



Review

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



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1. Introduction

Eighty five percent of all LBP presentations can be classified as from non-specific causes (NSLBP) [1] where joints, discs and connective tissues may be contributing to symptoms but no specific tissues can be identified as causing the symptoms [2]. 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 [3]. 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 [4]. The BPS model advocates integrating the assessment and treatment of relevant biological, psychological and social factors based on individual patient needs [1,5]. However practitioners' adherence to clinical guidelines is poor despite wide promulgation [6–8] 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 [9], 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 [10]. When psychosocial function is assessed it is based on 'gut feeling' [11] that is less accurate than using formal instruments [10,12]. 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 [7,13–15] and can transfer their unhelpful attitudes and beliefs towards back pain to patients [16,17]. Many previous studies have used a BPS educational intervention to influence practitioners' attitudes or behaviour and have shown variable effects [18–25]. 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 [26] 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 [22,24]. 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 [27] [28] [29]; 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 [8,30,31]. 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 [32,33]. 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 [34]. 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 [35].

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 [36]. 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,

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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

and gaps in research related to a defined area or field by systematically searching, selecting, and synthesising existing knowledge” [37]. Scoping reviews are becoming increasingly popular especially in the field of health where 75% of scoping reviews addressed a health topic [38]. 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 [39,40]. 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.

2. Methods

This scoping review followed Arksey and O'Malley's 5-stage framework [41] and included the recommendations of Levac et al. [40] and Daudt et al. [39]. The five stages are briefly outlined below.

2.1. 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 [42] training programme on the BPS approach for adult patients with NSLBP in a manual therapy context on any outcome measures reported in the literature?

2.2. 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 [43]: 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

[44]. 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 from 2004 onwards 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.

2.3. Stage 3. study selection

Results were downloaded into a Reference Management Software, Endnote (version ×4.0.2), 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.

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.

2.4. 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 [41]. 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.

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

2.5. 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 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 over 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.

3. 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 [9,45–58] and 32 systematic reviews [59–90]. The review process is documented in a PRISMA flow diagram (please see [Fig. 1](#) - Flowchart). 6 articles were excluded: 2 not focussing on manual therapy or knowledge and skills of interest in manual therapy consultation [48,85], 1 not published in English or French [52], 1 duplicate due to different order of the authors' names in two references [91], 1 not reporting the prognostic factors identified in their search [72], and 1 not about NSLBP [59]. One article was updated to its most recent version [57,92].

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).

4. 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 [18,19,21,25,94], 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 [9] and psychosocial factors have been emphasised in LBP clinical guidelines with the most striking example being the New Zealand clinical guidelines for LBP [45] 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 [95] 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 [18–20]. Previous training packages that detail their sources have less references than in this scoping review [22–24]. The inclusion of biological factors as

