

Accepted Manuscript

Identification of prognostic factors and assessment methods on the evaluation of non-specific low back pain in a biopsychosocial environment: A scoping review

Jerry Draper-Rodi, Steven Vogel, Annette Bishop



PII: S1746-0689(17)30069-X

DOI: [10.1016/j.ijosm.2018.07.001](https://doi.org/10.1016/j.ijosm.2018.07.001)

Reference: IJOSM 476

To appear in: *International Journal of Osteopathic Medicine*

Received Date: 23 April 2017

Revised Date: 23 April 2018

Accepted Date: 3 July 2018

Please cite this article as: Draper-Rodi J, Vogel S, Bishop A, Identification of prognostic factors and assessment methods on the evaluation of non-specific low back pain in a biopsychosocial environment: A scoping review, *International Journal of Osteopathic Medicine* (2018), doi: 10.1016/j.ijosm.2018.07.001.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Title page

Title

Identification of prognostic factors and assessment methods on the evaluation of non-specific low back pain in a biopsychosocial environment: a scoping review

Author names and affiliations

Jerry Draper-Rodi^a, Steven Vogel^a, Annette Bishop^b

- a. Research department, The British School of Osteopathy, 275 Borough High Street, London, SE1 1JE, UK
- b. Research Institute for Primary Care and Health Sciences, Keele University, Keele, Staffs ST5 5BG, UK

Corresponding author

Jerry Draper-Rodi J.Draper-Rodi@bso.ac.uk

IMPLICATIONS FOR PRACTICE

- This review lists biopsychosocial factors and assessment methods to use with non-specific low back pain
- These should be included in evidence-informed educational interventions
- This review supports a biopsychosocial approach in a manual therapy context

INTRODUCTION

85% of all LBP presentations can be classified as from non-specific causes (NSLBP) (Waddell 1987) where joints, discs and connective tissues may be contributing to symptoms but no specific tissues can be identified as causing the symptoms (Hartvigsen, Hancock et al. 2018). However, prior models of back pain were more biomedically orientated leading patient management to be informed by a biomedical approach that is still being used by many manual therapists (Synnott, O'Keeffe et al. 2015). In recognition of the lack of structural causes and acknowledging the predictive role of psychosocial factors, current guidance suggests the use of a biopsychosocial (BPS) model for LBP (Savigny, Kuntze et al. 2009). The BPS model advocates integrating the assessment and treatment of relevant biological, psychological and social factors based on individual patient needs (Waddell 1987, Waddell 2002). However practitioners' adherence to clinical guidelines is poor despite wide promulgation (Bekkering, van Tulder et al. 2005, Bishop, Foster et al. 2008, Evans, Breen et al. 2010) and BPS implementation is not clearly defined. Despite the fact that psychosocial factors are stronger predictors of low back pain outcomes than either physical

examination findings or severity/duration of pain (Chou, Qaseem et al. 2007), manual therapists' clinical assessments tend to focus on the biological aspect of the BPS model. Physical impairment is commonly assessed by manual therapists while psychosocial function is rarely assessed (Kent, Keating et al. 2009). When psychosocial function is assessed it is based on 'gut feeling' (Singla, Jones et al. 2015) that is less accurate than using formal instruments (Kent, Keating et al. 2009, Newell, Field et al. 2013). In addition, practitioners who hold a biomedical orientation to back pain tend to provide advice on work, physical activities and bed rest that are not in line with clinical guidelines (Rainville, Carlson et al. 2000, Houben, Gijsen et al. 2005, Bishop, Foster et al. 2008, Darlow, Fullen et al. 2012) and can transfer their unhelpful attitudes and beliefs towards back pain to patients (Coudeyre, Rannou et al. 2006, Poiraudreau, Rannou et al. 2006). Many previous studies have used a BPS educational intervention to influence practitioners' attitudes or behaviour and have shown variable effects (Asenlof, Denison et al. 2005, Hay, Mullis et al. 2005, Jellema, van der Windt et al. 2005, Stevenson, Lewis et al. 2006, Asenlof, Denison et al. 2009, Overmeer, Boersma et al. 2009, Hill, Whitehurst et al. 2011, Vibe Fersum, O'Sullivan et al. 2013). One key limitation of the studies that showed no effect was the limited content of the training programmes. Content analysis is the most critical step in the development of an educational intervention (Ghirardini 2011) but the content in these studies was drawn from literature that participants were likely to be aware of and authors of these studies hypothesise that this partly explains the absence of difference between the intervention and control groups (Jellema, van der

Windt et al. 2005, Stevenson, Lewis et al. 2006). In order to train manual therapists to develop their clinical judgements and their ability to prognosticate accurately with patients presenting with NSLBP, there is a need to synthesise evidence of BPS assessment methods and prognostic factors for NSLBP in order to inform clinical practice. Clinical guidelines and systematic reviews are appropriate sources to inform the content of training packages: systematic reviews offer high-quality information with minimisation of bias in the review process and the identification of sources of bias in the included studies (Furlan, Pennick et al. 2009, Higgins JPT & Green S (editors) 2011, Rushton, Calvert et al. 2011) and guidelines offer the additional interpretation and synthesis of a body of knowledge in an applied and pragmatic way to inform clinical practice and management of patients (Lugtenberg, Burgers et al. 2009, Evans, Breen et al. 2010, Jaspers, Smeulers et al. 2011). Combining systematic reviews and guidelines provides a synthesis of evidence with two complementary methodological features. The lack of external validity of systematic reviews can be challenging in a clinical setting, i.e. knowing if results from systematic reviews can be applied to a single individual (Rothwell 2005, Biondi-Zoccai, Lotrionte et al. 2011). Whereas clinical guidelines can sometimes rely more on experts' opinions than systematic methods, e.g. retrieving, appraising, synthesising and interpreting evidence using systematic and transparent methods (Oxman, Lavis et al. 2007). A review combining content from systematic reviews and clinical guidelines may offer reliable content to inform training packages that may also be meaningful to clinicians. The aim of this study was to provide a synthesis of

content to inform future BPS training programmes for NSLBP. The review results were used to inform the development of an e-learning educational intervention in 2015 (Draper-Rodi, Vogel et al. 2017).

The three most common approaches to summarise and disseminate research findings in allied health and rehabilitation have been traditional or narrative literature reviews, systematic literature reviews, and meta-analyses (Rumrill, Fitzgerald et al. 2010). Another method of summarising and disseminating research findings that has become increasingly popular in the last decade is the scoping review. Different authors have offered definitions of scoping reviews and the most recent, and most commonly reported is that it is “a form of knowledge synthesis that addresses an exploratory research question aimed at mapping key concepts, types of evidence, and gaps in research related to a defined area or field by systematically searching, selecting, and synthesizing existing knowledge” (Colquhoun, Levac et al. 2014). Scoping reviews are becoming increasingly popular especially in the field of health where 75% of scoping reviews addressed a health topic (Pham, Rajić et al. 2014). In 2005, Arksey and O’Malley published the first methodological framework for conducting a scoping study. They described five stages and an optional sixth one. The framework has since been refined by other authors (Levac, Colquhoun et al. 2010, Daudt, van Mossel et al. 2013). The BPS model and NSLBP are complex fields with a vast amount of literature dedicated to these topics. Informing future BPS training programmes requires a profile of the existing literature in this area. In order to achieve this,

the research question of this review was broad which suited the scoping review methodology. The aims of this scoping review were to:

1. summarise current guidance for the assessment and prognosis of NSLBP and the BPS model,
2. inform the development of a training programme synthesising evidence for the evaluation of NSLBP in a BPS context.

METHODS

This scoping review followed Arksey and O'Malley's 5-stage framework (Arksey and O'Malley 2005) and included the recommendations of Levac et al. (2010) and Daudt et al. (2013). The five stages are briefly outlined below.

Stage 1. Identifying the research question

The research question was: what are the BPS assessment methods and prognostic factors that should be included in an evidence-informed (Fryer 2008) training programme on the BPS approach for adult patients with NSLBP in a manual therapy context on any outcome measures reported in the literature?

Stage 2. Identifying relevant studies

The initial search strategy was piloted using Pubmed and AMED databases. We focussed on high quality secondary sources that reviewed primary sources on NSLBP or diagnostic assessment from literature that was the most likely to be accessed by clinicians to inform their practice: i.e. clinical guidelines and systematic reviews. It included biological, psychological or social factors, and assessment methods of NSLBP. The final search strategy was developed and fits with the Population – Concept – Context framework recommended for scoping

reviews (Joanna Briggs Institute 2015): Population – systematic reviews and guidelines; Concept – prognostic factors and or assessment methods; Context – Manual therapy BPS assessment approach to NSLBP. This aimed to identify literature relevant to different manual therapy professions and acknowledged the use of different words to describe the same concepts (Pillastrini, Vanti et al. 2015). The three authors from different manual therapy professions (osteopathy and physiotherapy) and an expert librarian in the manual therapy field developed the final search strategy to minimise the risk of excluding articles that could have been indexed incorrectly on electronic databases. A systematic online search was then performed on seven electronic databases: Medline, Cochrane, PsycINFO, OstMed, PEDro, AMED and CINAHL. The online search was performed between September and October 2014. Papers published since 2004 were included to ensure currency of information. The final search strategy included terms around four topics: NSLBP, manual therapy, the BPS model and examination. The search strategy was adapted for each database to ensure the greatest yield. See additional file 1 for details on the search strategy performed for each database.

