to be commercially or otherwise sensitive.

If you believe that this is the case for this document, please contact [UBIRA@lists.bham.ac.uk](mailto:UBIRA@lists.bham.ac.uk) providing details and we will remove access to the work immediately and investigate.



# Association between psychosocial factors and mental health symptoms to cervical spine pain with or without radiculopathy on health outcomes: systematic review protocol

Michael Mansfield<sup>a,\*</sup>, Nicolas Spahr<sup>b,c</sup>, Toby Smith<sup>d,e</sup>, Brendon Stubbs<sup>f,g</sup>, Lesley Haig<sup>h</sup>, Mick Thacker<sup>a</sup>

## Abstract

**Introduction:** Cervical spine pain with or without radiculopathy (CSp ± R) has significant negative impacts to a person's quality of life. Psychosocial factors and/or mental health symptoms are associated with spinal pain with or without radiculopathy and negatively impact health outcomes. This area of research is not yet established for CSp ± R. Our objective is to conduct a systematic review assessing the association between psychosocial factors and/or mental health symptoms and health outcomes in adults with CSp ± R.

**Methods:** A systematic electronic search of 3 online databases will retrieve studies in which adults (older than 18 years) with CSp ± R, assessing how psychosocial factors or mental health symptoms impact outcomes related to disability, pain, and/or healthcare utilisation. Data extracted will include study design, CSp ± R definition, psychosocial and/or mental health symptoms, and health outcomes. Reporting study quality through the Newcastle–Ottawa Quality Scale Assessment and certainty through Grading of Recommendations, Assessment, Development and Evaluations will be completed. Studies will be assessed from a clinical perspective, methodology design, and statistical testing to determine whether studies can be pooled for meta-analysis. If there is significant clinical heterogeneity, narrative description will be undertaken.

**Perspective:** This will be a comprehensive synthesis review to enhance understanding of the association of psychosocial factors and/or mental health symptoms and CSp ± R on health outcomes. The findings will support the formulation of prognosis, collaborative management decisions, and guide healthcare resources to improve outcomes for this patient group. The review will identify gaps in research, thereby informing future experimental and observational study design.

**Keywords:** Cervical spine pain, Cervical spine radiculopathy, Systematic review, Psychosocial, Mental health

## 1. Introduction

Cervical spine pain is characterised as pain perceived anywhere in the posterior region of the cervical spine, from the superior nuchal line to the first thoracic spinous process.<sup>5</sup> Any lesion causing a mechanical compromise to a spinal nerve or its root can cause radiculopathy directly through compression or indirectly through the interruption of the blood supply or nutrition to a nerve axon or its root.<sup>44</sup> Cervical spine radiculopathy is identified as an

objective loss of sensory and/or motor function as a result of conduction block to a spinal nerve or its root; this can occur with or without cervical spine pain.<sup>14</sup> People with CSp ± R may also describe lancinating symptoms along narrow bands, which is similar but not identical to “dermatomal distribution.” This is known as radicular pain.<sup>16,40</sup>

Cervical spine pain with or without radiculopathy (CSp ± R) has significant negative impacts to a person's physical and mental health and well-being and is an enormous burden for individuals,

Sponsorships or competing interests that may be relevant to content are disclosed at the end of this article.

<sup>a</sup> School of Health and Social Care, Division of Allied Health Sciences, London South Bank University, London, United Kingdom, <sup>b</sup> Guy's and St Thomas Hospital NHS Foundation Trust, Physiotherapy Department, St Thomas Hospital, London, United Kingdom, <sup>c</sup> Pain Section, Neuroimaging, Institute of Psychiatry, Kings College London, London, United Kingdom, <sup>d</sup> Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences, University of Oxford, Botnar Research Centre, Oxford, United Kingdom, <sup>e</sup> Faculty of Medicine and Health Sciences, University of East Anglia, Norwich, United Kingdom, <sup>f</sup> Department of Psychological Medicine, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, <sup>g</sup> South London and Maudsley NHS Foundation Trust, London, United Kingdom, <sup>h</sup> AECC University College, Parkwood Campus, Bournemouth, United Kingdom

\*Corresponding author. Address: Division of Allied Health Sciences, School of Health and Social Care, London South Bank University, London, SE1 0AA, United Kingdom. Tel.: +44 00 7815 7815. E-mail address: Michael.Mansfield@lsbu.ac.uk (M. Mansfield).

Copyright © 2021 The Author(s). Published by Wolters Kluwer Health, Inc. on behalf of The International Association for the Study of Pain. This is an open access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CCBY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

PR9 6 (2021) e870

<http://dx.doi.org/10.1097/PR9.0000000000000870>

families, and societies.<sup>7,11,19</sup> The one-year incidence of cervical spine pain ranges between 10.4% and 21.3%,<sup>20,21</sup> and cervical spine radiculopathy prevalence values range between 1.1% and 6.3%.<sup>34,37</sup> CSp ± R is a leading cause of years lived with disability.<sup>30</sup> The global prevalence of cervical spine pain and years lived with disability has increased by 18.7% and 18.6%, respectively, over the past 10 years.<sup>30</sup>

Multiple systematic reviews have established the fact that the presence of psychological and/or mental health symptoms are associated with low back pain and negatively impact health outcomes and quality of life.<sup>33,47</sup> This is not yet established for CSp ± R and warrants further attention. Psychosocial factors encompass a wide range of characteristics such as patient's beliefs, emotions, behaviours, and family and workplace aspects.<sup>27</sup> Mental health symptoms or conditions are an extension of such factors. Examples of mental health conditions include major depressive disorders and anxiety. These conditions are among the leading causes of years lived with disability globally and less than a 10% positive improvement between 1990 and 2016.<sup>30</sup> Stress, anxiety, depression, and negative coping behaviours can adversely impact prognosis with musculoskeletal conditions such as low back pain,<sup>35</sup> neck pain,<sup>39,42</sup> knee osteoarthritis,<sup>43,49</sup> carpal tunnel syndrome,<sup>18</sup> and shoulder pain.<sup>8</sup> Psychosocial factors and/or mental health symptoms should be considered as part of a clinical reasoning framework to positively affect health outcomes and support prognosis.<sup>25</sup>