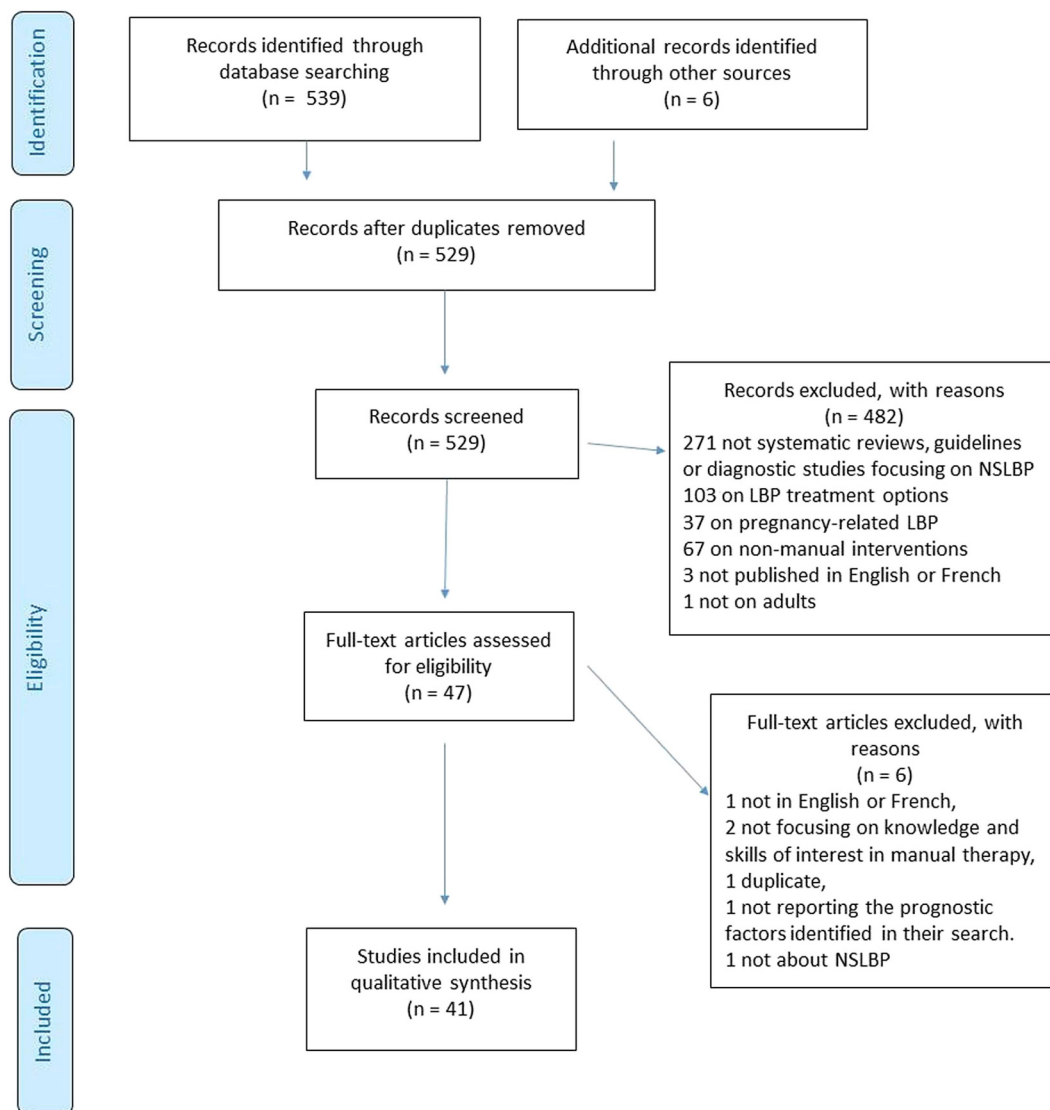


Fig. 1. Flowchart.

prognostic factors is not mentioned in several previous BPS training programmes [21–24]. One study that included biological factors shows relatively large effects on participants with chronic NSLBP [25]. This study reports being informed by O'Sullivan's BPS framework [96] that is itself informed by a book chapter [97]. Our findings support the categories of factors that need to be considered in a BPS approach, however there were two main differences in our framework [25]. O'Sullivan's framework has a lack of description of how these factors affect the course of a 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 [4,98].

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 [93,99]. Our recommendation is that this should be included in BPS-informed educational programmes for practitioners.

4.1. 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 [11]. Whilst current and accessible information is desirable for practitioners,

Table 1
List of biopsychosocial factors.

	References	Biological factors	Psychological factors	Social factors	Assessment methods
NSLBP onset					
Prognostic factors					
Low job satisfaction	[45] * [62]; ° [64]; ° [51]; * [73]; ° [79]; ° [84]; ° [57]; * [58]; *			x	
Possible prognostic factors					
Higher physical work demands	[45] * [60]; ° [47]; * [62]; ° [50]; * [51]; * [70]; ° [76]; ° [80]; ° [84]; ° [89]; °			x	
Obesity	[47] * [62]; ° [93]; ° [82]; °	x			
Non-prognostic factors					
Poor trunk muscle strength	[50] * [67]; °	x			
Leisure-time sport or exercises or professional level exercises	[60] ° [83]; °	x			
Prolonged standing or walking	[60]	x			
Depression	[45] * [47]; * [9]; * [63]; ° [50]; * [93]; ° [51]; * [53]; * [70]; ° [55]; * [78]; ° [79]; ° [56]; * [57]; * [58]; *		x		
Sitting, during leisure time or at work (independently or combined)	[60] ° [61]; °	x			
Sedentary work and desk/chair set up	[61] ° [70]; °			x	
Trunk muscle endurance	[67] °	x			
Chronic pain prognostic factors					
Prognostic factors					
Symptoms below the knee	[50] *	x			
Important functional impairment	[62] ° [64]; ° [53]; * [56]; *	x			
Previous back surgery	[47] *	x			
Preexisting sleep disturbances	[45] * [60]; ° [71]; °	x			
Belief that work is harmful	[45] * [68]; ° [78]; °			x	
Non-prognostic factors					
Stress at work and LBP	[45] * [68]; ° [84]; °			x	
Many structural changes (including OA, mild to moderate scoliosis, SIJ asymmetry, disc bulges)	[47] *	x			
Disability prognostic factors					
Prognostic factors					
Younger age (favourable prognostic factor)	[62] ° [64]; ° [70]; ° [76]; ° [55]; * [84]; °	x			
Multiple previous MSK complaints	[75] °	x			
Genetics (from complex and disabling LBP)	[50] * [66]; °	x			
Extreme symptom report	[45] * [47]; * [53]; *		x		
Low socioeconomic status	[45] * [47]; * [66];			x	
Possible prognostic factors					

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Table 1 (continued)

