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Fear-avoidance beliefs—a moderator of treatment efficacy in patients with low back pain: a systematic review

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Abstract

BACKGROUND CONTEXT: Psychological factors are believed to influence the development of chronic low back pain. To date, it is not known how fear-avoidance beliefs (FABs) influence the treatment efficacy in low back pain.

PURPOSE: To summarize the evidence examining the influence of FABs measured with the Fear-Avoidance Belief Questionnaire or the Tampa Scale of Kinesiophobia on treatment outcomes in patients with low back pain.

STUDY DESIGN/SETTING: This is a systematic review.

PATIENT SAMPLE: Patients with low back pain.

OUTCOME MEASURES: Work-related outcomes and perceived measures including return to work, pain, and disability.

METHODS: In January 2013, the following databases were searched: BIOSIS, CINAHL, Cochrane Library, Embase, OTSeeker, PeDRO, PsycInfo, PubMed/Medline, Scopus, and Web of Science. A hand search of the six most often retrieved journals and a bibliography search completed the search. Study eligibility criteria, participants, and interventions: research studies that included patients with low back pain who participated in randomized controlled trials (RCTs) investigating nonoperative treatment efficacy. Out of 646 records, 78 articles were assessed in full text and 17 RCTs were included. Study quality was high in five studies and moderate in 12 studies.

RESULTS: In patients with low back pain of up to 6 months duration, high FABs were associated with more pain and/or disability (4 RCTs) and less return to work (3 RCTs) (GRADE high-quality evidence, 831 patients vs. 322 in nonpredictive studies). A decrease in FAB values during treatment was associated with less pain and disability at follow-up (GRADE moderate evidence, 2 RCTs with moderate quality, 242 patients). Interventions that addressed FABs were more effective than control groups based on biomedical concepts (GRADE moderate evidence, 1,051 vs. 227 patients in studies without moderating effects). In chronic patients with LBP, the findings were less consistent. Two studies found baseline FABs to be associated with more pain and disability and less return to work (339 patients), whereas 3 others (832 patients) found none (GRADE low evidence). Heterogeneity of the studies impeded a pooling of the results.

CONCLUSIONS: Evidence suggests that FABs are associated with poor treatment outcome in patients with LBP of less than 6 months, and thus early treatment, including interventions to reduce FABs, may avoid delayed recovery and chronicity. Patients with high FABs are more likely to

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improve when FABs are addressed in treatments than when these beliefs are ignored, and treatment strategies should be modified if FABs are present.

Keywords: Low back pain; Back pain; Fear avoidance; Fear-avoidance beliefs; Moderator; Prognosis

Introduction

Low back pain is one of the leading causes globally of years lived with disability [1]. Almost all adults once in their lifetime complain about LBP, but 10% to 15% develop chronic LBP [2]. This small percentage accounts for three-quarters of the total costs of medical care and lost productivity associated with LBP [3]. There is a consensus in the literature in acute low back pain to avoid unnecessary investigation and overtreatment by treating symptomatically with encouragement to return to normal activity [4]. Persisting pain for several weeks predicts the development of chronic low back pain, a condition where complete recovery and return to 100% function are often difficult to achieve [5]. Current research aims at identifying subgroups at risk for delayed recovery in subacute LBP patients to optimize treatment and avoid chronification. Timely initiated and targeted multifaceted treatments in patients at risk for delayed recovery have shown health-care cost reductions and tend to facilitate recovery [6].

Psychological factors are believed to influence the development of chronic low back pain. The fear-avoidance model is commonly used to explain how psychological factors affect the experience of pain and the development of chronic pain and disability [7]. It is theorized that for some individuals with LBP, negative beliefs about pain and/or negative illness information lead to a catastrophizing response in which the worst possible outcome of activity is imagined. This leads to fear of activity and avoidance that in turn causes disuse and resultant distress, reinforcing the original negative appraisal in a deleterious cycle [7]. The fear-avoidance model suggests that patients without fear-avoidance beliefs (FABs) are more likely to confront pain problems and are more active in the coping process. This type of ''good'' coping has been used to develop interventions for those with high FABs.