Persistent pain and associative mental health symptoms are well established in low back pain.<sup>15,32,35</sup> Up to 20% of people with spinal pain, including CSp ± R, will experience symptoms associated with depression and anxiety.<sup>3,26</sup> Pain and disability associated with CSp ± R limits a person's participation in social activities, working life, and consequently negatively impacts quality of life.<sup>10,31,48</sup> Worryingly, there can be a devastating impact to a person's lived experience with CSp ± R. People report their "life is on hold," question their "life purpose," and consider suicidal thoughts.<sup>36</sup> This potentially distressing association between CSp ± R and psychosocial factors or mental health symptoms requires enhanced attention from researchers, clinicians, and healthcare services.

To date, no systematic review has examined the association between psychosocial factors and/or mental health symptoms in adults with CSp ± R on health outcomes. A robust systematic review will enhance understanding and improve quality of healthcare services for these burdensome conditions. Therefore, our objective is to conduct a systematic review to assess the association between psychosocial factors and/or mental health symptoms and health outcomes in adults with CSp ± R.

## 2. Methods

### 2.1. Protocol

The Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P)<sup>29</sup> checklist guided the development and reporting of this review protocol. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement<sup>28</sup> will be used on reporting the findings. The protocol for this systematic review has been registered with the International Prospective Register of Systematic Reviews (PROSPERO) database (CRD42020169497).

### 2.2. Eligibility criteria—population

This systematic review will retrieve studies with samples of adults aged 18 years and older with CSp ± R. It is anticipated that there

will be variance in the definition of CSp ± R across geographical location, clinical settings, and from a historical standpoint. For example, The International Association of the Study of Pain<sup>22</sup> defines cervical spine pain as pain perceived anywhere in the posterior region of the cervical spine, from the superior nuchal line to the first thoracic spinous process (Merskey and Bogduk, 1994). However, the Bone and Joint Decade 2000 to 2010 Task Force on Neck Pain describes cervical spine pain as the posterior neck region from the superior nuchal line to the spine of the scapula and the side region down to the superior border of the clavicle and the suprasternal notch.<sup>31</sup>

Two reviewers will review all potentially eligible studies and a consensus decision will be sought on the CSp ± R diagnosis. The CSp ± R diagnosis criteria of all included studies will be described. From our previous work (Mansfield et al., *unpublished*), we anticipate a variance in cervical spine radiculopathy diagnostic criteria. Therefore, in this review, we will take a pragmatic approach and include studies with *probable* or *definite* cervical spine radiculopathy diagnosis adapted from IASP and North American Spine Society<sup>6,22,38</sup> (Fig. 1). Patients with CSp ± R as a result of an upper motor neuron lesion, fracture, radiculitis, myelopathy, postsurgery, whiplash-associated disorder, systemic pathology, or metabolic diseases such as diabetes (including prediabetes) will be excluded.

### 2.3. Eligibility criteria—exposure

Studies will be included if they assess psychosocial factors or mental health symptoms as an exposure. Studies must investigate one or more psychosocial or mental health symptoms (or condition). Psychosocial factors including cognitive (eg, neuropsychological functioning), affective (eg, distress, mood), behavioural (eg, coping strategies), vocational (eg, job satisfaction, self-perceived work ability), or interpersonal processes (eg, social support) (Upton, 2013) will be considered. Mental health symptoms and conditions such as depressive symptoms, clinical depression, anxiety symptoms, perceived stress, personality, psychotic, traumatic, and/or eating disorders will also be considered. Self-reported, objective standardised questionnaires (eg, Beck Depression Index, Karasek's Job Control Questionnaire, and GHQ-12) and/or psychosocial factors or mental health symptoms using dichotomous data ("yes/no") will be considered.

### 2.4. Eligibility criteria—comparators

Studies will also be considered if the study population compares different severities of mental health symptoms or conditions or psychosocial factors. The "cutoff" values for mental health condition severity used in the included studies will be detailed in the data extraction tables.

### 2.5. Eligibility criteria—outcome

Studies that include health outcomes informed by, but not limited to, core outcome domains for Outcome Measures in Rheumatology (OMERACT) for osteoarthritis,<sup>4</sup> core outcome measurements for clinical trials with nonspecific low back pain,<sup>9</sup> and the Initiative on Methods Measurement and Pain Assessment in Clinical Trials for pain<sup>12</sup> will be considered. These domains are not designed specifically for CSp ± R but intend to guide this review's data collection and analysis in the absence of a core health outcome set for CSp ± R. The domains included for this review

**Definite CSR Diagnosis - *Either (i) or (ii)***

- (i) Acute denervation with EMG studies or sensory changes in dermatomal distribution  
AND  
Weakness, atrophy, or fasciculation in a myotomal distribution *and* unilateral diminished deep tendon reflexes
- (ii) Abnormal myelography, CT, or MRI correlating with radiculopathy *with* neck pain or combined neck and arm pain  
OR  
Paraesthesia, hyperaesthesia, or dysaesthesia in a nerve root distribution or muscle weakness in a myotomal distribution or atrophy