Stage 3. Study selection

Results were downloaded into a Reference Management Software, Endnote (version X4.0.2), and duplicates were removed. Titles and abstracts were screened and studies not meeting the inclusion criteria were removed. Titles and abstracts were screened for inclusion by all three authors with disagreements resolved by discussion among authors. See box 1 for inclusion/exclusion criteria.

Box 1– inclusion / exclusion criteria for papers

Inclusion criteria:

- Systematic reviews and clinical guidelines
- English and French language publications focussing on NSLBP and or related BPS factors and or assessment methods
- Studies published between 2004 and 2014

Exclusion criteria

- Studies not published in English or French
- Studies that are not systematic reviews or clinical guidelines
- Studies published before 2004
- Publications focussing on serious spinal pathology or nerve root problems
- Publications focussing on non-manual interventions, e.g. surgery, medication or injections
- Studies focussing on pregnancy related LBP
- Studies focussing on NSLBP treatment interventions

Reference lists of included articles were screened to identify any additional articles. Articles were then categorised according to their methodology: clinical guidelines or systematic reviews and full text papers were obtained.

Stage 4. Charting the data

A data extraction form was designed to extract data consistently from the articles (see Appendix A – data extraction form for guidelines as an example).

The data extraction form included recording of inclusion criteria, and BPS factors

or assessment methods described. Two authors (JDR and SV) piloted this form by reviewing together three articles, resulting in an appropriate data extraction (listing each item, their description and strength of evidence) and synthesis method. This method was then reviewed with the third author (AB). Once the method was agreed, the first author completed data extraction for each article. Only secondary sources were included as they were likely to include quality assessment of primary research. For these reasons, guideline and systematic review quality was not appraised directly. This approach was concordant with scoping review methodological guidelines (Arksey and O'Malley 2005). After completion of the process, 3 articles, randomly selected, were analysed by another author (SV) to assess consistency of information extraction. Extracted items were reviewed by the authors for omissions and commissions.

Stage 5. Collating, summarising and reporting the results

A large amount of data was extracted and was reviewed against the inclusion/exclusion criteria of factors (see Box 2 – inclusion/exclusion criteria for factors and assessment methods) to produce a final table. First a summary table was created to summarise which papers included which factor/assessment method. This process allowed the identification and merging of duplicate factors. Inclusion or exclusion of each factor/assessment method in the next stage was based on the clarity of its definition, the level of evidence provided for this factor/assessment method (i.e. presence of evidence for or against a factor/assessment method), its prevalence in the literature for having a prognostic value (for prognostic factors only) with priority given to systematic

reviews onto guidelines if there was conflicting information and its applicability to manual therapy (see Box 2 – inclusion/exclusion criteria for factors and assessment methods). Modifiable and non-modifiable factors were extracted where there was evidence for or against their prognostic value. . Included and excluded factors/assessment methods were then listed and independently assessed by the two other authors. Disagreements were discussed between the authors and decisions based on the inclusion/exclusion criteria listed in box 2 were made. A final table listed all the items that fulfilled the criteria to be included in a training programme informed by a synthesis of evidence and those that did not meet the criteria were then excluded. In summary, the factors/assessment methods drawn from guidelines and systematic reviews were triangulated on the basis of the frequency of their appearance in the literature and the level of evidence. Their inclusion/exclusion was also based on agreement between the three authors.

Box 2 – inclusion/exclusion criteria for factors and assessment methods

Inclusion criteria

- Clear definition of the factor/assessment method
- Level of evidence for the factor/assessment method provided
- Occurrence in a systematic review of modifiable and non-modifiable factors related to prognostic value
- Occurrence in more than one clinical guideline of modifiable and non-modifiable factors related to prognostic value (where conflicting evidence was identified systematic review evidence was prioritised)
- Applicability of the factor/assessment method to manual therapy

Exclusion criteria

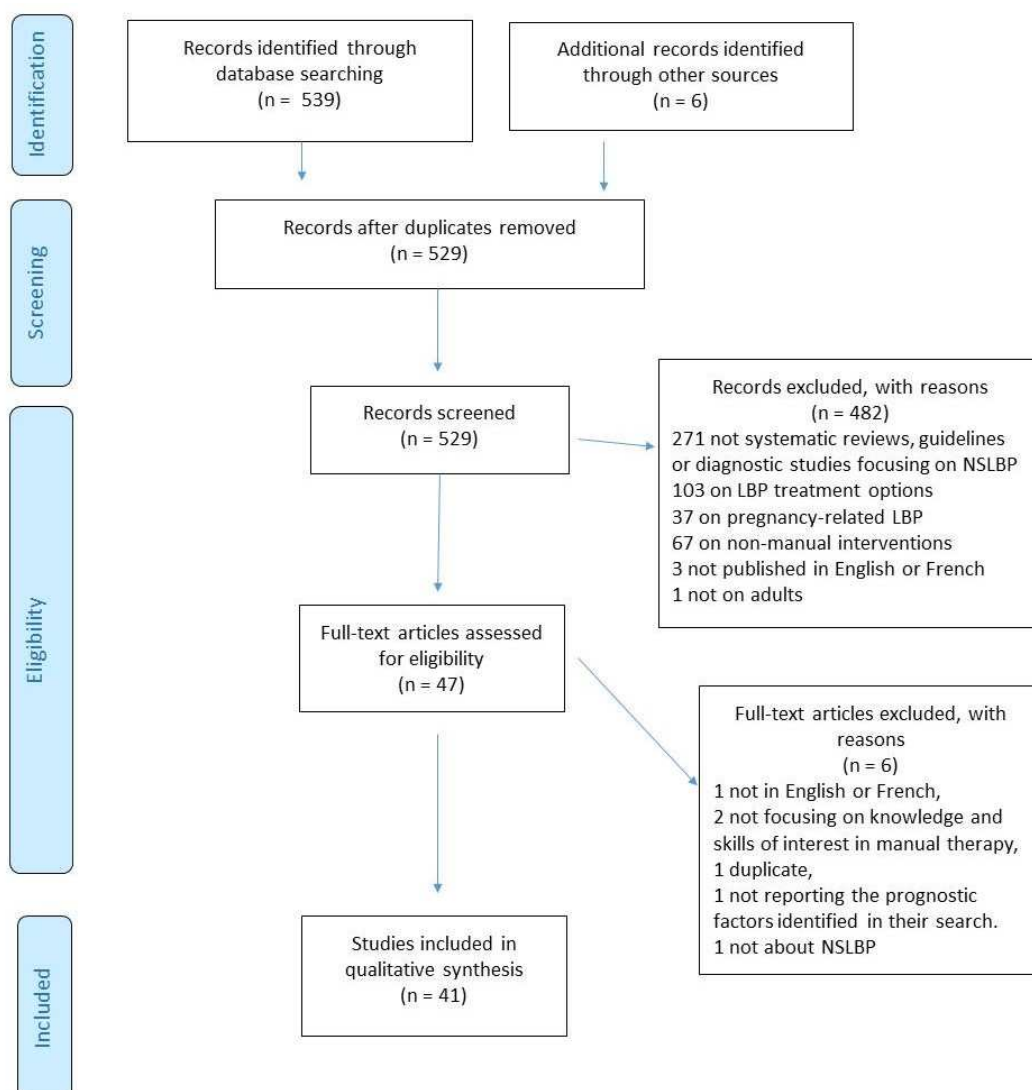
- Lack of clarity of the definition of the factor/assessment method
- Level of evidence of the factor/assessment method not provided

RESULTS

The online database search identified 539 articles. 41 articles met the inclusion criteria based on their titles and abstracts and 6 potential articles were identified in the reference lists of the articles: 15 clinical guidelines (Ashton, Butler et al. 2004, Hildebrandt, Ursin et al. 2004, Oostendorp, Scholten-Peeters et al. 2004, van Tulder, Becker et al. 2004, Burton, Balague et al. 2006, Chou, Qaseem et al. 2007, Chou, Loeser et al. 2009, Savigny, Kuntze et al. 2009, Chiodo, Alvarez et al. 2010, Clinical Guideline Subcommittee on Low Back Pain 2010, Koes, van Tulder et al. 2010, Guevara-Lopez, Covarrubias-Gomez et al. 2011, Toward Optimized Practice 2011, Delitto, George et al. 2012, Goertz, Thorson et al. 2012) and 32 systematic reviews (Fayad, Lefevre-Colau et al. 2004, Hartvigsen, Lings et al. 2004, Seffinger 2004, Steenstra, Verbeek et al. 2005, van Trijffel, Anderegg et al. 2005, May, Littlewood et al. 2006, Pincus, Vogel et al. 2006, Hamberg-van Reenen, Ariens et al. 2007, Littlewood and May 2007, Slebus, Kuijer et al. 2007, Kent and Keating 2008, Bakker, Verhagen et al. 2009, Chen, Liu et al. 2009, Iles, Davidson et al. 2009, Lakke, Soer et al. 2009, Chou and Shekelle 2010, Dagenais, Tricco et al. 2010, Shiri, Karppinen et al. 2010, Wai, Roffey et al. 2010, Alqarni, Schneiders et al. 2011, Kelly, Blake et al. 2011, Ramond, Bouton et al. 2011, Sitthipornvorakul, Janwantanakul et al. 2011, Janwantanakul, Sitthipornvorakul et al. 2012, Lang, Ochsmann et al. 2012, Luiisterburg, Miedema et al. 2012, Ribeiro, Aldabe et al. 2012, Verkerk, Luijsterburg et al. 2012, Ferreira, Beckenkamp et al. 2013, Ferreira, Pinheiro et al. 2013, Taylor, Goode et al. 2014,