	References	Biological factors	Psychological factors	Social factors	Assessment methods
Patients' pain misbeliefs	[45] * [47]; * [62]; * [50]; * [51]; * [73]; * [76]; * [55]; * [78]; * [79]; * [56]; * [57]; * [38]; * [58]; *		x		
Compensation issues, previous sick leave on LBP, financial problems and delay to access income support	[45] * [47]; * [51]; * [62]; * [79]; * [57]; * [58]; *		x		
Poor relationships with peers at work	[45] * [47]; * [51]; *			x	
Experience of conflicting diagnoses or explanations for back pain	[45] *			x	
Use of diagnostic language (eg. fear of ending up in a wheelchair)	[45] * [58]; *			x	
A careful initial examination (favourable prognostic factor)	[45] * [58]; *			x	
Patient expectation of a 'techno-fix', eg. requests to treat as if body were a machine	[45] *			x	
Lack of satisfaction with previous treatment for back pain	[45] *			x	
Advice from healthcare professional to withdraw from work	[45] *			x	
Unspecific poor outcomes prognostic factors					
Prognostic factors					
LBP associated with various other diseases, including osteoporosis, asthma, diabetes and chronic headaches.	[62] ° [50]; * [65]; ° [51]; * [70]; ° [79]; ° [84]; °	x			
Patients' poor self-perceived health	[62] ° [50]; * [65]; ° [51]; * [70]; ° [79]; ° [84]; °				
High intensity of LBP at baseline	[62] ° [50]; * [64]; ° [51]; * [53]; * [76]; ° [55]; * [84]; °	x			
Passive coping strategies, including extended rest and excessive reliance on use of aids or appliances	[45] * [9]; * [50]; * [51]; * [55]; * [57]; * [58]; *		x		
Reduced activity level	[45] * [55]; * [58]; *		x		
Patient's healthcare beliefs that do not fit best practice	[51] * [57]; *		x		
Poor patients' expectations of recovery	[51] * [55]; * [79]; °		x		
Fear of activity	[45] * [63] [50]; * [55]; * [4]; * [57] [90];		x		
Depression	[45] * [47]; * [9]; * [63]; ° [50]; * [65]; ° [51]; * [53]; * [70]; * [55]; * [78]; * [79]; * [56]; * [57]; * [58]; *		x		
Anxiety	[45] * [63]; ° [51]; * [79]; ° [4]; * [58]; *		x		
Current psychiatric comorbidity	[47] * [62]; °		x		
Lack of job accommodations and absence of graduated return to work pathways	[45] * [51]; *			x	
Recovery expectations	[47] * [51]; * [69]; °			x	
Clinician's fear-avoidance beliefs	[51] *			x	
Possible prognostic factors					
Low level of self-efficacy (coping skills) with regards to LBP	[55] *		x		
Higher work demands and/or history of specific manual works (including farming, nursing, truck driving)	[45] * [60]; ° [62]; ° [47]; * [50]; * [51]; * [70]; ° [76]; ° [80]; ° [84]; ° [89]; °			x	
Low job satisfaction predicts	[45] * [62]; ° [64]; [51]; * [73]; ° [79]; ° [84]; ° [57]; * [58]; *			x	
Labelling patients with Yellow Flags and sanctioning disability	[45] *			x	
Inflexible work schedule or unsociable hours	[45] * [51]; * [53]; * [57]; * [58]; *			x	
Spouse and family behaviour and/or negative expectations of recovery	[45] * [47]; * [51]; * [57]; *			x	
Non-pronostic factors					
Social support at work	[45] * [51]; * [53]; * [70]; ° [74]; ° [73] ° [79]; * [58]; *			x	
General health	[62] ° [50]; * [65]; ° [51]; * [70]; ° [79]; ° [84]; °	x			
Sedentary work	[61] ° [70]; °			x	

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Table 1 (continued)

	References	Biological factors	Psychological factors	Social factors	Assessment methods
Recurrence prognostic factors					
Prognostic factors					
Excessive mobility in other joints	[50] *				
History of LBP	[47] * [64], ° [51], * [53], * [70], ° [86], °	x			
Non-pronostic factors					
Decreased lumbar spine mobility	[50] * [67], ° [73], °	x			
Assessment					
Imaging should not be recommended for the management of NSLBP.	[45] * [47], * [9], * [62], ° [50], * [51], * [53], * [54], * [56], * [57], * [58], *				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.	[45] * [47], * [9], * [51], * [57], *				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	[47] * [50], * [51], * [55], * [78], ° [58], *				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.	[47] * [49], * [53], * [77], ° [81], °				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.	[50] * [51], * [53], * [81], °				x
Palpation of asymmetrical anatomic landmarks is part of the diagnosis of somatic dysfunction but palpation-based assessment has low reliability.	[49] * [77], ° [53], * [81], °				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.	[47] * [50], * [51], * [75], °				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.	[47] * [49], * [50], * [53], * [77], ° [81], ° [87], °				x

* = clinical guidelines.

° = systematic reviews.

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.