**Probable CSR Diagnosis - *Either (iii), (iv), or (v)***

- (iii) Neck pain, neck and arm pain, paraesthesia, hyperaesthesia, or dysaesthesia in a nerve root distribution or muscle weakness in a myotomal distribution or atrophy  
*with*  
Sensory changes in dermatomal distribution or muscle weakness in a myotomal distribution or atrophy or fasciculation in a myotomal distribution or unilateral diminished deep tendon reflexes
- (iv) Neck pain, neck and arm pain, paraesthesia, hyperaesthesia, or dysaesthesia in a nerve root distribution or muscle weakness in a myotomal distribution or atrophy  
*with*  
Abnormal myelography, CT, or MRI correlating with radiculopathy
- (v) Neck pain or neck and arm pain *with two* from:
  - (v-i) Sensory changes in dermatomal distribution
  - (v-ii) Muscle weakness in a myotomal distribution or atrophy
  - (v-iii) Fasciculation in a myotomal distribution
  - (v-iv) Unilateral diminished deep tendon reflexes

**Figure 1.** Modified radiculopathy diagnostic criteria.

will include: pain, such as, Visual Analogue Scale and Numeric Pain Rating Scale<sup>24</sup>; disability such as Neck Disability Index,<sup>45</sup> Disability of Arm and Shoulder Index,<sup>2</sup> and International Physical Activity Questionnaire<sup>17</sup>; and health status, such as, 36-item Short Form Survey (SF-36)<sup>23</sup> and 12-item Short Form Survey (SF-12).<sup>46</sup> Healthcare utilisation such as clinician visits, spinal imaging, and hospital length of stay will also be reviewed. The

outcomes at different follow-up periods for study inclusion (eg, 1, 3, and 6 months) will be reviewed. We will contact lead authors for missing or incomplete data to inform analysis. Where data are incomplete or missing, the authorship will take a pragmatic decision based on data available and whether to include for narrative review. A list of studies with missing or incomplete data sets will be listed as an appendix on publication.

## 2.6. Study characteristics

Studies must meet the population, exposure, comparator, and outcome criteria to be included. Studies must be in the English language (or can be translated to English) and be either case control, cross-sectional, or cohort study design. No restriction on publication date will be applied. All articles suitable for inclusion will be referenced in the final manuscript. Studies will be excluded if they are animal or cadaveric studies, commentaries, editorials, single case study, reports or laboratory data, books or book chapters, letters, conference posters or proceedings that do not have full methodology and data sets available on request, lecture slides, study protocols, social media postings (including blogs), or online learning material (eg, massive online learning sites and videos).

## 2.7. Information sources

The search strategy will be primarily developed by one author (M.M.) and reviewed by all corresponding authors to reach agreement and consensus. The draft search strategy is available as supplemental digital content at <http://links.lww.com/PR9/A95>. A systematic search of electronic databases EMBASE, CINAHL, and MEDLINE (PubMed) from inception to April 2020 will be completed by one reviewer (N.S.). The full PubMed search strategy will be made available as a supplementary file on dissemination. EndNote (X9.2 for MacOS) will be the reference manager software to store records and identify and remove duplicates. All included studies will undergo reference checking. When formal study inclusion has taken place, we will agree on “expert” authors in the field to contact by email requesting any pending articles and/or missing data. An unpublished (gray) literature search and trial registry will also be completed (eg, WHO.It, ZETOC, and British library higher education thesis deposits).

## 2.8. Data collection—study selection

Results of the search strategy will be uploaded into Microsoft Excel spreadsheet. This will be securely remote-stored for all authors to access. Two reviewers will independently review, check titles and abstracts, and document decisions on which of the studies should be included. A third reviewer will independently review decisions made by the 2 reviewers. The third reviewer will adjudicate any disagreements and discussion to reach final consensus.

An assessment of reliability will take place between M.M. and N.S. of 10% potentially eligible articles for full-text order using a weighted Kappa statistic. The between reviewer agreement data will be available in the final manuscript for the overall agreement. After the title and abstract screening, potential eligible articles will be ordered full text. M.M. and N.S. will independently review full-text articles against the inclusion criteria. Independent decisions on the inclusion criteria will be stored in table format and will be made available on request. M.M. and N.S. will reach consensus through discussion; where consensus cannot be reached, a third author (M.T.) will act as an adjudicator.

## 2.9. Data collection—data collection and extraction

Data extraction forms will be designed by the lead author (M.M.). This form will be reviewed and agreed by all authors who are part of this review. Two authors (M.M. and T.S.) will independently extract data from the included studies. Two authors (M.M. and T.S.) will meet to discuss the data extracted, discuss any disagreements, and reach consensus. If consensus cannot be achieved, a third author (M.T.) will be consulted and will act as an adjudicator. Data extracted will

include lead author and date of publication; study design; study demographics (country, sample size, age range or mean, and sex ratio); definition of exposure; definition of comparator; outcome measure description; and risk estimates (risk ratios, hazard ratios, odds ratio, and/or mean differences including 95% confidence intervals where available or can be calculated post hoc).

## 2.10. Methodological quality

Two authors (M.M. and N.S.) will independently assess the quality of each included study using a Newcastle–Ottawa Quality Scale Assessment quality appraisal tool.<sup>41</sup> This appraisal tool is recommended by the Cochrane Handbook for Systematic Review. The Newcastle–Ottawa Quality Scale checklist assesses quality of articles across 3 domains: selection of the studies groups; comparability of the groups and control for confounding factors; and exposure. M.M. and N.S. will discuss quality appraisal disagreements to reach consensus. M.M. and N.S. will independently determine whether outcomes are very low, low, moderate, or high certainty based on the Grading of Recommendations, Assessment, Development and Evaluations.<sup>1</sup> GRADE will facilitate understanding outcome quality and transparent grading of certainty in the included studies.<sup>1</sup> GRADE has 5 domains assessing the certainty of evidence: risk of bias; imprecision; inconsistency; indirectness; and publication bias.