Wertli, Rasmussen-Barr et al. 2014). The review process is documented in a PRISMA flow diagram (please see Figure 1 - Flowchart). 6 articles were excluded: 2 not focussing on manual therapy or knowledge and skills of interest in manual therapy consultation (Steenstra, Verbeek et al. 2005, Chou, Loeser et al. 2009), 1 not published in English or French (Guevara-Lopez, Covarrubias-Gomez et al. 2011), 1 duplicate due to different order of the authors' names in two references (Verkerk, Luijsterburg et al. 2012), 1 not reporting the prognostic factors identified in their search (Kent and Keating 2008), and 1 not about NSLBP (Alqarni, Schneiders et al. 2011). One article was updated to its most recent version (Toward Optimized Practice 2009, Toward Optimized Practice 2011).

Fig 1 – Flowchart



41 papers were included in this review. The overall agreement of JDR and SV on the extraction of three randomly selected articles was good. Minor amendments were made relating to items with absence of evidence: only those with evidence (either for or against their prognostic value) were included as specified in the inclusion criteria in box 2. The third author's mediation was not required. 83 BPS factors and assessment procedures were identified. After agreement between the three authors, 18 BPS factors and assessment procedures were excluded for

being supported only by weak or mixed evidence (12), for a lack of applicability in manual therapy (3), for being a non-modifiable factor that may not influence clinical reasoning (1), for being duplicate factors (1) or for having an unclear definition of the factor (1). 65 remained (see table 1): 10 assessment procedures and 55 BPS factors: 19 biological, 13 psychological and 23 social factors. Five categories of BPS factors emerged during the data extraction and interpretation: NSLBP onset (includes 10 prognostic factors), chronic pain (7 prognostic factors), disability (13 prognostic factors), unspecific poor outcomes (22 prognostic factors) and risk of recurrence (3 prognostic factors) (see table 1 for more details).

TABLE ONE HERE

DISCUSSION

The aims of this scoping review were to both inform practice by summarising current guidance in NSLBP and the BPS model and to inform the development of a training programme informed by a synthesis of evidence on the evaluation of NSLBP in a BPS context. A broad range of factors covering BPS aspects of back pain were identified: 55 BPS factors were extracted, 19 biological, 13 psychological and 23 social factors. Whilst recent initiatives have focussed on interventions aimed broadly at psychosocial factors and targeting those at risk of chronicity (Asenlof, Denison et al. 2005, Asenlof, Denison et al. 2009, Lamb, Lall et al. 2010, Hill, Whitehurst et al. 2011, Vibe Fersum, O'Sullivan et al. 2013), there has been little discussion of biological factors and their role in NSLBP.

Psychosocial factors are described as stronger predictors of low back pain outcomes than either physical examination findings or severity/duration of pain (Chou, Qaseem et al. 2007) and psychosocial factors have been emphasised in LBP clinical guidelines with the most striking example being the New Zealand clinical guidelines for LBP (Ashton, Butler et al. 2004) but this scoping review identified 13 biological factors as prognostic factors. Two possible reasons could explain the emergence of biological prognostic factors for NSLBP in this review: 1/ there might be a variation in classification of factors, e.g. it could be argued that sleep disorders could be classified as psychological rather than biological. 2/ biological prognostic factors may have been neglected in recent times while there was more emphasis on psychosocial factors. While it is of importance to assess and manage psychosocial issues, it may be time to include biological factors more explicitly as possible obstacles to recovery. Most of the biological factors that had a prognostic value were not modifiable within the context of manual therapy: e.g. previous back surgery, excessive mobility in other joints or history of LBP. However, they are valuable for informing the prognostic information given to patients and setting realistic therapeutic goals.

Poor description of interventions is a common issue in reporting of randomised controlled trials (Michie, Abraham et al. 2011) and the same issue applies to the existing reports of BPS training programmes in published studies. This presents a challenge when comparing the results from our study to the content of most previous interventions (Asenlof, Denison et al. 2005, Hay, Mullis et al. 2005, Asenlof, Denison et al. 2009). Previous training packages that detail their sources

have less references than in this scoping review (Jellema, van der Windt et al. 2005, Stevenson, Lewis et al. 2006, Overmeer, Boersma et al. 2009). The inclusion of biological factors as prognostic factors is not mentioned in several previous BPS training programmes (Jellema, van der Windt et al. 2005, Stevenson, Lewis et al. 2006, Overmeer, Boersma et al. 2009, Hill, Whitehurst et al. 2011). One study that included biological factors shows relatively large effects on participants with chronic NSLBP (Vibe Fersum, O'Sullivan et al. 2013). This study reports being informed by a BPS framework (O'Sullivan 2005) that is itself informed by a book chapter (Elvey and O'Sullivan 2004). Our findings support the categories of factors that need to be considered in a BPS however there were two main differences in our framework. Vibe Fersum, O'Sullivan (2013) 's framework has a lack of description of how these factors affect the course of an LBP episode and it emphasises patho-anatomical factors. It can be challenging to train manual therapists with a BPS model that does not include patho-anatomical factors but no patho-anatomical prognostic factors were extracted in the review presented here. This follows current guidance on the impossibility of diagnosing a specific tissue responsible for NSLBP (Airaksinen, Brox et al. 2006, Savigny, Kuntze et al. 2009).

The impact of the therapeutic alliance on patient outcomes was found in 6 factors identified in this review. This concurs with findings from other studies that found a positive association between therapeutic alliance and patient outcomes (Hall, Ferreira et al. 2010, Ferreira, Ferreira et al. 2013). Our

recommendation is that this should be included in BPS-informed educational programmes for practitioners.

Implications / recommendations

Whilst the BPS classification of the factors and assessment methods was presented to help the readability of the results, it is expected that the content could be used as a whole in training packages without making use of the classification itself. There was considerable overlap between the BPS categories in this study reinforcing the need to have an integrated teaching programme which incorporates the relationships between the 'Bio', 'Psycho' and 'Social' domains. There are a range of BPS factors that are available for manual therapists to evaluate in the clinical setting and that may have an impact on the prognosis of patients with NSLBP. The evaluation of BPS factors in the context of an individual patient is anticipated as leading clinicians towards targeted intervention and management strategies. If practitioners are to adopt a BPS approach this information should be included in all manual therapy undergraduate curricula. Post-graduate training should be accessible for manual therapists who trained before the BPS model became part of undergraduate training and in order to facilitate the adoption of current evidence to support their management of patients with NSLBP. This need is expressed by manual therapists who ask for specific training at both undergraduate and postgraduate levels to improve their understanding of psychosocial factors and how to assess these factors (Singla, Jones et al. 2015). Whilst current and accessible information is desirable for practitioners, there is little evidence that including

information about these prognostic factors at undergraduate or postgraduate levels changes manual therapists' behaviour to back pain and/or patient outcomes. Further research needs to explore the translation of evidence into changes in practitioner attitudes and behaviour.

Strengths and limitations

This scoping review is the first to be done on this topic. Scoping review methodology allowed inclusion of articles from various sources and various methodologies that were then arranged thematically in order to summarise and disseminate research findings to practitioners (Arksey and O'Malley 2005). One of its strengths is that it focussed on literature of high levels of evidence: systematic reviews and clinical guidelines commonly accessed by practitioners. It provided a synthesis of guidance and evidence useful to manual therapists managing patients with NSLBP and identified key elements to be included in training programmes informed by a synthesis of evidence on the evaluation of NSLBP in a BPS environment in a manual therapy context. Adherence and uptake of clinical guidelines has been demonstrated as poor (Bekkering, van Tulder et al. 2005, Bishop, Foster et al. 2008, Evans, Breen et al. 2010). In osteopathy, there is some evidence of a subgroup of osteopaths who reject synthesised evidence based guidance (Figg-Latham and Rajendran 2017). This adds further weight to the argument that there is a need for enhancing the implementation of practice that is informed by the best available clinical evidence. Hence our results can be used to inform the design of educational programmes using the most up-to-date

evidence about back pain aimed at enhancing BPS and evidence informed practice.