Although the fear-avoidance model is generally accepted, it is a matter of debate as to how and when to best assess FABs in clinical practice. Current treatment guidelines for low back pain recommend the timely identification and initiation of multidisciplinary treatment for other psychological factors (eg, depression, distress, job dissatisfaction) associated with increased risk for delayed recovery [4,8,9]. There are, however, no recommendations for the assessment of FABs. In a recent systematic review [10], high FABs, identified by the most frequently used questionnaires, the Fear-Avoidance Belief Questionnaire (FABQ [11]) and the Tampa Scale of (Kinesiophobia Miller RP, Kori SH, Todd DD. unpublished data, 1991) (TSK [12]), were prognostic in patients with subacute low back pain for not returning to work in observational studies. Whether high FABs identified by these two questionnaires specifically influence treatment efficacy in currently used treatment strategies is unknown [13–17].

To date, the role of FABs in treatment outcomes and in moderating effects of treatment efficacy in LBP has not been reviewed systematically. The aim of the current review is, therefore, to assess the influence of FABs on the outcome of various treatments in randomized controlled trials (RCTs) for patients with LBP.

Methods

The review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement on conducting systematic reviews of RCTs [18]. To allow for comparison among studies and to clarify the moderating role of FABs on treatment efficacy in patients with LBP, we restricted this review to studies that assessed FABs with the most often used questionnaires, the FABQ and the TSK. For both questionnaires, a moderate overlap has been shown.

Literature search

We identified all RCTs meeting our eligibility criteria (defined in detail subsequently) published between January 1990 and January 2013. The following databases were searched in January 2013: BIOSIS, CINAHL, Cochrane Library, Embase, OTSeeker, PeDRO, PsycInfo, PubMed/Medline, Scopus, and Web of Science. The search was conducted with the help of an experienced librarian. Search terms included ''fear'' and ''avoidance'' as Medical Subject Headings and other subject headings and different combinations. Two detailed search strategies are depicted in Supplementary data. To ensure the completeness of the literature search, one reviewer (MMW) conducted an electronic hand search of the six most often retrieved journals and added all potentially eligible references not retrieved by the systematic search. In addition, bibliographies of included studies relevant to the research question were searched, and potentially eligible references were included in the full-text review (inclusion and exclusion criteria applied). Authors of studies that were eligible but did not report sufficient information were contacted, and, where available, this information was included in the analysis.

Eligibility criteria

All RCTs were considered eligible for inclusion in this investigation that met the following criteria: they

reported research concerning patients seeking care for LBP; they demonstrated at least moderate study quality; they investigated the effect of FABs assessed by the two most often used questionnaires, the FABQ and the TSK; and they were published between January 1990 and January 2012. We focused on RCTs with at least 30 patients per group because of a concern about sample size. Assuming a 50% reduction in perceived disability that was one-third greater in the treatment group compared with the reference group, a sample size of 37 patients per group would be sufficient to detect the difference in allowing a drop-out rate of 15% (alpha 0.80, significance level 0.05). No limits for the study setting or language of the publication were applied. Excluded were conference proceedings.

Study selection, data extraction, and synthesis

The bibliographic details of all retrieved articles were stored in an EndNote file. Two reviewers (MMW and ER-B) independently screened all 691 references by title and abstract. The full text was reviewed by both the reviewers independently (MMW and ER-B) in all studies meeting the predefined eligibility criteria (n=78). Disagreements were discussed and resolved by consensus or by the third-party arbitration (SW). Researchers with specific language proficiencies reviewed non-English references. In the case of several publications for the same RCT without change in outcome or follow-up duration, the most recent publication was chosen and missing information from the previous publication added.