## 2.11. Synthesis

Two authors (M.M. and T.S.) will assess included articles from a clinical perspective (eg, diagnosis and variability in population characteristics) and study methodology to determine whether studies could be pooled together for synthesis. Where indicated, statistical heterogeneity assessments will be completed. If there is significant clinical heterogeneity, studies will be described narratively, eg, patient populations and clinical diagnosis. When there is minimal or no clinical heterogeneity, a random-effects meta-analysis will be undertaken to compare the prevalence, odds, or the risk of different psychosocial and mental health risk factors in CSp ± R. In addition, statistical heterogeneity testing will be completed through the inconsistency value ( $I^2$ ) and Cochran Q statistic. It is anticipated that there will variability on assessment across included studies; therefore, a random-effect model will be adopted. A calculation of publication bias will be conducted using a Galbraith plot.<sup>13</sup> Data analysis will follow guidelines in the Cochrane handbook (Section 9.4.5). We will complete an inverse-variance random-effects method by assessing the standardised mean difference and present with 95% confidence intervals and forest plots.

Mixed-sample populations are anticipated. An analysis of studies with cervical spine pain and radiculopathy will be completed as an additional subgroup analysis. In addition, we will stratify results by duration of CSp ± R (acute <3 months in duration and persistent ≥3 months in duration). Point of estimates (risk ratio, hazard ratio, and odds ratio) will also be analysed separately. A further subanalysis on cervical spine radiculopathy *probable* and *definite* diagnostic criteria and their association with psychosocial and/or mental health factors will be completed. Furthermore, analyses will be conducted separately for cohort and case-control studies, and for unadjusted associations. Sensitivity analysis will be completed by an analysis of the study quality (risk of bias).

## 3. Discussion

This will be the first systematic review investigating the association between psychosocial factors or mental health

symptoms in adults with CSp  $\pm$  R. This is a comprehensive synthesis review with the aim to enhance understanding of the association of psychosocial factors and CSp  $\pm$  R on health outcomes.

It is acknowledged that there will be limitations to this review. First, there are no core outcome sets for CSp  $\pm$  R, which may mean a variability of measurements used to assess outcomes in the literature. We have recognised this and have identified closely related core outcome sets for osteoarthritis, chronic pain, and low back pain to inform our analysis. Furthermore, we will complete subgroup analyses as detailed above. Second, there are no universally accepted diagnostic criteria for cervical spine radiculopathy. Therefore, we have adopted an approach reflecting contemporary clinical practice to moderate radiculopathy diagnostic variance. A strength of our review will be including studies with standardised validated health outcome questionnaires. However, questionnaires may not be generalisable across all healthcare settings globally. This will be discussed narratively in our analysis.

We are expecting that the topic theme, methodology, and results will have interest for a wide range of audiences. We will submit the final piece of work to an international multidisciplinary, peer-reviewed journal (eg, *PAIN Reports* and *PAIN*) with open access. We aim to present findings at an international health science conference (eg, International Association of the Study of Pain and World Conference of Physical Therapists). The findings will also form part of the knowledge exchange and research informed teaching strategies with health and social care students in our affiliated university posts and associated clinical departments. All authors have a social media presence freely available to the general public. We plan to detail plain English findings through this medium (eg, Twitter).

In summary, our findings will have relevance to patients, healthcare clinicians, researchers, and policy makers. Enhancing our understanding of how psychosocial factors and/or mental health symptoms are associated with health outcomes in people with CSp  $\pm$  R will support the formulation of prognosis and collaborative management decisions. The review will identify gaps in research, thereby informing future experimental and observational study design. The results will also support the guidance of healthcare resources and aim to enhance overall health outcomes for patients.

## Disclosures

The authors have no conflicts of interest to declare.

## Acknowledgements

This study forms part of M. Mansfield's PhD study programme. Significance Statement: This is the first systematic review protocol investigating the association of psychosocial factors and mental health symptoms and outcomes in adults with cervical spine pain with or without upper-limb radiculopathy. The findings of this review are intended to enhance assessment and management decisions of clinicians and healthcare services for this complex and disabling condition.

PROSPERO Registration Number: CRD42020169497.

Author Contributions: conceptualisation: M. Mansfield and M. Thacker. Methodology: M. Mansfield, T. Smith, N. Spahr, B. Stubbs, L. Haig, and M. Thacker. Project administration: M. Mansfield. Writing and original draft: M. Mansfield. Writing, reviewing, and editing: M. Mansfield, T. Smith, N. Spahr, B. Stubbs, L. Haig, and M. Thacker.