4.2. 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 [41]. 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 [6–8]. In osteopathy, there is some evidence of a subgroup of osteopaths who reject synthesised evidence based guidance [100]. 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 [101] 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 of 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 [39] and this remains a minority of published scoping reviews (less than 23%) [38]. 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.

5. 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.

Conflicts of interest

Steven Vogel is an Editor of the International Journal of Osteopathic Medicine but was not involved in the review or editorial decisions regarding this manuscript.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.ijosm.2018.07.001>.

References

- [1] Waddell G. 1987 Volvo award in clinical sciences. A new clinical model for the treatment of low-back pain. *Spine J* 1987;12(7):632–44.
- [2] Hartvigsen J, Hancock MJ, Kongsted A, Louw Q, Ferreira ML, Genevay S, Hoy D, Karppinen J, Pransky G, Sieper J, Smeets RJ, Underwood M, Buchbinder R, Hartvigsen J, Cherkov D, Foster NE, Maher CG, Underwood M, van Tulder M, Anema JR, Chou R, Cohen SP, Menezes Costa L, Croft P, Ferreira M, Ferreira PH, Fritz JM, Genevay S, Gross DP, Hancock MJ, Hoy D, Karppinen J, Koes BW, Kongsted A, Louw Q, Öberg B, Peul WC, Pransky G, Schoene M, Sieper J, Smeets RJ, Turner JA, Woolf A. What low back pain is and why we need to pay attention. *Lancet* 2018 Jun 9;391(10137):2356–67. [https://doi.org/10.1016/S0140-6736\(18\)30480-X](https://doi.org/10.1016/S0140-6736(18)30480-X). [Epub: 2018 Mar 21].
- [3] Synnott A, O'Keeffe M, Bunzli S, Dankaerts W, O'Sullivan P, O'Sullivan K. Physiotherapists may stigmatise or feel unprepared to treat people with low back pain and psychosocial factors that influence recovery: a systematic review. *J Physiother* 2015;61(2):68–76.
- [4] Savigny P, Kuntze S, Watson P, Underwood M, Ritchie G, Cotterell M, et al. Low back pain: early management of persistent non-specific low back pain. London: National Institute for Health and Clinical Excellence; 2009.
- [5] Waddell G. Models of disability: using low back pain as an example. London: Royal Society of Medicine Press; 2002.
- [6] Bekkering G, van Tulder MW, Hendriks EJ, Koopmanschap MA, Knol DL, Bouter LX, Oostendorp RA. 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. *Phys Ther* 2005;85(6):544–55.
- [7] Bishop A, Foster NE, Thomas E, Hay EM. 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* 2008;135(1–2):187–95.
- [8] Evans D, Breen A, Pincus T, Sim J, Underwood M, Vogel S, Foster N. 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* 2010;35(8):858–66.
- [9] Chou R, Qaseem A, Snow V, Casey D, Cross Jr. JT, Shekelle P, Owens DK. 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]. *Ann Intern Med* 2007;147(7):478–91.
- [10] Kent PM, Keating JL, Taylor NF. Primary care clinicians use variable methods to assess acute nonspecific low back pain and usually focus on impairments. *Man Ther* 2009;14(1):88–100.
- [11] Singla M, Jones M, Edwards I, Kumar S. Physiotherapists' assessment of patients' psychosocial status: are we standing on thin ice? A qualitative descriptive study. *Man Ther* 2015;20(2):328–34.
- [12] Newell D, Field J, Visnes N. Prognostic accuracy of clinicians for back, neck and shoulder patients in routine practice. *Chiropr Man Ther* 2013;21(42) [Online] Available at: <http://www.chiromt.com/content/21/21/42>.
- [13] Darlow B, Fullen BM, Dean S, Hurley DA, Baxter GD, Dowell A. 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* 2012;16(1):3–17.
- [14] Houben RMA, Gijzen A, Peterson J, de Jong PJ, Vlaeyen JWS. Do health care providers' attitudes towards back pain predict their treatment recommendations? Differential predictive validity of implicit and explicit attitude measures. *Pain* 2005;114(3):491–8.
- [15] Rainville J, Carlson N, Polatin P, Gatchel RJ, Indahl A. Exploration of physicians' recommendations for activities in chronic low back pain. *Spine* 2000;25(17):2210–20.
- [16] Coudeyre E, Rannou F, Tubach F, Baron G, Coriat F, Brin S, Revel M, Poiraudau S. General practitioners' fear-avoidance beliefs influence their management of patients with low back pain. *Pain* 2006;124(3):330–7.
- [17] Poiraudau S, Rannou F, Le Henaff A, Coudeyre E, Rozenberg S, Huas D, Martineau C, Jolivet-Landreau I, Revel M, Ravaud P. Outcome of subacute low back pain: influence of patients' and rheumatologists' characteristics. *Rheumatology* 2006;45(6):718–23.