The factors/assessment methods drawn from the included clinical guidelines and systematic reviews summarises those that have been published in synthesised secondary sources and not an exhaustive list of all the prognostic, non-prognostic factors and assessment methods related to NSLBP. Prognostic studies are difficult to identify and are more prone to publication bias (Altman 2001) and that may have impacted the results of the studies included in this scoping review. In addition, some of the factors were drawn from clinical guidelines which typically include expert opinion in addition to evidential review. It is expected that the list of prognostic factors and assessment methods from this scoping review will need to be updated regularly as knowledge develops in this field. Another limitation is that the data extraction was only done by one reviewer (JDR). To minimise the possible effects of that, the process was verified on two levels. Firstly the two other authors (SV and AB) were from different manual therapy professions and were able to provide feedback according to their specific knowledge in the professional literature. Secondly, second and third authors' feedback was obtained at several stages in order to minimise the effects of the first author's judgement on the results: the overall agreement of the first two authors on the extraction of three randomly selected articles was good; the list of factors/assessment methods extracted was submitted to the second and third authors independently to elicit their decisions on inclusion and exclusion of the factors listed. Disagreements were discussed and consensus

reached in meetings. The authors' agreement on the extraction process could have been assessed with quantitative tools to offer a more precise analysis of their agreement. The appraisal of quality could have enhanced the information summarised in this scoping review, however it is a strength to have adopted a pragmatic, real-world, approach as recommended in scoping review methodology: scoping reviews can include quality appraisal when it is done as a first step towards conducting a systematic review (Daudt, van Mossel et al. 2013) and this remains a minority of published scoping reviews (less than 23%) (Pham, Rajić et al. 2014). The authors recognise that the frequency with which the factors have been reviewed is not an indicator of their effect size, however the number of times they appear in clinical guidelines is arguably a reflection of their importance. Another limitation is how results were presented: the classification of the factors and assessment methods could have been different to enhance its readability but we elected to report the findings in line with the time course of back pain in the anticipation that it may have good face validity. This scoping review aimed to broadly describe the literature in order to provide an inclusive evidence synthesis; however the breadth of a scoping review may equate to a lack of depth. A systematic review would offer more in-depth results and appraisal of sources and quality of evidence.

CONCLUSION

This scoping review aimed to identify biopsychosocial factors and reported assessment methods from the existing literature to inform the clinical practice of manual therapists managing patients with NSLBP and identify key elements to be

included in training programmes informed by a synthesis of evidence on the evaluation of NSLBP in a BPS context in a manual therapy context. This scoping review identified and included 55 BPS factors and 10 assessment methods.

ACCEPTED MANUSCRIPT

References,

Airaksinen, O., J. I. Brox, C. Cedraschi, J. Hildebrandt, J. Klaber-Moffett, F. Kovacs, A. F. Mannion, S. Reis, J. B. Staal, H. Ursin and G. Zanolli (2006). "Chapter 4. European guidelines for the management of chronic nonspecific low back pain." European spine journal **15**(Suppl 2): S192-300.

Alqarni, A. M., A. G. Schneiders and P. A. Hendrick (2011). "Clinical tests to diagnose lumbar segmental instability: A systematic review." Journal of Orthopaedic and Sports Physical Therapy **41**(3): 130-140.

Altman, D. (2001). "Systematic reviews of evaluations of prognostic variables." British Medical Journal **323**(7306): 224-228.

Arksey, H. and L. O'Malley (2005). "Scoping studies: towards a methodological framework." International journal of social research methodology **8**(1): 19-32.

Asenlof, P., E. Denison and P. Lindberg (2005). "Individually tailored treatment targeting activity, motor behavior, and cognition reduces pain-related disability: a randomized controlled trial in patients with musculoskeletal pain." J Pain **6**(9): 588-603.

Asenlof, P., E. Denison and P. Lindberg (2009). "Long-term follow-up of tailored behavioural treatment and exercise based physical therapy in persistent musculoskeletal pain: A randomized controlled trial in primary care." Eur J Pain **13**(10): 1080-1088.

Ashton, J., M. Butler, M. Bridge, R. Griffiths, J. Hawtin, N. Kendall, C. McGrath, H. McNaughton, S. Mercer, D. Nicholls, R. Nicholson, D. Scott, J. P. y. f. K. N. Watt, S. Linton and C. N. Z. A. C. C. Main (2004). "New Zealand acute low back pain guide, incorporating the guide to assessing psychosocial yellow flags in acute low back pain, October 2004 edition."

Bakker, E. W., A. P. Verhagen, E. van Trijffel, C. Lucas and B. W. Koes (2009). "Spinal mechanical load as a risk factor for low back pain: a systematic review of prospective cohort studies." Spine (Phila Pa 1976) **34**(8): E281-293.

Bekkering, G., M. W. van Tulder, E. J. Hendriks, M. A. Koopmanschap, D. L. Knol, L. X. Bouter and R. A. Oostendorp (2005). "Implementation of clinical guidelines on physical therapy for patients with low back pain: randomized trial comparing patient outcomes after a standard and active implementation strategy." Physical Therapy **85**(6): 544-555.

Biondi-Zoccai, G., M. Lotrionte, G. Landoni and M. G. Modena (2011). "The rough guide to systematic reviews and meta-analyses." HSR Proc Intensive Care Cardiovasc Anesth. **3**(3): 161-173.

Bishop, A., N. E. Foster, E. Thomas and E. M. Hay (2008). "How does the self-reported clinical management of patients with low back pain relate to the attitudes and beliefs of health care practitioners? A survey of UK general practitioners and physiotherapists." Pain **135**(1-2): 187-195.

Burton, A. K., F. Balague, G. Cardon, H. R. Eriksen, Y. Henrotin, A. Lahad, A. Leclerc, G. Muller and A. J. van der Beek (2006). "Chapter 2. European guidelines for prevention in low back pain: November 2004." European Spine Journal **15**(Suppl 2): [Online] Available at: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3454541/>.

Chen, S. M., M. F. Liu, J. Cook, S. Bass and S. K. Lo (2009). "Sedentary lifestyle as a risk factor for low back pain: a systematic review." International Archives of Occupational and Environmental Health **82**(7): 797-806.

Chiodo, A. E., D. J. Alvarez, G. P. Graziano, A. J. Haig, R. V. Harrison, P. Park, C. J. Standiford, R. A. Wasserman and U. o. M. H. System; (2010). "Acute low back pain: guidelines for clinical care [with consumer summary]." [Online] Available at: <http://www.med.umich.edu/1info/FHP/practiceguides/back/back.pdf>.

Chou, R., J. D. Loeser, D. K. Owens, R. W. Rosenquist, S. J. Atlas, J. Baisden, E. J. Carragee, M. Brabois, D. R. Murphy, D. K. Resnick, S. P. Stanos, W. O. Shaffer and E. M. Wall (2009). "Interventional therapies, surgery, and interdisciplinary rehabilitation for low back pain." Spine **34**(10): 1066-1077.

Chou, R., A. Qaseem, V. Snow, D. Casey, J. T. Cross, Jr., P. Shekelle and D. K. Owens (2007). "Diagnosis and treatment of low back pain: a joint clinical practice guideline from the American College of Physicians and the American Pain Society [with consumer summary]." Annals of Internal Medicine **147**(7): 478-491.

Chou, R. and P. Shekelle (2010). "Will this patient develop persistent disabling low back pain?" JAMA **303**(13): 1295-1302.

Clinical Guideline Subcommittee on Low Back Pain (2010). "American Osteopathic Association Guidelines for Osteopathic Manipulative Treatment (OMT) for Patients With Low Back Pain." J Am Osteopath Assoc **110**(11): 653-666.

Colquhoun, H. L., D. Levac, K. K. O'Brien, S. Straus, A. C. Tricco, L. Perrier, M. Kastner and D. Moher (2014). "Scoping reviews: time for clarity in definition, methods, and reporting." Journal of Clinical Epidemiology **67**(12): 1291-1294.

Coudeyre, E., F. Rannou, F. Tubach, G. Baron, F. Coriat, S. Brin, M. Revel and S. Poiraudreau (2006). "General practitioners' fear-avoidance beliefs influence their management of patients with low back pain." Pain **124**(3): 330-337.

- Dagenais, S., A. C. Tricco and S. Haldeman (2010). "Synthesis of recommendations for the assessment and management of low back pain from recent clinical practice guidelines." Spine J **10**(6): 514-529.
- Darlow, B., B. M. Fullen, S. Dean, D. A. Hurley, G. D. Baxter and A. Dowell (2012). "The association between health care professional attitudes and beliefs and the attitudes and beliefs, clinical management, and outcomes of patients with low back pain: a systematic review." Eur J Pain **16**(1): 3-17.
- Daudt, H., C. van Mossel and S. Scott (2013). "Enhancing the scoping study methodology: a large, inter-professional team's experience with Arksey and O'Malley's framework." BMC Medical Research Methodology **13**(48): [Online] Available at: <http://bmcmmedresmethodol.biomedcentral.com/articles/10.1186/1471-2288-1113-1148>.
- Delitto, A., S. Z. George, L. V. Dillen, J. M. Whitman, G. Sowa, P. Shekelle, T. R. Denninger and J. J. Godges (2012). "Low back pain clinical practice guidelines linked to the International Classification of Functioning, Disability, and Health from the Orthopaedic Section of the American Physical Therapy Association [with consumer summary]." The Journal of Orthopaedic and Sports Physical Therapy **42**(4): A1-A57.
- Draper-Rodi, J., S. Vogel and A. Bishop (2017). "Design and development of an e-learning programme: an illustrative commentary." International Journal of Osteopathic Magazine (**submitted**).
- Elvey, R. and P. O'Sullivan (2004). A contemporary approach to manual therapy. Grieve's Modern Manual Therapy. J. Boyling and G. Jull. Amsterdam, Elsevier, Churchill Livingstone.
- Evans, D., A. Breen, T. Pincus, J. Sim, M. Underwood, S. Vogel and N. Foster (2010). "The effectiveness of a posted information package on the beliefs and behavior of musculoskeletal practitioners: the UK Chiropractors, Osteopaths, and Musculoskeletal Physiotherapists Low Back Pain Management (COMPLEMENT) randomized trial." Spine **35**(8): 858-866.
- Fayad, F., M. M. Lefevre-Colau, S. Poiraudau, J. Fermanian, F. Rannou, S. Wlodyka Demaille, R. Benyahya and M. Revel (2004). "[Chronicity, recurrence, and return to work in low back pain: common prognostic factors]." Ann Readapt Med Phys **47**(4): 179-189.
- Ferreira, P. H., P. Beckenkamp, C. G. Maher, J. L. Hopper and M. L. Ferreira (2013). "Nature or nurture in low back pain? Results of a systematic review of studies based on twin samples." Eur J Pain **17**(7): 957-971.