Quality assessment

The quality of each study was assessed using the Scottish Intercollegiate Guidelines Network methodology checklist for RCTs [19]. In addition, all quality criteria not covered in this checklist but considered to be important according to a consensus study on methodological criteria for the assessment of moderators in the systematic reviews were added [20]. Meta-analyses were only considered when all the following criteria were met: moderators were measured before randomization, adequate quality of measurement of baseline factors, and explicit test of interaction between moderator and treatment. All information needed to describe the study population were extracted. To assess the baseline characteristics of the study population, important prognostic factors for the course of low back pain were extracted and assigned to one of the 16 domains used in the previous research [21] and proposed by Hyden et al. [22]: general characteristics, social environment, overall health status, overall psychological health, previous LBP, work-psychosocial demands, work-physical demands, work-history and attributes, disability related to LBP, time change of LBP, physical examination findings, change in physical examination, diagnosis of LBP, and compensation related to LBP. The number of domains reported is given for each study.

This information was used to rate the overall bias risk and study quality according to the Scottish Intercollegiate Guidelines Network recommendations. The ratings included high quality (++, most criteria fulfilled, and if not fulfilled, the study conclusions are very unlikely to be altered), moderate quality (+, some criteria fulfilled, and if not fulfilled, the study conclusions are unlikely to be altered), low quality (−, few or no criteria fulfilled, conclusions likely to be altered). Studies rated as low quality by both the reviewers were excluded from further analysis.

Outcome definition

All investigated outcomes were extracted and categorized into work-related (eg, sick days, return to work) and non–work-related (eg, pain, perceived disability) outcomes. Each method of outcome was appraised and operationalized (eg, perceived disability measured by Oswestry disability index or by Roland-Morris disability questionnaire). For patient-specific measures, only validated scales were further used in the analysis.

Operationalization of FABs as predictor, mediator, and moderator

The definitions for predictor, mediator, and moderator were adopted from Pincus et al. [20]. Predictor: baseline FABs affect outcome but do not interact with the allocated treatment intervention. Mediator: change in FABs during treatment affects outcome, with or without interacting with allocated treatment. Moderator: FABs at baseline interact with treatment. The quality of the moderator analysis was assessed for each study by two reviewers (ER-B and MMW) and discussed with an experienced statistician (UH). The following factors were considered: when multiple comparisons were conducted, was the significance level adjusted from p less than .05 to less than .001; was an interaction test between treatment and moderator conducted; and were moderators equally distributed between groups at baseline. ‘‘Predictive’’ or ‘‘moderating’’ means that FABs were significantly associated with outcome in an univariate analysis or in a stepwise procedure and, therefore, were included in the final multiple model.

Treatment definition

All information given about the treatments delivered were extracted. Based on this information, each treatment was categorized into treatment based on a biomedical approach (eg, physical therapy without cognitive behavioral therapy [CBT] approach, the Handy Hints Back Book) and treatments aimed to address FABs (eg, psychological informed physical therapy, CBT, active advice including information about psychological factors, graded activity).

Whether a treatment addresses FABs was rated independently by two reviewers (MMW, ER-B), and disagreements were discussed. If no consensus could be achieved, an independent third reviewer (SW) decided whether a treatment addressed FABs.

Psychometric properties and description of the investigated questionnaires

The FABQ [11] is a 16-item questionnaire, each item scored 0 to 6. High levels indicate increased levels of FABs. Two subscales exist: a seven-item work subscale of FABQ (FABQ-W, range 0–42, ''My pain was caused by my work or by an accident at work'') and a four-item physical activity subscale of FABQ (FABQ-P, range 0–24, ''Physical activity makes my pain worse''). Fear-Avoidance Belief Questionnaire and the two subscales have been shown to be reliable and valid for the measurement of FAB. The Cronbach alpha for the FABQ-P was 0.75 and the test-retest reliability r=0.64. For the FABQ-W, the Cronbach alpha was 0.82 and test-retest reliability r=0.80 [23].