- [18] Asenlof P, Denison E, Lindberg P. Individually tailored treatment targeting activity, motor behavior, and cognition reduces pain-related disability: a randomized controlled trial in patients with musculoskeletal pain. *J Pain* 2005;6(9):588–603.
- [19] Asenlof P, Denison E, Lindberg P. 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* 2009;13(10):1080–8.
- [20] Hay E, Mullis R, Lewis M, Vohora K, Main CJ, Watson P, Dziedzic KS, Sim J, Lowe CM, Croft PR. Comparison of physical treatments versus a brief pain-management programme for back pain in primary care: a randomised clinical trial in physiotherapy practice. *Lancet* 2005;365(9476):2024–30.
- [21] Hill JC, Whitehurst DG, Lewis M, Bryan S, Dunn KM, Foster NE, Konstantinou K, Main CJ, Mason E, Somerville S, Sowden G, Vohora K, Hay EM. Comparison of stratified primary care management for low back pain with current best practice (StarT Back): a randomised controlled trial. *Lancet* 2011;378(9802):1560–71.
- [22] Jellema P, van der Windt D, van der Horst H, Twisk JWR, Stalman WAB, Bouter LM. Should treatment of (sub)acute low back pain be aimed at psychosocial prognostic factors? Cluster randomised clinical trial in general practice. *BMJ* 2005;331(7508) [Online] Available at: <http://www.bmj.com/content/bmj/331/7508/7584.full.pdf>.
- [23] Overmeer T, Boersma K, Main CJ, Linton SJ. Do physical therapists change their beliefs, attitudes, knowledge, skills and behaviour after a biopsychosocially orientated university course? *J Eval Clin Pract* 2009;15(4):724–32.
- [24] Stevenson K, Lewis M, Hay E. Does physiotherapy management of low back pain change as a result of an evidence-based educational programme? *J Eval Clin Pract* 2006;12:365–75.
- [25] Vibe Fersum K, O'Sullivan P, Skouen JS, Smith A, Kvale A. Efficacy of classification-based cognitive functional therapy in patients with non-specific chronic low back pain: a randomized controlled trial. *Eur J Pain* 2013;17(6):916–28.
- [26] Ghirardini B. E-learning methodologies: a guide for designing and developing e-learning courses. Rome: Food and Agriculture Organisation for the United Nations; 2011.
- [27] Furlan A, Pennick V, Bombardier C, van Tulder M. "2009 updated method guidelines for systematic reviews in the Cochrane Back Review Group. *Spine* 2009;34(18):1929–41.
- [28] Higgins JPT, Green S, editors. *Cochrane handbook for systematic reviews of interventions* version 5.1.0 [updated march 2011]. The Cochrane collaboration. 2011 Available from www.cochrane-handbook.org.
- [29] Rushton A, Calvert M, Wright C, Freemantle N. Physiotherapy trials for the 21st century: time to raise the bar? *J R Soc Med* 2011;104(11):437–41.
- [30] Jaspers MW, Smeulders M, Vermeulen H, Peute LW. Effects of clinical decision-support systems on practitioner performance and patient outcomes: a synthesis of high-quality systematic review findings. *J Am Med Assoc* 2011;305(3):327–34.
- [31] Lugtenberg M, Burgers JS, Westert GP. Effects of evidence-based clinical practice guidelines on quality of care: a systematic review. *Qual Saf Health Care* 2009;18(5):385–92.
- [32] Biondi-Zoccai G, Lotrionte M, Landoni G, Modena MG. The rough guide to systematic reviews and meta-analyses. *HSR Proc Intensive Care Cardiovasc Anesth* 2011;3(3):161–73.
- [33] Rothwell PM. External validity of randomised controlled trials: "to whom do the results of this trial apply? *Lancet* 2005;365(9543):82–93.
- [34] Oxman AD, Lavis JN, Fretheim A. Use of evidence in WHO recommendations. *Lancet* 2007;369(9576):1883–9.
- [35] Draper-Rodi J. Effects of an e-learning programme on osteopaths' back pain attitudes: a mixed methods study Professional doctorate thesis Luton, UK: The University of Bedfordshire; 2016.
- [36] Rumrill PD, Fitzgerald SM, Merchant WR. Using scoping literature reviews as a means of understanding and interpreting existing literature. *Work* 2010;35(3):399–404.
- [37] Colquhoun HL, Levac D, O'Brien KK, Straus S, Tricco AC, Perrier L, Kastner M, Moher D. Scoping reviews: time for clarity in definition, methods, and reporting. *J Clin Epidemiol* 2014;67(12):1291–4.
- [38] Pham MT, Rajić A, Greig JD, Sargeant JM, Papadopoulos A, McEwen SA. A scoping review of scoping reviews: advancing the approach and enhancing the consistency. *Res Synth Meth* 2014;5(4):371–85.
- [39] Daudt H, van Mossel C, Scott S. Enhancing the scoping study methodology: a large, inter-professional team's experience with Arksey and O'Malley's framework. *BMC Med Res Meth* 2013;13(48) [Online] Available at: <http://bmcmedresmethodol.biomedcentral.com/articles/10.1186/1471-2288-1113-1188>.