## Article history:

Received 18 March 2020

Received in revised form 29 September 2020

Accepted 30 September 2020

## References

- [1] Atkins D, Best D, Briss PA, Eccles M, Falck-Ytter Y, Flottorp S, Guyatt GH, Harbour RT, Haugh MC, Henry D, Hill S, Jaeschke R, Leng G, Liberati A, Magrini N, Mason J, Middleton P, Mrukowicz J, O'Connell D, Oxman AD, Phillips B, Schunemann HJ, Edejer T, Varonen H, Vist GE, Williams JW Jr, Zaza S, Group GW. Grading quality of evidence and strength of recommendations. *BMJ* 2004;328:1490.
- [2] Beaton DE, Katz JN, Fossel AH, Wright JG, Tarasuk V, Bombardier C. Measuring the whole or the parts? Validity, reliability, and responsiveness of the Disabilities of the Arm, Shoulder and Hand outcome measure in different regions of the upper extremity. *J Hand Ther* 2001;14:128–46.
- [3] Blozik E, Laptinskaya D, Herrmann-Lingen C, Schaefer H, Kochen MM, Himmel W, Scherer M. Depression and anxiety as major determinants of neck pain: a cross-sectional study in general practice. *BMC Musculoskelet Disord* 2009;10:13.
- [4] Boers M, Kirwan JR, Wells G, Beaton D, Gossec L, d'Agostino MA, Conaghan PG, Bingham CO III, Brooks P, Landewe R, March L, Simon LS, Singh JA, Strand V, Tugwell P. Developing core outcome measurement sets for clinical trials: OMERACT filter 2.0. *J Clin Epidemiol* 2014;67:745–53.
- [5] Bogduk N. The anatomy and pathophysiology of neck pain. *Phys Med Rehabil Clin N Am* 2011;22:367–82, vii.
- [6] Bono CM, Ghiselli G, Gilbert TJ, Kreiner DS, Reitman C, Summers JT, Baisden JL, Easa J, Fernand R, Lamer T, Matz PG, Mazanec DJ, Resnick DK, Shaffer WO, Sharma AK, Timmons RB, Toton JF; North American Spine S. An evidence-based clinical guideline for the diagnosis and treatment of cervical radiculopathy from degenerative disorders. *Spine J* 2011;11:64–72.
- [7] Carroll LJ, Hogg-Johnson S, van der Velde G, Haldeman S, Holm LW, Carragee EJ, Hurwitz EL, Cote P, Nordin M, Peloso PM, Guzman J, Cassidy JD. Course and prognostic factors for neck pain in the general population: results of the Bone and Joint decade 2000–2010 Task Force on neck pain and its associated disorders. *Spine* 2008;33(4 suppl): S75–82.
- [8] Chester R, Jerosch-Herold C, Lewis J, Shepstone L. Psychological factors are associated with the outcome of physiotherapy for people with shoulder pain: a multicentre longitudinal cohort study. *Br J Sports Med* 2018;52:269–75.
- [9] Chiarotto A, Boers M, Deyo RA, Buchbinder R, Corbin TP, Costa LOP, Foster NE, Grotle M, Koes BW, Kovacs FM, Lin CC, Maher CG, Pearson AM, Peul WC, Schoene ML, Turk DC, van Tulder MW, Terwee CB, Ostelo RW. Core outcome measurement instruments for clinical trials in nonspecific low back pain. *PAIN* 2018;159: 481–95.
- [10] Chou R, Cote P, Randhawa K, Torres P, Yu H, Nordin M, Hurwitz EL, Haldeman S, Cedraschi C. The Global Spine Care Initiative: applying evidence-based guidelines on the non-invasive management of back and neck pain to low- and middle-income communities. *Eur Spine J* 2018; 27(suppl 6):851–60.
- [11] Cote P, Cassidy JD, Carroll LJ, Kristman V. The annual incidence and course of neck pain in the general population: a population-based cohort study. *PAIN* 2004;112:267–73.
- [12] Dworkin RH, Turk DC, Farrar JT, Haythornthwaite JA, Jensen MP, Katz NP, Kerns RD, Stucki G, Allen RR, Bellamy N, Carr DB, Chandler J, Cowan P, Dionne R, Galer BS, Hertz S, Jadad AR, Kramer LD, Manning DC, Martin S, McCormick CG, McDermott MP, McGrath P, Quessy S, Rappaport BA, Robbins W, Robinson JP, Rothman M, Royal MA, Simon L, Stauffer JW, Stein W, Tolle J, Wernicke J, Witter J, Immpact. Core outcome measures for chronic pain clinical trials: IMMPACT recommendations. *PAIN* 2005;113:9–19.
- [13] Egger M, Davey Smith G, Schneider M, Minder C. Bias in meta-analysis detected by a simple, graphical test. *BMJ* 1997;315:629–34.
- [14] Finnerup NB, Haroutounian S, Kamerman P, Baron R, Bennett DL, Bouhassira D, Cruccu G, Freeman R, Hansson P, Nurmikko T, Raja SN, Rice AS, Serra J, Smith BH, Treede RD, Jensen TS. Neuropathic pain: an updated grading system for research and clinical practice. *PAIN* 2016; 157:1599–606.
- [15] Foster NE, Anema JR, Cherkin D, Chou R, Cohen SP, Gross DP, Ferreira PH, Fritz JM, Koes BW, Peul W, Turner JA, Maher CG. Lancet Low Back Pain Series Working G. Prevention and treatment of low back pain:

- evidence, challenges, and promising directions. *Lancet* 2018;391:2368–83.
- [16] Haanpää M, Attal N, Backonja M, Baron R, Bennett M, Bouhassira D, Cruccu G, Hansson P, Haythornthwaite JA, Iannetti GD, Jensen TS, Kauppila T, Nurmikko TJ, Rice AS, Rowbotham M, Serra J, Sommer C, Smith BH, Treede RD. NeuPSIG guidelines on neuropathic pain assessment. *PAIN* 2011;152:14–27.
- [17] Hagstromer M, Oja P, Sjostrom M. The International Physical Activity Questionnaire (IPAQ): a study of concurrent and construct validity. *Public Health Nutr* 2006;9:755–62.
- [18] Harris-Adamson C, Eisen EC, Dale AM, Evanoff B, Hegmann KT, Thiese MS, Kapellusch J, Garg A, Burt S, Silverstein B, Bao S, Merlino L, Gerr F, Rempel D. Personal and workplace psychosocial risk factors for carpal tunnel syndrome: a pooled study cohort: author response. *Occup Environ Med* 2014;71:303–4.
- [19] Hogg-Johnson S, van der Velde G, Carroll LJ, Holm LW, Cassidy JD, Guzman J, Cote P, Haldeman S, Ammendolia C, Carragee E, Hurwitz E, Nordin M, Peloso P. The burden and determinants of neck pain in the general population: results of the Bone and Joint decade 2000-2010 Task Force on neck pain and its associated disorders. *J Manipul Physiol Ther* 2009;32(2 suppl):S46–60.
- [20] Hoy D, March L, Woolf A, Blyth F, Brooks P, Smith E, Vos T, Barendregt J, Blore J, Murray C, Burstein R, Buchbinder R. The global burden of neck pain: estimates from the global burden of disease 2010 study. *Ann Rheum Dis* 2014;73:1309–15.
- [21] Hoy DG, Protani M, De R, Buchbinder R. The epidemiology of neck pain. *Best Pract Res Clin Rheumatol* 2010;24:783–92.
- [22] IASP. Classification of chronic pain. Descriptions of chronic pain syndromes and definitions of pain terms. Prepared by the International Association for the Study of Pain, Subcommittee on Taxonomy. *Pain Suppl* 1986;3:S1–226.
- [23] Jenkinson C, Wright L, Coulter A. Criterion validity and reliability of the SF-36 in a population sample. *Qual Life Res* 1994;3:7–12.
- [24] Jensen MP, McFarland CA. Increasing the reliability and validity of pain intensity measurement in chronic pain patients. *PAIN* 1993;55:195–203.
- [25] Jones M, Edwards I, Gifford L. Conceptual models for implementing biopsychosocial theory in clinical practice. *Man Ther* 2002;7:2–9.
- [26] Liu F, Fang T, Zhou F, Zhao M, Chen M, You J, Jin Y, Xie J, Liu Z. Association of depression/anxiety symptoms with neck pain: a systematic review and meta-analysis of literature in China. *Pain Res Manag* 2018;2018:3259431.
- [27] Martikainen P, Bartley M, Lahelma E. Psychosocial determinants of health in social epidemiology. *Int J Epidemiol* 2002;31:1091–3.
- [28] Moher D, Liberati A, Tetzlaff J, Altman DG, Group P. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *BMJ* 2009;339:b2535.
- [29] Moher D, Shamseer L, Clarke M, Ghersi D, Liberati A, Petticrew M, Shekelle P, Stewart LA, Group PP. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Syst Rev* 2015;4:1.
- [30] Murray CJ, Barber RM, Foreman KJ, Abbasoglu Ozgoren A, Abd-Allah F, Abera SF, Aboyans V, Abraham JP, Abubakar I, Abu-Raddad LJ, Abu-Rmeileh NM, Achoki T, Ackerman IN, Ademi Z, Adou AK, Adsuar JC, Afshin A, Agardh EE, Alam SS, Alasfoor D, Albittar MI, Alegretti MA, Alemu ZA, Alfonso-Cristancho R, Alhabib S, Ali R, Alla F, Allebeck P, Almazroa MA, Alsharif U, Alvarez E, Alvis-Guzman N, Amare AT, Ameh EA, Amini H, Ammar W, Anderson HR, Anderson BO, Antonio CA, Anwari P, Arnlov J, Arsic Arsenijevic VS, Artaman A, Asghar RJ, Assadi R, Atkins LS, Avila MA, Awuah B, Bachman VF, Badawi A, Bahit MC, Balakrishnan K, Banerjee A, Barker-Collo SL, Barquera S, Barregard L, Barrero LH, Basu A, Basu S, Basulaiman MO, Beardslay J, Bedi N, Beghi E, Bekele T, Bell ML, Benjet C, Bennett DA, Bensenor IM, Benzian H, Bernabe E, Bertozzi-Villa A, Beyene TJ, Bhalla N, Bhalla A, Bhutta ZA, Bienhoff K, Bikbov B, Biryukov S, Blore JD, Blosser CD, Blyth FM, Bohensky MA, Bolliger IW, Bora Basara B, Bornstein NM, Bose D, Boufous S, Bourne RR, Boyers LN, Brainin M, Brayne CE, Brazinova A, Breitborde NJ, Brenner H, Briggs AD, Brooks PM, Brown JC, Brugha TS, Buchbinder R, Buckle GC, Budke CM, Bulchis A, Bulloch AG, Campos-Nonato IR, Carabin H, Carapetis JR, Cardenas R, Carpenter DO, Caso V, Castaneda-Orjuela CA, Castro RE, Catala-Lopez F, Cavalleri F, Cavlin A, Chadha VK, Chang JC, Charlson FJ, Chen H, Chen W, Chiang PP, Chimed-Ochir O, Chowdhury R, Christensen H, Christophi CA, Cirillo M, Coates MM, Coffeng LE, Coggeshall MS, Colistro V, Colquhoun SM, Cooke GS, Cooper C, Cooper LT, Coppola LM, Cortinovis M, Criqui MH, Crump JA, Cuevas-Nasu L, Danawi H, Dandona L, Dandona R, Dansereau E, Dargan PI, Davey G, Davis A, Davitoli DV, Dayama A, De Leo D, Degenhardt L, Del Pozo-Cruz B, Dellavalle RP, Deribe K, Derrett S, Des Jarlais DC, Dessalegn M, Dharmaratne SD, Dherani MK, Diaz-Torne C, Dicker D, Ding EL, Dokova K, Dorsey ER, Driscoll TR, Duan L, Duber HC, Ebel BE, Edmond KM, Elshrek YM, Endres M, Ermakov SP, Erskine HE, Eshrati B, Esteghamati