The TSK is a 17-item questionnaire (''I am afraid that I might injure myself accidentally,'' ''Pain lets me know when to stop exercising so that I don't injure myself'' [23]). Each item is measured on a four-point Likert scale (1=strongly disagree to 4=strongly agree). The scale ranges from 17 (no fear) to 68 (strong fear of reinjury). Several studies found support for the construct and predictive validity and reliability of the TSK (Kinesiophobia Miller RP, Kori SH, Todd DD. unpublished data, 1991) [24]. Further research found that a two-factor model based on 13 items to explain up to 70% of the variation, and its validity was confirmed [25]. Two-factor model consisted of a ''harm factor'' (items 3, 5, 6, 9, 11, 15 with a range of 6–24) and an ''activity-avoidance'' factor (items 1, 2, 7, 10, 13, 14, 17 with a range of 7–28) [23]. The harm factor reflects the beliefs that something is seriously wrong with the body, whereas the activity-avoidance factor indicates that avoiding exercise or activity might prevent an increase in pain.

Although the two scales measure different concepts (ie, FABQ measures fear of pain caused by physical activity and TSK measures fear of movement and reinjury), a moderate overlap has been shown [23,26,27]. The correlation between TSK and FABQ ranged from 0.39 (FABQ-P) and 0.33 (FABQ-W) [23] to 0.53 (FABQ-P) and 0.76 (FABQ-W) [27].

Statistical analysis

Because of heterogeneous study populations, measurements and scales used, and outcomes investigated, no meta-analysis was performed. Descriptive statistics (ranges) were used to summarize findings across all RCTs for baseline fear-avoidance mean values. Forest plots were generated using the R statistical software [28]. Forest plots were based on the values (odds ratio, hazard ratio, beta with corresponding 95% confidence interval) reported in the study reports.

For appraising the evidence of the results, the Grading of Recommendations Assessment, Development and Evaluation (GRADE) system [29] was used that was also adopted by the Cochrane Back Review Group [30]: high quality (75% of the RCTs with consistent findings, direct and precise data, no suspected publication biases, further research is very unlikely to change our confidence in the estimate of effect), moderate quality (several RCTs of moderate quality, further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate), low quality (only a few RCTs of moderate quality available, further research is very likely to have an important impact on the estimate of effect and is likely to change the estimate), and very low quality (effect is very uncertain).

Results

Study selection

The search and inclusion process is summarized in Fig. 1. Out of 2,331 records, 78 were reviewed in full text. The full-text assessment utilizing the inclusion and exclusion criteria resulted in the exclusion of 60 studies. The main reasons for exclusion were not investigating FABs as a predictor or moderator (n=32), use of questionnaires other than FABQ and TSK (n=6), duplicate publications (n=10), and study protocol only (n=8). In total, 18 publications based on 17 RCTs were included in the analysis. One study led to two publications reporting different interventions. Therefore, both publications were included [31,32]. Study quality was mostly moderate (n=12, 70%) and good (n=5, 30%).

Study characteristics

Baseline characteristics are summarized in Table 1. Most studies included patients with nonspecific low back pain (NSLBP, n=15). One study also included patients with SLBP [33]. In two studies, LBP was not further specified [34,35]. Ten studies included patients with LBP of up to 6 months (range of patients included 66–314) and followed them for 4 weeks to 12 months. Patients with LBP of 6 months and longer were the scope in six studies (range of patients included 71–598, disease duration 9–19 years) with a follow-up between 3 months [34] and 3 years [36]. Most RCTs compared interventions addressing FABs to usual care or studies based on biomedical approaches (n=14, 82%). Two RCTs compared treatments based on the biomedical approaches [17,37] and one RCT on fear-avoidance addressing strategies [38]. Outcome measures were based in 14 studies (78%) on self-perceived measures