- [40] Levac D, Colquhoun H, O'Brien KK. Scoping studies: advancing the methodology. *Implement Sci* 2010;5(69) [Online] Available at: <http://implementationscience.biomedcentral.com/articles/10.1186/1748-5908-1185-1169>.
- [41] Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *Int J Soc Res Meth* 2005;8(1):19–32.
- [42] Fryer G. Teaching critical thinking in osteopathy – integrating craft knowledge and evidence-informed approaches. *Int J Osteopath Med* 2008;11(2):56–61.
- [43] Joanna Briggs Institute. The Joanna Briggs' Institute reviewers' manual 2015. Methodol JBI Scoping Rev Joanna Briggs Inst JBI 2015;2015.
- [44] Pillastrini P, Vanti C, Curti S, Mattioli S, Ferrari S, Violante FS, Guccione A. Using PubMed search strings for efficient retrieval of manual therapy research literature. *J Manipulative Physiol Therapeut* 2015;38(2):159–66.
- [45] Ashton J, Butler M, Bridge M, Griffiths R, Hawtin J, Kendall N, et al. New Zealand acute low back pain guide, incorporating the guide to assessing psychosocial yellow flags in acute low back pain, October 2004 edition. 2004.
- [46] Burton AK, Balague F, Cardon G, Eriksen HR, Henrotin Y, Lahad A, Leclerc A, Muller G, van der Beek AJ. Chapter 2. European guidelines for prevention in low back pain: november 2004. *Eur Spine J* 2006;15(Suppl 2) [Online] Available at: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3454541/>.
- [47] Chiodo AE, Alvarez DJ, Graziano GP, Haig AJ, Harrison RV, Park P, Standford CJ, Wasserman RA, System UOMH. Acute low back pain: guidelines for clinical care [with consumer summary]. 2010 [Online] Available at: <http://www.med.umich.edu/linfo/FHP/practiceguides/back/back.pdf>.
- [48] Chou R, Loeser JD, Owens DK, Rosenquist RW, Atlas SJ, Baisden J, et al. Interventional therapies, surgery, and interdisciplinary rehabilitation for low back pain. *Spine* 2009;34(10):1066–77.
- [49] Clinical Guideline Subcommittee on Low Back Pain. American osteopathic association guidelines for osteopathic manipulative treatment (OMT) for patients with low back pain. *J Am Osteopath Assoc* 2010;110(11):653–66.
- [50] Delitto A, George SZ, Dillen LV, Whitman JM, Sowa G, Shekelle P, Denninger TR, Godes JJ. 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]. *J Orthop Sports Phys Ther* 2012;42(4):A1–57.
- [51] Goertz M, Thorson DC, Campbell R, Kuku O, Mueller B, Locketz A, et al. Adult acute and subacute low back pain. fifteenth ed. Institute for Clinical Systems Improvement; 2012.
- [52] Guevara-Lopez U, Covarrubias-Gomez A, Elias-Dib J, Reyes-Sanchez A, Rodriguez-Reyna TS. Practice guidelines for the management of low back pain. Consensus group of practice parameters to manage low back pain. *Cir Cir* 2011;79(3):264–79. 286–302.
- [53] Hildebrandt J, Ursin H, Mannion A, Arikainen O, Brox JI, Cedraschi C, Klaber-Moffett J, Kovacs F, Reis S, Staal B, Zanoli G. 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. 2004.
- [54] Koes BW, van Tulder M, Lin CW, Macedo LG, McAuley J, Maher C. An updated overview of clinical guidelines for the management of non-specific low back pain in primary care. *Eur Spine J* 2010;19(12):2075–94.
- [55] Oostendorp RAB, Scholten-Peeters GGM, Swinkels RAH, Bekkering GE, Heijmans MWF, Huijbregts PA, Hendriks EJM. Evidence-based practice in physical and manual therapy: development and content of Dutch National Practice Guidelines for patients with non-specific low back pain. *J Man Manip Ther* 2004;12(1):21–31.
- [56] Savigny P, Kuntze S, Watson P, Underwood M, Ritchie G, Cotterell M, et al. R. C. o. G. P. Walsh D National Collaborating Centre for Primary Care. Low back pain: early management of persistent non-specific low back pain: full guideline. 2009.
- [57] Toward Optimized Practice. Guideline for the evidence-informed primary care management of low back pain. Edmonton (AB). 2011. p. 37.
- [58] van Tulder M, Becker A, Bekkering T, Breen A, Carter T, Gil del Real MT, et al. S European Commission Research Directorate General. European guidelines for the management of acute nonspecific low back pain in primary care [with consumer summary]. 2004.
- [59] Alqarni AM, Schneiders AG, Hendrick PA. Clinical tests to diagnose lumbar segmental instability: a systematic review. *J Orthop Sports Phys Ther* 2011;41(3):130–40.
- [60] Bakker EW, Verhaagen AP, van Trijffel E, Lucas C, Koes BW. Spinal mechanical load as a risk factor for low back pain: a systematic review of prospective cohort studies. *Spine* 2009;34(8):E281–93.