A, Estep K, Faraon EJ, Farzadfar F, Fay DF, Feigin VL, Felson DT, Fereshtehnejad SM, Fernandes JG, Ferrari AJ, Fitzmaurice C, Flaxman AD, Fleming TD, Foigt N, Forouzanfar MH, Fowkes FG, Paleo UF, Franklin RC, Furst T, Gabbe B, Gaffkin L, Gankpe FG, Geleijnse JM, Gessner BD, Getthing P, Gibney KB, Giroud M, Giussani G, Gomez Dantes H, Gona P, Gonzalez-Medina D, Gosselin RA, Gotay CC, Goto A, Gouda HN, Graetz N, Gughani HC, Gupta R, Gupta R, Gutierrez RA, Haagsma J, Hafezi-Nejad N, Hagan H, Halasa YA, Hamadeh RR, Hamavid H, Hammami M, Hancock J, Hancock GJ, Hansen GM, Hao Y, Harb HL, Haro JM, Havmoeller R, Hay SI, Hay RJ, Heredia-Pi IB, Heuton KR, Heydarpour P, Higashi H, Hajar M, Hoek HW, Hoffman HJ, Hosgood HD, Hossain M, Hotez PJ, Hoy DG, Hsairi M, Hu G, Huang C, Huang JJ, Hussein A, Huynh C, Iannarone ML, Iburg KM, Innos K, Inoue M, Islami F, Jacobsen KH, Jarvis DL, Jassal SK, Jee SH, Jeemon P, Jensen PN, Jha V, Jiang G, Jiang Y, Jonas JB, Juel K, Kan H, Karch A, Karema CK, Karimkhani C, Karthikeyan G, Kassebaum NJ, Kaul A, Kawakami N, Kazanjan K, Kemp AH, Kengne AP, Keren A, Khader YS, Khalifa SE, Khan EA, Khan G, Khang YH, Kieling C, Kim D, Kim S, Kim Y, Kinfu Y, Kinge JM, Kivipelto M, Knibbs LD, Knudsen AK, Kokubo Y, Kosen S, Krishnaswami S, Kuate Defo B, Kucuk Bicer B, Kuipers EJ, Kulkarni C, Kulkarni VS, Kumar GA, Kyu HH, Lai T, Lalloo R, Lallukka T, Lam H, Lan Q, Lansing VC, Larsson A, Lawrynowicz AE, Leasher JL, Leigh J, Leung R, Levitz CE, Li B, Li Y, Li Y, Lim SS, Lind M, Lipshultz SE, Liu S, Liu Y, Lloyd BK, Lofgren KT, Logroscino G, Looker KJ, Lotret-Tieulent J, Lotufo PA, Lozano R, Lucas RM, Lunevicius R, Lyons RA, Ma S, Macintyre MF, Mackay MT, Majdan M, Malekzadeh R, Marcenos W, Margolis DJ, Margono C, Marzan MB, Masci JR, Mashal MT, Matzopoulos R, Mayosi BM, Mazorodze TT, McGill NW, McGrath JJ, McKee M, McLain A, Meaney PA, Medina C, Mehndiratta MM, Mekonnen W, Melaku YA, Meltzer M, Memish ZA, Mensah GA, Meretoja A, Mhimbira FA, Michra R, Miller TR, Mills EJ, Mitchell PB, Mock CN, Mohamed Ibrahim N, Mohammad KA, Mokdad AH, Mola GL, Monasta L, Montanez Hernandez JC, Montico M, Montine TJ, Mooney MD, Moore AR, Moradi-Lakeh M, Moran AE, Mori R, Moschandreass J, Moturi WN, Moyer ML, Mozaffarian D, Msemburi WT, Mueller UO, Mukaigawara M, Mullany EC, Murdoch ME, Murray J, Murthy KS, Naghavi M, Naheed A, Naidoo KS, Naldi L, Nand D, Nangia V, Narayan KM, Nejari C, Neupane SP, Newton CR, Ng M, Ngelesoni FN, Nguyen G, Nisar MI, Nolte S, Norheim OF, Norman RE, Norrving B, Nyakarahuka L, Oh IH, Ohkubo T, Ohno SL, Olusanya BO, Opio JN, Ortblad K, Ortiz A, Pain AW, Pandian JD, Panelo CI, Papachristou C, Park EK, Park JH, Patten SB, Patton GC, Paul VK, Pavlin BI, Pearce N, Pereira DM, Perez-Padilla R, Perez-Ruiz F, Perico N, Pervaz A, Pesudovs K, Peterson CB, Petzold M, Phillips MR, Phillips BK, Phillips DE, Piel FB, Plass D, Poenaru D, Polinder S, Pope D, Popova S, Poulton RG, Pourmalek F, Prabhakaran D, Prasad NM, Pullan RL, Qato DM, Quistberg DA, Rafay A, Rahimi K, Rahman SU, Raju R, Rana SM, Razavi H, Reddy KS, Refaat A, Remuzzi G, Resnikoff S, Ribeiro AL, Richardson L, Richardus JH, Roberts DA, Rojas-Rueda D, Ronfani L, Roth GA, Rothenbacher D, Rothstein DH, Rowley JT, Roy N, Ruhago GM, Saeedi MY, Saha S, Sahraian MA, Sampson UK, Sanabria JR, Sandar L, Santos IS, Satpathy M, Sawhney M, Scarborough P, Schneider IJ, Schottker B, Schumacher AE, Schwebel DC, Scott JG, Seedat S, Sepanlou SG, Serina PT, Servan-Mori EE, Shackelford KA, Shaheen S, Shahrz S, Shamah Levy T, Shangquan S, She J, Sheikhbahaei S, Shi P, Shibuya K, Shinohara Y, Shiri R, Shishani K, Shiue I, Shrimme MG, Sigfusdottir ID, Silberberg DH, Simard EP, Sindi S, Singh A, Singh JA, Singh L, Skirbekk V, Slepak EL, Sliwa K, Soneji S, Soreide K, Soshnikov S, Sposato LA, Sreeramareddy CT, Stanaway JD, Stathopoulou V, Stein DJ, Stein MB, Steiner C, Steiner TJ, Stevens A, Stewart A, Stovner LJ, Stroumpoulis K, Sunguya BF, Swaminathan S, Swaroop M, Sykes BL, Tabb KM, Takahashi K, Tandon N, Tanne D, Tanner M, Tavakkoli M, Taylor HR, Te Ao BJ, Tediosi F, Temesgen AM, Templin T, Ten Have M, Tenkorang EY, Terkawi AS, Thomson B, Thorne-Lyman AL, Thrift AG, Thurston GD, Tillmann T, Tonelli M, Topouzis F, Toyoshima H, Traebert J, Tran BX, Trillini M, Truelsen T, Tsilimbaris M, Tuzcu EM, Uchendu US, Ukwaja KN, Undurraga EA, Uzun SB, Van Brakel WH, Van De Vijver S, van Gool CH, Van Os J, Vasankari TJ, Venketasubramanian N, Violante FS, Vlassov VV, Vollset SE, Wagner GR, Wagner J, Waller SG, Wan X, Wang H, Wang J, Wang L, Warouw TS, Weichenthal S, Weiderpass E, Weintraub RG, Wenzhi W, Werdecker A, Westerman R, Whiteford HA, Wilkinson JD, Williams TN, Wolfe CD, Wolock TM, Woolf AD, Wulf S, Wurtz B, Xu G, Yan LL, Yano Y, Ye P, Yentur GK, Yip P, Yonemoto N, Yoon SJ, Younis MZ, Yu C, Zaki ME, Zhao Y, Zheng Y, Zonies D, Zou X, Salomon JA, Lopez AD, Vos T. Global, regional, and national disability-adjusted life years (DALYs) for 306 diseases and injuries and healthy life