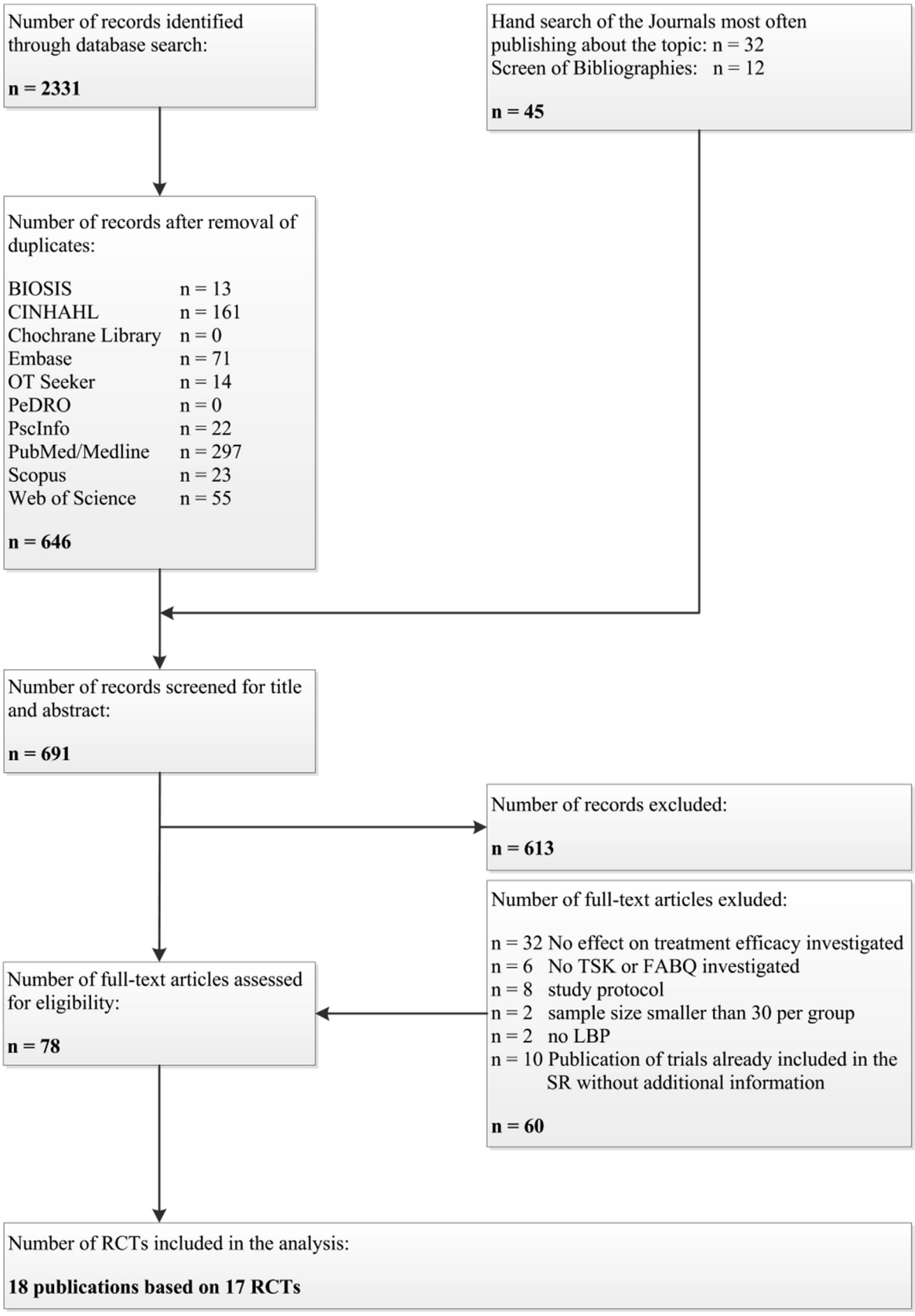

Fig. 1. PRISMA study flow.