- [61] Chen SM, Liu MF, Cook J, Bass S, Lo SK. Sedentary lifestyle as a risk factor for low back pain: a systematic review. *Int Arch Occup Environ Health* 2009;82(7):797–806.
- [62] Chou R, Shekelle P. Will this patient develop persistent disabling low back pain? *J Am Med Assoc* 2010;303(13):1295–302.
- [63] Dagenais S, Tricco AC, Haldeman S. Synthesis of recommendations for the assessment and management of low back pain from recent clinical practice guidelines. *Spine J* 2010;10(6):514–29.
- [64] Fayad F, Lefevre-Colau MM, Poiraudau S, Fermandian J, Rannou F, Wlodyka Demaille S, Benyahya R, Revel M. [Chronicity, recurrence, and return to work in low back pain: common prognostic factors. *Ann Readapt Med Phys* 2004;47(4):179–89.
- [65] Ferreira PH, Beckenkamp P, Maher CG, Hopper JL, Ferreira ML. Nature or nurture in low back pain? Results of a systematic review of studies based on twin samples. *Eur J Pain* 2013;17(7):957–71.
- [66] Ferreira PH, Pinheiro MB, Machado GC, Ferreira ML. Is alcohol intake associated with low back pain? A systematic review of observational studies. *Man Ther* 2013;18(3):183–90.
- [67] Hamberg-van Reenen HH, Ariens GA, Blatter BM, van Mechelen W, Bongers PM. A systematic review of the relation between physical capacity and future low back and neck/shoulder pain. *Pain* 2007;130(1–2):93–107.
- [68] Hartvigsen J, Lings S, Leboeuf-Yde C, Bakkeiteig L. Psychosocial factors at work in relation to low back pain and consequences of low back pain; a systematic, critical review of prospective cohort studies. *Occup Environ Med* 2004;61(1). 10p.
- [69] Iles RA, Davidson M, Taylor NF, O'Halloran P. Systematic review of the ability of recovery expectations to predict outcomes in non-chronic non-specific low back pain. *J Occup Rehabil* 2009;19(1):25–40.
- [70] Janwantanakul P, Sitthipornvorakul E, Paksaichol A. Risk factors for the onset of nonspecific low back pain in office workers: a systematic review of prospective cohort studies. *J Manip Physiol Ther* 2012;35(7):568–77.
- [71] Kelly GA, Blake C, Power CK, O'Keeffe D, Fullen BM. The association between chronic low back pain and sleep: a systematic review. *Clin J Pain* 2011;27(2):169–81.
- [72] Kent PM, Keating JL. Can we predict poor recovery from recent-onset nonspecific low back pain? A systematic review. *Man Ther* 2008;13(1):12–28.
- [73] Lakke SE, Soer R, Takken T, Reneman MF. Risk and prognostic factors for non-specific musculoskeletal pain: a synthesis of evidence from systematic reviews classified into ICF dimensions. *Pain* 2009;147(1–3):153–64.
- [74] Lang J, Ochsmann E, Kraus T, Lang JWB. Psychosocial work stressors as antecedents of musculoskeletal problems: a systematic review and meta-analysis of stability-adjusted longitudinal studies. *Soc Sci Med* 2012;75(7):1163–74.
- [75] Littlewood C, May S. Measurement of range of movement in the lumbar spine - what methods are valid? A systematic review. *Physiotherapy* 2007;93(3):201.
- [76] Luijsterburg PAJ, Miedema HS, Verkerk K, Pool-Goudzwaard A, Koes BW. Prognostic factors for recovery in chronic nonspecific low back pain: a systematic review. *Phys Ther* 2012;92(9):1093–108.
- [77] May S, Littlewood C, Bishop A. Reliability of procedures used in the physical examination of non-specific low back pain: a systematic review. *Aust J Physiother* 2006;52(2):91–102.
- [78] Pincus T, Vogel S, Burton AK, Santos R, Field AP. Fear avoidance and prognosis in back pain: a systematic review and synthesis of current evidence. *Arthritis Rheum* 2006;54(12):3999–4010.
- [79] 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(1):12–21.
- [80] Ribeiro DC, Aldabe D, Abbott JH, Sole G, Milosavljevic S. Dose-response relationship between work-related cumulative postural exposure and low back pain: a systematic review. *Ann Occup Hyg* 2012;56(6):684–96.
- [81] Seffinger MN, Mishra WI, Adams SI, Dickerson A, Murphy VM, Reinsch LS. Reliability of spinal palpation for diagnosis of back and neck pain: a systematic review of the literature. *Spine J* 2004;29(19):E413–25.