Ferreira, P. H., M. L. Ferreira, C. G. Maher, K. M. Refshauge, J. Latimer and R. D. Adams (2013). "The therapeutic alliance between clinicians and patients predicts outcome in chronic low back pain." Physical Therapy **93**(4): 470-478.

Ferreira, P. H., M. B. Pinheiro, G. C. Machado and M. L. Ferreira (2013). "Is alcohol intake associated with low back pain? A systematic review of observational studies." Manual therapy **18**(3): 183-190.

Figg-Latham, J. and D. Rajendran (2017). "Quiet dissent: The attitudes, beliefs and behaviours of UK osteopaths who reject low back pain guidance—A qualitative study." Musculoskeletal Science and Practice **27**: 97-105.

Fryer, G. (2008). "Teaching critical thinking in osteopathy – Integrating craft knowledge and evidence-informed approaches." International Journal of Osteopathic Medicine **11**(2): 56-61.

Furlan, A., V. Pennick, C. Bombardier and M. van Tulder (2009). "2009 updated method guidelines for systematic reviews in the Cochrane Back Review Group." Spine **34**(18): 1929-1941.

Ghirardini, B. (2011). E-learning methodologies: A guide for designing and developing e-learning courses. Rome, Food and Agriculture Organisation for the United Nations.

Goertz, M., D. C. Thorson, R. Campbell, O. Kuku, B. Mueller, A. Locketz, J. Bonsell, B. Haake, R. Timming, B. Bonte, S. Peterson, C. Kramer, K. Retzer and J. Foreman (2012). Adult acute and subacute low back pain: fifteenth edition, Institute for Clinical Systems Improvement.

Guevara-Lopez, U., A. Covarrubias-Gomez, J. Elias-Dib, A. Reyes-Sanchez and T. S. Rodriguez-Reyna (2011). "Practice guidelines for the management of low back pain. Consensus Group of Practice Parameters to Manage Low Back Pain." Cirugia y Cirujanos **79**(3): 264-279, 286-302.

Hall, A. M., P. H. Ferreira, C. G. Maher, J. Latimer and M. L. Ferreira (2010). "The influence of the therapist-patient relationship on treatment outcome in physical rehabilitation: a systematic review." Physical Therapy **90**(8): 1099-1110.

Hamberg-van Reenen, H. H., G. A. Ariens, B. M. Blatter, W. van Mechelen and P. M. Bongers (2007). "A systematic review of the relation between physical capacity and future low back and neck/shoulder pain." Pain **130**(1-2): 93-107.

Hartvigsen, J., M. J. Hancock, A. Kongsted, Q. Louw, M. L. Ferreira, S. Genevay, D. Hoy, J. Karppinen, G. Pransky, J. Sieper, R. J. Smeets, M. Underwood, R. Buchbinder, J. Hartvigsen, D. Cherkin, N. E. Foster, C. G. Maher, M. Underwood, M. van Tulder, J. R. Anema, R. Chou, S. P. Cohen, L. Menezes Costa, P. Croft, M. Ferreira, P. H. Ferreira, J. M. Fritz, S. Genevay, D. P. Gross, M. J. Hancock, D. Hoy,

J. Karppinen, B. W. Koes, A. Kongsted, Q. Louw, B. Öberg, W. C. Peul, G. Pransky, M. Schoene, J. Sieper, R. J. Smeets, J. A. Turner and A. Woolf (2018). "What low back pain is and why we need to pay attention." The Lancet.

Hartvigsen, J., S. Lings, C. Leboeuf-Yde and L. Bakketeig (2004). "Psychosocial factors at work in relation to low back pain and consequences of low back pain; a systematic, critical review of prospective cohort studies." Occupational and Environmental Medicine **61**(1): 10p.

Hay, E., R. Mullis, M. Lewis, K. Vohora, C. J. Main, P. Watson, K. S. Dziedzic, J. Sim, C. M. Lowe and P. R. Croft (2005). "Comparison of physical treatments versus a brief pain-management programme for back pain in primary care: a randomised clinical trial in physiotherapy practice." Lancet **365**(9476): 2024–2030.

Higgins JPT & Green S (editors) (2011). Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0 [updated March 2011]. The Cochrane Collaboration, Available from www.cochrane-handbook.org.

Hildebrandt, J., H. Ursin, A. Mannion, O. Ariksainen, J. I. Brox, C. Cedraschi, J. Klaber-Moffett, F. Kovacs, S. Reis, B. Staal and G. Zanolli (2004). European guidelines for the management of chronic non-specific low back pain [with consumer summary]. Clinical Guideline Subcommittee on Low Back. COST B13 Working Group on Guidelines for Chronic Low Back Pain.

Hill, J. C., D. G. Whitehurst, M. Lewis, S. Bryan, K. M. Dunn, N. E. Foster, K. Konstantinou, C. J. Main, E. Mason, S. Somerville, G. Sowden, K. Vohora and E. M. Hay (2011). "Comparison of stratified primary care management for low back pain with current best practice (STarT Back): a randomised controlled trial." The Lancet **378**(9802): 1560-1571.

Houben, R. M. A., A. Gijzen, J. Peterson, P. J. de Jong and J. W. S. Vlaeyen (2005). "Do health care providers' attitudes towards back pain predict their treatment recommendations? Differential predictive validity of implicit and explicit attitude measures." Pain **114**(3): 491-498.

Iles, R. A., M. Davidson, N. F. Taylor and P. O'Halloran (2009). "Systematic review of the ability of recovery expectations to predict outcomes in non-chronic non-specific low back pain." JOURNAL OF OCCUPATIONAL REHABILITATION **19**(1): 25-40.

Janwantanakul, P., E. Sitthipornvorakul and A. Paksaichol (2012). "Risk factors for the onset of nonspecific low back pain in office workers: a systematic review of prospective cohort studies." J Manipulative Physiol Ther **35**(7): 568-577.

Jaspers, M. W., M. Smeulders, H. Vermeulen and L. W. Peute (2011). "Effects of clinical decision-support systems on practitioner performance and patient

outcomes: a synthesis of high-quality systematic review findings." J Am Med Inform Assoc **18**(3): 327-334.

Jellema, P., D. van der Windt, H. van der Horst, J. W. R. Twisk, W. A. B. Stalman and L. M. Bouter (2005). "Should treatment of (sub)acute low back pain be aimed at psychosocial prognostic factors? Cluster randomised clinical trial in general practice." BMJ **331**(7508): [Online] Available at: <http://www.bmj.com/content/bmj/331/7508/7584.full.pdf>.

Joanna Briggs Institute (2015). The Joanna Brigg's Institute reviewers' manual 2015. Methodol JBI Scoping Rev Joanna Briggs Inst JBI 2015.

Kelly, G. A., C. Blake, C. K. Power, D. O'Keeffe and B. M. Fullen (2011). "The association between chronic low back pain and sleep: a systematic review." Clinical Journal of Pain **27**(2): 169-181.

Kent, P. M. and J. L. Keating (2008). "Can we predict poor recovery from recent-onset nonspecific low back pain? A systematic review." Manual Therapy **13**(1): 12-28.

Kent, P. M., J. L. Keating and N. F. Taylor (2009). "Primary care clinicians use variable methods to assess acute nonspecific low back pain and usually focus on impairments." Manual Therapy **14**(1): 88-100.

Koes, B. W., M. van Tulder, C. W. Lin, L. G. Macedo, J. McAuley and C. Maher (2010). "An updated overview of clinical guidelines for the management of non-specific low back pain in primary care." European spine journal **19**(12): 2075-2094.

Lakke, S. E., R. Soer, T. Takken and M. F. Reneman (2009). "Risk and prognostic factors for non-specific musculoskeletal pain: a synthesis of evidence from systematic reviews classified into ICF dimensions." Pain **147**(1-3): 153-164.

Lamb, S., R. Lall, Z. Hansen, E. Castelnuovo, E. Withers, V. Nichols, F. Griffiths, R. Potter, A. Szczepura, M. Underwood and B. t. group. (2010). "A multicentred randomised controlled trial of a primary care-based cognitive behavioural programme for low back pain. The Back Skills Training (BeST) trial." Health Technol Assess **14**(41): 1-253.