Table 1
Baseline characteristics

Study	Setting	Diagnostic criteria	DD: days, mean (SD)	Age, mean (SD)	Important comorbid condition	Treatment	n (f)	First episode (%)	FU	SIGN	PF
Low back pain of less than 6 mo duration											
Fritz and George [17], ID 5	Health-care workers, recruited from occupational health-care providers, USA	Work-related NSLBP ≥3, requiring modification of employment duties; 18% symptoms distal to the knee	5.5 (4.6)	37.4 (10.4)	None	Control (n 37): PT (according to AHCPR clinical practice guidelines); intervention (n=41), PT according to the Classification System by Delitto et al. [68]	78 (30)	50	1 mo	+	10
George et al. [39], ID 7	Two RCTs in general population and one RCT military personnel, recruited from outpatient physical therapy clinic communities, USA	Acute NSLBP (≤30 d)+in treatment arms. Leg pain in 32.3%	13.3 (10.3)	36.2 (10.3)	None	Three RCT pooled— Trial 1 (n 75): manipulation+ exercise; Trial 2 (n 59) stabilization exercise; Trial 3 (n 31): direction-specific exercise	165 (83)	23.7	1 mo	+	7
Jellema et al. [45], ID 12	Randomization on level of GP practice. Participating GPs selected 10 consecutive patients, The Netherlands	NSLBP, 14.6% radiating below the knee	UC 14 (10.4), MIC 13 (11.9)	UC 42 (12), MIC 43.4 (11.1)	None	UC (n 171) vs. MIC (n 143)	314 (149)	NR	6 wk	+	8
Hancock et al. [31], ID 9B	Patient presenting in 40 GPs working in primary practice across Sydney, Australia	NSLBP, 12% rib to buttock crease with moderate pain and moderate disability (SF-36, item 7/8)	9.13 (9.31)	40.7 (15.6)	None	Diclofenac/ placebo+sham manipulation/ spinal manipulative therapy	239 (105)	Previous episodes: mean (SD) 3.7 (6.4)	Until to recovery	++	6
Hancock et al. [32], ID 9C	Same study as Hancock et al. [32]					Spinal manipulation+ diclofenac/ placebo (n 119) vs. placebo spinal manipulation+ diclofenac/placebo (n 120)			Time to recovery	++	6

(*Continued*)

Table 1
(*Continued*)

Study	Setting	Diagnostic criteria	DD: days, mean (SD)	Age, mean (SD)	Important comorbid condition	Treatment	n (f)	First episode (%)	FU	SIGN	PF
Staal et al. [40], ID 17	Occupational health-care setting Dutch airline workers, The Netherlands	NSLBP (≥4 wk duration), full or partial absence from work	Median 8 wk (IQR 6–12 wk)	38 (8.5)	None	UC (n 67) vs. behaviorally oriented GA intervention (n 67)	134 (8)	NR	1 y	++	6
George et al. [33,42], ID 8	Patients referred for rehabilitation to three participating clinics affiliated to University of Florida, USA	NSLBP+SLBP Quebec Task Force on Spinal Disorders. Leg pain TBC 38%, GA 49%, GX 42%	TBC 47 (34), GA 41 (39), GX 69 (49)	37.5 (14.9)	None	TBC physical therapy vs. TBC+GA vs. TBC+GX	108 (74)	TBC 50%, GA 31%, GX 33%	1 and 6 mos	+	8
Storheim et al. [41], ID 18A	Recruitment: National Insurance Offices, GPs in two counties. Total population of about 150,000 people near Oslo, Norway	NSLBP, sick listed from a permanent job and receiving between 50% and 100% compensation	8–12 wk sick listed because of LBP, no previous sick listing for LBP for 12 wk	41 (10)	None	UC, PT, CBT as covariant: no influence on the predictor model	93 (51)	NR	1 y	+	12
George et al. [42], ID 6	Patients referred by physicians to outpatient PT for evaluation and treatment, Rehab Center Florida, USA	NSLBP±leg pain (nonradicular) <8 wk. Leg pain 62%, sudden onset 53%	27.3 d, SD 16.2 d	38.2 (10.1)	None	UC (n 32) vs. fear avoidance treatment (n 34)	66 (38)	32%–47%	1 and 6 mo	+	7
Burton et al. [47], ID 2	Six primary care practices in the northeast section of England, five National Health Service GP, one osteopathic practice	New episode of acute or recurrent NSLBP, with or without referred leg pain	Acute to subacute (<3 mo)	Control 44.7 (12.2), experimental 42.6 (10.9)	None	Control booklet (n 79) vs. experimental booklet (n 83)	162 (89)	NR	3 mo	+	5
Woods and Asmundson [46], ID 20B	Recruited via newspaper, e-mail advertisements, posters	NSLBP+TSK score ≥38	Acute to subacute (<7 wk)	46.5 (11.9)	None	GivE protocol+GA, GA only, and waiting list	83 (29)	NR	2 mo	+	6
Klaber Moffett et al. [43], ID 13A	Referral by 87 participating GPs in the York area, UK	NSLBP, 4 wk to 6 mo of duration	4 wk to 6 mo	41.9 (8.9)	None	UC GP (n 98) vs. exercise program (n 89)	187 (106)	NR	1 y	+	5
Low back pain of 6 mo or longer											
Ang et al. [34], ID 1	Electronic medical record identification, invitation. Enrollment GP clinic of Indiana	LBP (60%), hip or knee (40%), ≥3 mo despite analgesic treatment, at least moderate severity	Intervention 8 y, UC 10 y	Intervention 55.2 (12.6), UC 55.8 (11)	Depression, hip and knee pain 40%	Intervention (n 123): Step 1 optimized antidepressant therapy (12 wk), Step 2 pain self-management	250 (132)	NR	3 mo	++	7