- [82] Shiri R, Karppinen J, Leino-Arjas P, Solovieva S, Viikari-Juntura E. The association between obesity and low back pain: a meta-analysis. *Am J Epidemiol* 2010;171(2):135–54.
- [83] Sitthipornvorakul E, Janwantanakul P, Purepong N, Pensri P, van der Beek AJ. The association between physical activity and neck and low back pain: a systematic review. *Eur Spine J* 2011;20(5):677–89.
- [84] Slebus FG, Kuijter PPF, Willems JHB, Sluiter JK, Frings-Dresen MHW. Prognostic factors for work ability in sicklisted employees with chronic diseases. *Occup Environ Med* 2007;64(12):814–9.
- [85] Steenstra IA, Verbeek JH, Heymans MW, Bongers PM. Prognostic factors for duration of sick leave in patients sick listed with acute low back pain: a systematic review of the literature. *Occup Environ Med* 2005;62(12):851–60.
- [86] Taylor JB, Goode AP, George SZ, Cook CE. Incidence and risk factors for first-time incident low back pain: a systematic review and meta-analysis. *Spine J* 2014;14(10):2299–319.
- [87] van Trijffel E, Anderegg Q, Bossuyt PMM, Lucas C. Inter-examiner reliability of passive assessment of intervertebral motion in the cervical and lumbar spine: a systematic review. *Man Ther* 2005;10(4):256–69.
- [88] Verkerk K, Luijsterburg PA, Miedema HS, Pool-Goudzwaard A, Koes BW. Prognostic factors for recovery in chronic nonspecific low back pain: a systematic review. *Phys Ther* 2012;92(9):1093–108.
- [89] Wai EK, Roffey DM, Bishop P, Kwon BK, Dagenais S. Causal assessment of occupational carrying and low back pain: results of a systematic review. *Spine J* 2010;10(7):628–38.
- [90] Wertli MM, Rasmussen-Barr E, Weiser S, Bachmann LM, Brunner F. The role of fear avoidance beliefs as a prognostic factor for outcome in patients with nonspecific low back pain: a systematic review. *Spine J: Offic J North Am Spine Society* 2014;14(5):816–36. e814.
- [91] Verkerk K, Luijsterburg PAJ, Miedema HS, Pool-Goudzwaard A, Koes BW. Prognostic factors for recovery in chronic nonspecific low back pain: a systematic review. *Phys Ther* 2012;92(9):1093–108.
- [92] Toward Optimized Practice. Guideline for the evidence-informed primary care management of low back pain. Edmonton (AB). 2009. p. 21.
- [93] Ferreira PH, Ferreira ML, Maher CG, Refshauge KM, Latimer J, Adams RD. The therapeutic alliance between clinicians and patients predicts outcome in chronic low back pain. *Phys Ther* 2013;93(4):470–8.
- [94] Lamb S, Lall R, Hansen Z, Castelnovo E, Withers E, Nichols V, Griffiths F, Potter R, Szczepura A. M. Underwood and B. t. group. 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* 2010;14(41):1–253.
- [95] Michie S, Abraham C, Eccles MP, Francis G, Hardeman W, Johnston M. Strengthening evaluation and implementation by specifying components of behaviour change interventions: a study protocol. *Implement Sci* 2011;6(10) [Online] Available at: <https://implementationscience.biomedcentral.com/articles/10.1186/1748-5908-1186-1110>.
- [96] O'Sullivan P. Diagnosis and classification of chronic low back pain disorders: maladaptive movement and motor control impairments as underlying mechanism. *Man Ther* 2005;10(4):242–55.
- [97] Elvey R, O'Sullivan P. A contemporary approach to manual therapy. Grieve's Modern Manual Therapy. J. Boyling and G. Jull. Amsterdam: Elsevier, Churchill Livingstone; 2004.
- [98] Airaksinen O, Brox JI, Cedraschi C, Hildebrandt J, Klaber-Moffett J, Kovacs F, Mannion AF, Reis S, Staal JB, Ursin H, Zanolli G. Chapter 4. European guidelines for the management of chronic nonspecific low back pain. *Eur Spine J* 2006;15(Suppl 2):S192–300.
- [99] Hall AM, Ferreira PH, Maher CG, Latimer J, Ferreira ML. The influence of the therapist-patient relationship on treatment outcome in physical rehabilitation: a systematic review. *Phys Ther* 2010;90(8):1099–110.
- [100] Figg-Latham J, Rajendran D. Quiet dissent: the attitudes, beliefs and behaviours of UK osteopaths who reject low back pain guidance—A qualitative study. *Musculoskel Sci Pract* 2017;27:97–105.
- [101] Altman D. Systematic reviews of evaluations of prognostic variables. *Br Med J* 2001;323(7306):224–8.