Lang, J., E. Ochsmann, T. Kraus and J. W. B. Lang (2012). "Psychosocial work stressors as antecedents of musculoskeletal problems: A systematic review and meta-analysis of stability-adjusted longitudinal studies." Social Science and Medicine **75**(7): 1163-1174.

Levac, D., H. Colquhoun and K. K. O'Brien (2010). "Scoping studies: advancing the methodology." Implementation science : IS **5**(69): [Online] Available at:

<http://implementationscience.biomedcentral.com/articles/10.1186/1748-5908-1185-1169>.

Littlewood, C. and S. May (2007). "Measurement of range of movement in the lumbar spine - what methods are valid? A systematic review." PHYSIOTHERAPY (LONDON) **93**(3): 201.

Lugtenberg, M., J. S. Burgers and G. P. Westert (2009). "Effects of evidence-based clinical practice guidelines on quality of care: a systematic review." Qual Saf Health Care **18**(5): 385-392.

Luijsterburg, P. A. J., H. S. Miedema, K. Verkerk, A. Pool-Goudzwaard and B. W. Koes (2012). "Prognostic Factors for Recovery in Chronic Nonspecific Low Back Pain: A Systematic Review." Physical Therapy **92**(9): 1093-1108.

May, S., C. Littlewood and A. Bishop (2006). "Reliability of procedures used in the physical examination of non-specific low back pain: A systematic review." Australian Journal of Physiotherapy **52**(2): 91-102.

Michie, S., C. Abraham, M. P. Eccles, G. Francis, W. Hardeman and M. Johnston (2011). "Strengthening evaluation and implementation by specifying components of behaviour change interventions: a study protocol." Implementation Science **6**(10): [Online] Available at: <https://implementationscience.biomedcentral.com/articles/10.1186/1748-5908-1186-1110>.

Newell, D., J. Field and N. Visnes (2013). "Prognostic accuracy of clinicians for back, neck and shoulder patients in routine practice." Chiropractic & manual therapies **21**(42): [Online] Available at: <http://www.chiromt.com/content/21/21/42>.

O'Sullivan, P. (2005). "Diagnosis and classification of chronic low back pain disorders: maladaptive movement and motor control impairments as underlying mechanism." Manual Therapy **10**(4): 242-255.

Oostendorp, R. A. B., G. G. M. Scholten-Peeters, R. A. H. Swinkels, G. E. Bekkering, M. W. F. Heijmans, P. A. Huijbregts and E. J. M. Hendriks (2004). "Evidence-based practice in physical and manual therapy: development and content of Dutch National Practice Guidelines for patients with non-specific low back pain." Journal of Manual & Manipulative Therapy **12**(1): 21-31.

Overmeer, T., K. Boersma, C. J. Main and S. J. Linton (2009). "Do physical therapists change their beliefs, attitudes, knowledge, skills and behaviour after a biopsychosocially orientated university course?" Journal of Evaluation in Clinical Practice **15**(4): 724-732.

- Oxman, A. D., J. N. Lavis and A. Fretheim (2007). "Use of evidence in WHO recommendations." The Lancet **369**(9576): 1883-1889.
- Pham, M. T., A. Rajić, J. D. Greig, J. M. Sargeant, A. Papadopoulos and S. A. McEwen (2014). "A scoping review of scoping reviews: advancing the approach and enhancing the consistency." Research Synthesis Methods **5**(4): 371-385.
- Pillastrini, P., C. Vanti, S. Curti, S. Mattioli, S. Ferrari, F. S. Violante and A. Guccione (2015). "Using PubMed search strings for efficient retrieval of manual therapy research literature." Journal of Manipulative and Physiological Therapeutics **38**(2): 159-166.
- Pincus, T., S. Vogel, A. K. Burton, R. Santos and A. P. Field (2006). "Fear avoidance and prognosis in back pain: A systematic review and synthesis of current evidence." Arthritis and Rheumatism **54**(12): 3999-4010.
- Poiraudeau, S., F. Rannou, A. Le Henaff, E. Coudeyre, S. Rozenberg, D. Huas, C. Martineau, I. Jolivet-Landreau, M. Revel and P. Ravaud (2006). "Outcome of subacute low back pain: influence of patients' and rheumatologists' characteristics." Rheumatology **45**(6): 718-723.
- Rainville, J., N. Carlson, P. Polatin, R. J. Gatchel and A. Indahl (2000). "Exploration of physicians' recommendations for activities in chronic low back pain." Spine **25**(17): 2210-2220.
- Ramond, A., C. Bouton, I. Richard, Y. Roquelaure, C. Baufreton, E. Legrand and J. F. Huez (2011). "Psychosocial risk factors for chronic low back pain in primary care--a systematic review." Family practice **28**(1): 12-21.
- Ribeiro, D. C., D. Aldabe, J. H. Abbott, G. Sole and S. Milosavljevic (2012). "Dose-response relationship between work-related cumulative postural exposure and low back pain: a systematic review." Annals of Occupational Hygiene **56**(6): 684-696.
- Rothwell, P. M. (2005). "External validity of randomised controlled trials: "to whom do the results of this trial apply?"" Lancet **365**(9543): 82-93.
- Rumrill, P. D., S. M. Fitzgerald and W. R. Merchant (2010). "Using scoping literature reviews as a means of understanding and interpreting existing literature." Work **35**(3): 399-404.
- Rushton, A., M. Calvert, C. Wright and N. Freemantle (2011). "Physiotherapy trials for the 21st century: time to raise the bar?" Journal of the Royal Society of Medicine **104**(11): 437-441.
- Savigny, P., S. Kuntze, P. Watson, M. Underwood, G. Ritchie, M. Cotterell, D. Hill, N. Browne, E. Buchanan, P. Coffey, P. Dixon, C. Drummond, M. Flanagan, C.

Greenough, M. Griffiths, J. Halliday-Bell, D. Hettinga, S. Vogel and D. Walsh (2009). *Low back pain: early management of persistent non-specific low back pain*. London, National Institute for Health and Clinical Excellence.

Savigny, P., S. Kuntze, P. Watson, M. Underwood, G. Ritchie, M. Cotterell, D. Hill, N. Browne, E. Buchanan, P. Coffey, P. Dixon, C. Drummond, M. Flanagan, C. Greenough, M. Griffiths, J. Halliday-Bell, D. Hettinga, S. Vogel and R. C. o. G. P. Walsh D National Collaborating Centre for Primary Care (2009). "Low back pain: early management of persistent non-specific low back pain: full guideline."

Seffinger, M. N., Wl. Mishra, Sl. Adams, A. Dickerson, VM. Murphy, LS. Reinsch, S. (2004). "Reliability of spinal palpation for diagnosis of back and neck pain: a systematic review of the literature." *Spine J* **29**(19): E413-425.

Shiri, R., J. Karppinen, P. Leino-Arjas, S. Solovieva and E. Viikari-Juntura (2010). "The association between obesity and low back pain: a meta-analysis." *American Journal of Epidemiology* **171**(2): 135-154.

Singla, M., M. Jones, I. Edwards and S. Kumar (2015). "Physiotherapists' assessment of patients' psychosocial status: Are we standing on thin ice? A qualitative descriptive study." *Manual Therapy* **20**(2): 328-334.

Sitthipornvorakul, E., P. Janwantanakul, N. Purepong, P. Pensri and A. J. van der Beek (2011). "The association between physical activity and neck and low back pain: a systematic review." *European Spine Journal* **20**(5): 677-689.

Slebus, F. G., P. P. F. Kuijer, J. H. B. Willems, J. K. Sluiter and M. H. W. Frings-Dresen (2007). "Prognostic factors for work ability in sicklisted employees with chronic diseases." *Occupational and Environmental Medicine* **64**(12): 814-819.

Steenstra, I. A., J. H. Verbeek, M. W. Heymans and P. M. Bongers (2005). "Prognostic factors for duration of sick leave in patients sick listed with acute low back pain: a systematic review of the literature." *Occupational and Environmental Medicine* **62**(12): 851-860.

Stevenson, K., M. Lewis and E. Hay (2006). "Does physiotherapy management of low back pain change as a result of an evidence-based educational programme?" *Journal of Evaluation in Clinical Practice* **12**: 365-375.

Synnott, A., M. O'Keeffe, S. Bunzli, W. Dankaerts, P. O'Sullivan and K. O'Sullivan (2015). "Physiotherapists may stigmatise or feel unprepared to treat people with low back pain and psychosocial factors that influence recovery: a systematic review." *J Physiother* **61**(2): 68-76.

Taylor, J. B., A. P. Goode, S. Z. George and C. E. Cook (2014). "Incidence and risk factors for first-time incident low back pain: a systematic review and meta-analysis." *The spine journal* **14**(10): 2299-2319.

Toward Optimized Practice (2009). Guideline for the evidence-informed primary care management of low back pain. Edmonton (AB): 21 p.