	University +Veterans Administration Medical Center, USA	(BPI score of ≥5)				program (12 wk) vs. UC (n 127) vs. control: not depressed					
Rasmussen-Barr et al. [36], ID 3B	Subjects with LBP seeking care at a primary health-care setting, a private physiotherapy clinic, primary health-care setting were included	NSLBP (costal margin−inferior gluteal folds, no leg pain), recurrent for 8 wk, still at work. Before episode ≥1 y pain free	10 (range 1–38) y	38 (11)	None	Reference group (advice) (n 35), vs. exercise group (n 36)	71 (36)	27%		6, 12, and 36 mo	+	10
Mannion et al. [37], ID 16	Hospital-based outpatient treatment, recruitment by advertisement, Switzerland	NSLBP±referred pain (nonradicular), continual or recurrent, ≥3 mo, causing absence from work or solicitation of medical attention	10.9 (9.4) y	45.1 (10.0)	None	Modern active PT (n 49) vs. muscle conditioning on training devices (n 49) vs. low-impact aerobics (n 50)	148 (84)	NR		6 mo	+	14
van der Hulst et al. [49], ID 19	Patients admitted to outpatient multidisciplinary Back Rehabilitation Program (MR), The Netherlands	NSLBP at least 3 mo	Median 60 mo, UC 48 mo, range 559 d, MR 72 mo, range 380 d	39 (10)	None	UC (n 84) vs. MR (n 79)	163 (64)	NR		End of treatment and 4 mo	++	7
Underwood et al. [38], ID 14C	Fifty-six general practices in seven regions across England	NSLBP, at least moderate troublesomeness for >6 wk	13 y since first onset (13)	53.8 (15)	None	AM vs. AM+CBT: treatment as covariant	598 (356)	NR		1 y	++	10
Magnussen et al. [35], ID 15	Participants on disability pension >1 y, county of Hordaland, Norway; identified through the National Insurance Administration	LBP not further specified	Control group: disability pension for 11.6 (5.8) y, intervention 9.8 (4.8) y	49 (5.45)	All on disability pension for a mean of 11 y	Control group (n 44) vs. intervention including FAB reducing information (n 45); 29 patients completed the intervention	89 (56)	NR		1 y	+	8

AHCPR, Agency for Health Care Policy and Research; AM, active management; BPI, brain performance index; CBT, cognitive behavioral therapy; DD, disease duration; FAB, fear-avoidance beliefs; FABQ, fear-avoidance belief questionnaire; FABQ-P, FABQ physical activity subscale; FABQ-W, FABQ work subscale; FU, follow-up; GA, graded activity; GivE, graded in vivo exposure; GP, general practitioner; GX, graded exposure; IQR, interquartile range; LBP, low back pain; MIS, minimal intervention strategy; MR, multidisciplinary rehabilitation; NR, nonreported; NSLBP, nonspecific low back pain; PF, prognostic factor reporting of the total of 16 possible domains; PT, physical therapy; RCT, randomized controlled trial; SD, standard deviation; SIGN, Scottish Intercollegiate Guidelines Network quality rating; ++, high quality, +, moderate quality; QA, questionnaire used; RTW, return to work; TBC, treatment-based classification; TSK, Tampa Scale of Kinesiophobia; UC, usual care.