- expectancy (HALE) for 188 countries, 1990-2013: quantifying the epidemiological transition. *Lancet* 2015;386:2145–91.
- [31] Nordin M, Carragee EJ, Hogg-Johnson S, Weiner SS, Hurwitz EL, Peloso PM, Guzman J, van der Velde G, Carroll LJ, Holm LW, Cote P, Cassidy JD, Haldeman S. Bone, Joint decade - Task Force on neck P, its associated D. Assessment of neck pain and its associated disorders: results of the Bone and Joint decade 2000-2010 Task Force on neck pain and its associated disorders. *Spine* 2008;33(4 suppl):S101–22.
- [32] Pincus T, Burton AK, Vogel S, Field AP. A systematic review of psychological factors as predictors of chronicity/disability in prospective cohorts of low back pain. *Spine* 2002;27:E109–20.
- [33] Pinheiro MB, Ferreira ML, Refshauge K, Maher CG, Ordonana JR, Andrade TB, Tsathas A, Ferreira PH. Symptoms of depression as a prognostic factor for low back pain: a systematic review. *Spine J* 2016;16:105–16.
- [34] Radhakrishnan K, Litchy WJ, O'Fallon WM, Kurland LT. Epidemiology of cervical radiculopathy. A population-based study from Rochester, Minnesota, 1976 through 1990. *Brain* 1994;117:325–35.
- [35] Ramond A, Bouton C, Richard I, Roquelaure Y, Baufreton C, Legrand E, Huez JF. Psychosocial risk factors for chronic low back pain in primary care—a systematic review. *Fam Pract* 2011;28:12–21.
- [36] Ryan C, Roberts L. Life on hold: the lived experience of radicular symptoms. A qualitative, interpretative inquiry. *Musculoskelet Sci Pract* 2019;39:51–7.
- [37] Schoenfeld AJ, George AA, Bader JO, Caram PM Jr. Incidence and epidemiology of cervical radiculopathy in the United States military: 2000 to 2009. *J spinal Disord Tech* 2012;25:17–22.
- [38] Scholz J, Finnerup NB, Attal N, Aziz Q, Baron R, Bennett MI, Benoliel R, Cohen M, Cruccu G, Davis KD, Evers S, First M, Giamberardino MA, Hansson P, Kaasa S, Korwisi B, Kosek E, Lavand'homme P, Nicholas M, Nurmikko T, Perrot S, Raja SN, Rice ASC, Rowbotham MC, Schug S, Simpson DM, Smith BH, Svensson P, Vlaeyen JWS, Wang SJ, Barke A, Rief W, Treede RD. Classification Committee of the Neuropathic Pain Special Interest G. The IASP classification of chronic pain for ICD-11: chronic neuropathic pain. *PAIN* 2019;160:53–9.
- [39] Shahidi B, Curran-Everett D, Maluf KS. Psychosocial, physical, and neurophysiological risk factors for chronic neck pain: a prospective inception cohort study. *J Pain* 2015;16:1288–99.
- [40] Smyth MJ, Wright V. Sciatica and the intervertebral disc; an experimental study. *J Bone Joint Surg Am* 1958;40-A:1401–18.
- [41] Stang A. Critical evaluation of the Newcastle-Ottawa scale for the assessment of the quality of nonrandomized studies in meta-analyses. *Eur J Epidemiol* 2010;25:603–5.
- [42] Sterud T, Johannessen HA, Tynes T. Work-related psychosocial and mechanical risk factors for neck/shoulder pain: a 3-year follow-up study of the general working population in Norway. *Int Arch Occup Environ Health* 2014;87:471–81.
- [43] Stubbs B, Aluko Y, Myint PK, Smith TO. Prevalence of depressive symptoms and anxiety in osteoarthritis: a systematic review and meta-analysis. *Age Ageing* 2016;45:228–35.
- [44] Treede RD, Jensen TS, Campbell JN, Cruccu G, Dostrovsky JO, Griffin JW, Hansson P, Hughes R, Nurmikko T, Serra J. Neuropathic pain: redefinition and a grading system for clinical and research purposes. *Neurology* 2008;70:1630–5.
- [45] Vernon H, Mior S. The Neck Disability Index: a study of reliability and validity. *J Manipulat Physiol Ther* 1991;14:409–15.
- [46] Ware J Jr, Kosinski M, Keller SD. A 12-Item Short-Form Health Survey: construction of scales and preliminary tests of reliability and validity. *Med Care* 1996;34:220–33.
- [47] Wertli MM, Burgstaller JM, Weiser S, Steurer J, Kofmehl R, Held U. Influence of catastrophizing on treatment outcome in patients with nonspecific low back pain: a systematic review. *Spine* 2014;39:263–73.
- [48] Wibault J, oberg B, Dederling A, Lofgren H, Zsigmond P, Persson L, Peolsson A. Individual factors associated with neck disability in patients with cervical radiculopathy scheduled for surgery: a study on physical impairments, psychosocial factors, and life style habits. *Eur Spine J* 2014;23:599–605.
- [49] Wise BL, Niu J, Zhang Y, Wang N, Jordan JM, Choy E, Hunter DJ. Psychological factors and their relation to osteoarthritis pain. *Osteoarthritis Cartilage* 2010;18:883–7.