Toward Optimized Practice (2011). Guideline for the evidence-informed primary care management of low back pain. Edmonton (AB): 37 p.

van Trijffel, E., Q. Anderegg, P. M. M. Bossuyt and C. Lucas (2005). "Inter-examiner reliability of passive assessment of intervertebral motion in the cervical and lumbar spine: a systematic review." Manual therapy **10**(4): 256-269.

van Tulder, M., A. Becker, T. Bekkering, A. Breen, T. Carter, M. T. Gil del Real, A. Hutchinson, B. Koes, P. Kryger-Baggesen, E. Laerum, A. Malmivaara, A. Nachemson, W. Niehus, E. Roux and C. B. w. g. o. g. f. t. m. o. a. l. b. p. i. p. c. Rozenberg S European Commission Research Directorate General (2004). "European guidelines for the management of acute nonspecific low back pain in primary care [with consumer summary]."

Verkerk, K., P. A. Luijsterburg, H. S. Miedema, A. Pool-Goudzwaard and B. W. Koes (2012). "Prognostic factors for recovery in chronic nonspecific low back pain: A systematic review." Physical Therapy **92**(9): 1093-1108.

Verkerk, K., P. A. J. Luijsterburg, H. S. Miedema, A. Pool-Goudzwaard and B. W. Koes (2012). "Prognostic Factors for Recovery in Chronic Nonspecific Low Back Pain: A Systematic Review." Physical Therapy **92**(9): 1093-1108.

Vibe Fersum, K., P. O'Sullivan, J. S. Skouen, A. Smith and A. Kvale (2013). "Efficacy of classification-based cognitive functional therapy in patients with non-specific chronic low back pain: a randomized controlled trial." Eur J Pain **17**(6): 916-928.

Waddell, G. (1987). "1987 Volvo award in clinical sciences. A new clinical model for the treatment of low-back pain." Spine J **12**(7): 632-644.

Waddell, G. (2002). Models of disability: using low back pain as an example. London, Royal Society of Medicine Press.

Wai, E. K., D. M. Roffey, P. Bishop, B. K. Kwon and S. Dagenais (2010). "Causal assessment of occupational carrying and low back pain: results of a systematic review." Spine J **10**(7): 628-638.

Wertli, M. M., E. Rasmussen-Barr, S. Weiser, L. M. Bachmann and F. Brunner (2014). "The role of fear avoidance beliefs as a prognostic factor for outcome in patients with nonspecific low back pain: a systematic review." The spine journal : official journal of the North American Spine Society **14**(5): 816-836 e814.

	References	Biological factors	Psychological factors	Social factors	Assessment methods
NSLBP onset					
Prognostic factors					
Low job satisfaction	Ashton J. et al. 2004*; Chou R. & Shekelle P. 2010°; Fayad F. et al. 2004°; Goertz M. et al. 2012*; Lakke S. et al. 2009°; Ramond A. et al. 2011°; Slebus F. et al. 2007°; Toward Optimized Practice 2011*; Van Tulder M. et al. 2004*			x	
Possible prognostic factors					
Higher physical work demands	Ashton J. et al. 2004*; Bakker E. et al. 2009°; Chiodo A. et al. 2010*; Chou R. & Shekelle P. 2010°; Delitto A. et al. 2012*; Goertz M. et al. 2012*; Janwantanakul P. & Sitthipornvorakul E. 2012°; Luiisterburg P. et al. 2012°; Ribeiro D. et al. 2012°; Slebus F. et al. 2007°; Wai E. et al. 2010°			x	
Obesity	Chiodo A. et al. 2010*; Chou R. & Shekelle P. 2010°; Ferreira PH. et al. 2013°; Shiri R. et al. 2010°	x			
Non-prognostic factors					
Poor trunk muscle strength	Delitto A. et al. 2012*; Hamberg-Van Reenen HH. et al. 2007°	x			
Leisure-time sport or exercises or professional level exercises	Bakker EW. et al. 2009°; Sitthipornvorakul E. 2011°	x			
Prolonged standing or walking	Bakker EW. et al. 2009	x			
Depression	Ashton J. et al. 2004*; Chiodo A. et al. 2010*; Chou R. et al. 2007*; Dagenais S. et al. 2010°; Delitto A. et al. 2012*; Ferreira P. et al. 2013°; Goertz M. et al. 2012*; Hildebrandt J. et al. 2005*; Janwantanakul P. & Sitthipornvorakul E. 2012°; Oostendorp R. et al. 2004*; Pincus T. et al. 2006°; Ramond A. et al. 2011°; Savigny P. et al. 2009°; Toward Optimized Practice 2011*; Van Tulder M. et al. 2004*		x		

Sitting, during leisure time or at work (independently or combined)	Bakker EW. et al. 2009°; Chen SM. et al. 2009°	x	
Sedentary work and desk/chair set up	Chen S. et al. 2009°; Janwantanakul P. & Sitthipornvorakul E. 2012°		x
Trunk muscle endurance	Hamberg-Van Reenen HH. et al. 2007°	x	
Chronic pain prognostic factors			
Prognostic factors			
Symptoms below the knee	Delitto A. 2012*	x	
Important functional impairment	Chou R. & Shekelle P. 2010°; Fayad F. et al. 2004°; Hildebrandt J. et al. 2005*; Savigny P. et al. 2009*	x	
Previous back surgery	Chiodo A. et al. 2010*	x	
Preexisting sleep disturbances	Ashton J. et al. 2004*; Bakker W. et al. 2009°; Kelly G. et al. 2011°	x	
Belief that work is harmful	Ashton J. et al. 2004*; Hartvigsen J. et al. 2004°; Pincus T. et al. 2006°		x
Non-prognostic factors			
Stress at work and LBP	Ashton J. et al. 2004*; Hartvigsen J. et al. 2004°; Slebus F. et al. 2007°		x
Many structural changes (including OA, mild to moderate scoliosis, SIJ asymmetry, disc bulges)	Chiodo A. et al. 2010*	x	
Disability prognostic factors			
Prognostic factors			
Younger age (favourable prognostic factor)	Chou R. & Shekelle P. 2010°; Fayad F. et al. 2004°; Janwantanakul P. & Sitthipornvorakul E. 2012°; Luiisterburg P. et al. 2012°; Oostendorp R. et al. 2004*; Slebus F. et al. 2007°	x	
Mutliple previous MSK complaints	Littlewood C. & May S. 2007°	x	
Genetics (from complex and disabling LBP)	Delitto A. et al. 2012*; Ferreira P. et al. 2013°	x	
Extreme symptom report	Ashton J. et al. 2004*; Chiodo A. et al. 2010°; Hildebrandt J. et al. 2005*		x
Low socioeconomic status	Ashton J. et al. 2004*; Chiodo A. et al. 2010°; Ferreira P. et al. 2013		x
Possible prognostic factors			

Patients' pain misbeliefs	Ashton J. et al. 2004*; Chiodo A. et al. 2010*; Chou R. & Shekelle P. 2010°; Delitto A. et al. 2012*; Goertz M. et al. 2012*; Lakke S. et al. 2009°; Luiisterburg P. 2012°; Oostendorp R. et al. 2004*; Pincus T. 2006°; Ramond A. et al. 2011°; Savigny P. et al. 2009*; Toward Optimized Practice 2011*; Van Tulder M. et al. 2004*	x
Compensation issues, previous sick leave on LBP, financial problems and delay to access income support	Ashton J. et al. 2004*; Chiodo A. et al. 2010*; Goertz M. et al. 2012*; Chou R. & Shekelle P. 2010°; Ramond A. et al. 2011°; Toward Optimized Practice 2011*; Van Tulder M. et al. 2004*	x
Poor relationships with peers at work	Ashton J. et al. 2004*; Chiodo A. et al. 2010*; Goertz M. et al. 2012*	x
Experience of conflicting diagnoses or explanations for back pain	Ashton J. et al. 2004*	x
Use of diagnostic language (eg, fear of ending up in a wheelchair)	Ashton J. et al. 2004*; Van Tulder M. et al. 2004*	x
A careful initial examination (favourable prognostic factor)	Ashton J. et al. 2004*; Van Tulder M. et al. 2004*	x
Patient expectation of a 'techno-fix', eg, requests to treat as if body were a machine	Ashton J. et al. 2004*	x
Lack of satisfaction with previous treatment for back pain	Ashton J. et al. 2004*	x
Advice from healthcare professional to withdraw from work	Ashton J. et al. 2004*	x
Unspecific poor outcomes prognostic factors		
Prognostic factors		
LBP associated with various other diseases, including osteoporosis, asthma, diabetes and chronic headaches.	Chou R. & Shekelle P. 2010°; Delitto A. et al. 2012*; Ferreira P. Et al. 2013°; Goertz M. et al. 2012*; Janwantanakul P. & Sitthipornvorakul E. 2012°; Ramond A. et al. 2011°; Slebus F. et al. 2007°	x

Patients' poor self-perceived health	Chou R. & Shekelle P. 2010°; Delitto A. et al. 2012*; Ferreira P. et al. 2013°; Goertz M. et al. 2012*; Janwantanakul P. & Sitthipornvorakul E. 2012°; Ramond A. et al. 2011°; Slebus F. et al. 2007°	x
High intensity of LBP at baseline	Chou R. & Shekelle P. 2010°; Delitto A. et al. 2012*; Fayad F. et al. 2004°; Goertz M. et al. 2012*; Hildebrandt J. et al. 2005*; Luiisterburg P. et al. 2012°; Oostendorp R. et al. 2004*; Slebus F. et al. 2007°	x
Passive coping strategies, including extended rest and excessive reliance on use of aids or appliances	Ashton J. et al. 2004*; Chou R. et al. 2007*; Delitto A. et al. 2012*; Goertz M. et al. 2012*; Oostendorp R. et al. 2004*; Toward Optimized Practice 2011*; Van Tulder M. et al. 2004*	x
Reduced activity level	Ashton J. et al. 2004*; Oostendorp R. et al. 2004*; Van Tulder M. et al. 2004*	x
Patient's healthcare beliefs that do not fit best practice	Goertz M. et al. 2012*; Toward Optimized Practice 2011*	x
Poor patients' expectations of recovery	Goertz M. et al. 2012*; Oostendorp R. et al. 2004*; Ramond A. et al. 2011°	x
Fear of activity	Ashton J. et al. 2004*; Dagenais S. et. 2010; Delitto A. et al. 2012*; Oostendorp R. et al. 2004*; Savigny P. et al. 2009*; Toward Optimized Practice 2011; Wertli M. et al. 2014	x
Depression	Ashton J. et al. 2004*; Chiodo A. et al. 2010*; Chou R. et al. 2007*; Dagenais S. et. 2010°; Delitto A. et al. 2012*; Ferreira P. et al. 2013°; Goertz M. et al. 2012*; Hildebrandt J. et al. 2005*; Janwantanakul P. & Sitthipornvorakul E. 2012°; Oostendorp R. et al. 2004*; Pincus T. et al. 2006°; Ramond A. et al. 2011°; Savigny P. et al. 2009*; Toward Optimized Practice 2011*; Van Tulder M. et al. 2004*	x
Anxiety	Ashton J. et al. 2004*; Dagenais S. et. 2010°; Goertz M. et al. 2012*; Ramond A. et al. 2011°; Savigny P. et al. 2009*; Van Tulder M. et al. 2004*	x

Current psychiatric comorbidity	Chiodo A. et al. 2010*; Chou R. & Shekelle P. 2010°	x
Lack of job accommodations and absence of graduated return to work pathways	Ashton J. et al. 2004*, Goertz M. et al. 2012*	x
Recovery expectations	Chiodo A. et al. 2010*, Goertz M. et al. 2012*, Iles R. et al. 2009°	x
Clinician's fear-avoidance beliefs	Goertz M. et al. 2012*	x
Possible prognostic factors		
Low level of self-efficacy (coping skills) with regards to LBP	Oostendorp R. et al. 2004*	x
Higher work demands and/or history of specific manual works (including farming, nursing, truck driving)	Ashton J. et al. 2004*, Bakker E. et al. 2009°, Chou R. & Shekelle P. 2010°, Chiodo A. et al. 2010*, Delitto A. et al. 2012*, Goertz M. et al. 2012*, Janwantanakul P. & Sitthipornvorakul E. 2012°, Luiisterburg P et al. 2012°, Ribeiro D. et al. 2012°, Slebus F. et al. 2007°, Wai E. et al. 2010°	x
Low job satisfaction predicts	Ashton J. et al. 2004*, Chou R. & Shekelle P. 2010°, Fayad F. et al. 2004°, Goertz M. et al. 2012*, Lakke S et al. 2009°, Ramond A. et al. 2011°, Slebus F. et al. 2007°, Toward Optimized Practice 2011*, Van Tulder M. et al. 2004*	x
Labelling patients with Yellow Flags and sanctioning disability	Ashton J. et al. 2004*	x
Inflexible work schedule or unsociable hours	Ashton J. et al. 2004*, Goertz M. et al. 2012*, Hildebrandt J. et al. 2005*, Toward Optimized Practice 2011*, Van Tulder M. et al. 2004*	x
Spouse and family behaviour and/or negative expectations of recovery	Ashton J. et al. 2004*, Chiodo A. et al. 2010*, Goertz M. et al. 2012*, Toward Optimized Practice 2011*	x
Non-pronostic factors		
Social support at work	Ashton J. et al. 2004*, Goertz M. et al. 2012*, Hildebrandt J. et al. 2005*, Janwantanakul P. & Sitthipornvorakul E. 2012°, Lang J et al. 2012°, Lakke S et al. 2009°, Ramond A. et al. 2011°, Van Tulder M. et al. 2004*	x

General health	Chou R. & Shekelle P. 2010°; Delitto A. et al. 2012*; Ferreira P. Et al. 2013°; Goertz M. et al. 2012*; Janwantanakul P. & Sitthipornvorakul E. 2012°; Ramond A. et al. 2011°; Slebus F. et al. 2007°	x
Sedentary work	Chen S et al. 2009°, Janwantanakul P. & Sitthipornvorakul E. 2012°	x
Recurrence prognostic factors		
Prognostic factors		
Excessive mobility in other joints	Delitto A et al. 2012*	x
History of LBP	Chiodo A et al. 2010*, Fayad F et al. 2004°, Goertz M. et al. 2012*, Hildebrandt J. et al. 2005*, Janwantanakul P. & Sitthipornvorakul E. 2012°, Taylor J et al. 2014°	x
Non-pronostic factors		
Decreased lumbar spine mobility	Delitto A et al. 2012*, Hamberg-Van Reenen HH. et al. 2007°, Lakke S et al. 2009°	x
Assessment		
Imaging should not be recommended for the management of NSLBP.	Ashton J. et al. 2004*, Chiodo A. et al. 2010*, Chou R. et al. 2007*, Chou R & Shekelle P 2010°, Delitto A. et al. 2012*, Goertz M. et al. 2012*, Hildebrandt J. et al. 2005*, Koes B et al. 2010°, Savigny P. et al. 2009*, Toward Optimized Practice 2011*, Van Tulder M. et al. 2004*	x
The history taking should be thorough and should investigate pain characteristics, sensory changes, strength changes, job and activity associations, psychosocial factors that may delay recovery. Psychosocial factors and emotional distress should be assessed because they are stronger predictors of low back pain outcomes than either physical examination findings or severity and duration of pain. The healthcare practitioner should ask the patient if he or she has any specific questions or expectations from this visit.	Ashton J. et al. 2004*, Chiodo A. et al. 2010*, Chou R. et al. 2007*, Goertz M et al. 2012*, Toward Optimized Practice 2011*	x

Clinical impressions are not sensitive enough to detect depression in patients with low back pain but there are several questionnaires easy to use in practice that are available for practitioners to assess depression or disability	Chiodo A. et al. 2010*, Delitto A. et al. 2012*, Goertz M. et al. 2012*, Oostendorp R et al. 2004*, Pincus T et al 2006°, Van Tulder M. et al. 2004*	x
There is moderate to strong evidence of low reliability of the observation during the examination.	May S et al. 2006°	x
Soft tissue palpation is not a reliable independent tool in the evaluation of NSLBP.	Chiodo A. et al. 2010*, Clinical Guideline Subcommittee on LBP 2010*, Hildebrandt J et al. 2005*, May S. et al. 2006°, Seffinger M. et al. 2004°	x
Straight leg raising tests (Lasegue) in the diagnosis of non-specific CLBP are not recommended.	Hildebrandt J et al. 2005°	x
Pain provocation tests are the most reliable of the palpatory tests, e.g. spring tests.	Delitto A. et al. 2012*, Goertz M. et al. 2012*, Hildebrandt J et al. 2005*, Seffinger M. et al. 2004°	x
Palpation of asymmetrical anatomic landmarks is part of the diagnosis of somatic dysfunction but palpation-based assessment has low reliability.	Clinical Guideline Subcommittee on LBP 2010*, May S. et al. 2006°, Hildebrandt J et al. 2005*, Seffinger M. et al. 2004°	x
There is a general consensus that active range of motion should be assessed. Observation of aberrant movements has demonstrated moderate to good reliability. Double-inclinometer is a valid method for assessing the total range of motion of the lumbar spine.	Chiodo A et al. 2010*, Delitto A. et al. 2012*, Goertz M et al. 2012*, Littlewood C & May S 2007°	x
General consensus in manual therapy that passive assessment of the lumbar spine is an integral part of the examination of patients with NS LBP. Passive range of motion (ROM) tests of the lumbar spine have a low reliability, regional ROM is more reliable than segmental ROM.	Chiodo A et al. 2010*, Clinical Guideline Subcommittee on LBP 2010*, Delitto A. et al. 2012*, Hildebrandt J et al. 2005*, May S. et al. 2006°, Seffinger M. et al. 2004°, Van Trijffel E. et al. 2005°	x

* = clinical guidelines, ° = systematic reviews

Conflicts of interests

SV is the IJOM editor but was not involved in the review decisions of this article.

Acknowledgments

The British School of Osteopathy library team provided expertise and support in the design of the search strategy.

Funding

This research is part of Jerry Draper-Rodi's Professional Doctorate in Osteopathy, partly funded by the British School of Osteopathy. The British School of Osteopathy had no involvement in the study design; in the collection, analysis and interpretation of data; in the writing of the report; and in the decision to submit the article for publication.