(eg, pain, disability) and in four studies (22%) on return-to-work (RTW) information.

Influence of baseline FABs on treatment outcome in patients with LBP of up to 6 months

Seven out of nine RCTs (77%) found baseline FABs to influence treatment outcome (Table 2) [17,33,39-43]. Patients with high baseline scores had more pain and/or disability (four studies [33,39,42,43], Fig. 2) and were less likely to return to work (three studies [17,40,41]). Fear-avoidance work scores (FABQ-W) were assessed in seven studies and predicted poor work-related outcomes in four studies [17,40,41] and disability in one study [39]. High FABQ-W scores were not associated with RTW in one study [42] and did not predict pain in two studies [31,32]. Of the seven studies that used FABQ-P, high FABQ-P scores were associated with less RTW in one study [40] and more disability in two studies [42,43]. One study found a combination of high FABs and catastrophizing to be associated with more pain and disability, whereas fear avoidance (FABQ-P) alone was not [33,44]. Three studies found no influence of FABQ-P on RTW [17,41] and pain [45]. Tampa Scale of Kinesiophobia was used only once. In this study, only patients with high TSK scores (>38) were included, and in this group, there was no association between TSK and pain [46].

Mediating effect of change in FABs on treatment outcome in patients with LBP of up to 6 months

All three RCTs that investigated mediating effects found an association of decrease in FABs during treatment with more RTW [40] (FABQ-P, FABQ-W, TSK), less pain [33,44] (FABQ-P, not FABQ-W), and disability [47] (FABQ-P) (Table 2, Fig. 3).

Moderating effect of FABs on treatment efficacy in patients with LBP of up to 6 months

Ten RCTs investigated moderating effects of FABs on specific treatments. Six studies found moderating effects on one or more treatments (Table 2, Fig. 4). Baseline FABs were associated with more pain or disability and less RTW in treatment arms based on biomedical concepts and fear-avoidance strategies (Table 3, Fig. 4). Higher scores in FABs were associated with increased treatment efficacy of FABs addressing treatment strategies. Interventions providing information to reduce FABs (the Back Book, minimal intervention by general practitioners) led to less reported disability in patients with high FABs (FABQ-P) at short-term follow-up [45,47], Graded activity based on operant conditioning described by Vlaeyen et al. [48] was less effective in patients with high FABs in two studies [40,46]. Woods and Asmundson [46] compared graded activity alone to additional CBT-based education and found an increased efficacy of combining the two in patients with high FABs. Randomized controlled trials that combined fear-avoidance addressing information, graded exposure, and physical treatments found an increased treatment efficacy in patients with high FABs with less disability [42,43]. In treatment arms based on the biomedical concepts, eight out of nine (89%) found that baseline FABs were associated with poor outcome for pain (n=1), disability (n=4), and RTW (n=4) at short- and long-term follow-up (Table 3). Compared with the Back Book, a booklet based on biomedical concepts (Handy Hints Booklet) was associated with less clinical meaningful important change at follow-up compared with patients with the Back Book [47].

Influence of baseline FABs on treatment outcome in patients with LBP of 6 months and longer

Out of five RCTs, two found high baseline FABs to be associated with increased pain (TSK [34]) and RTW (FABQ-W [35]) (Table 4, Fig. 2). No association of FABs with disability at follow-up was found in three studies (FABQ-P [36], TSK [49], FABQ-P [38]).

Mediating effect of change in FABs on treatment outcome in patients with LBP of 6 months and longer

One study investigated the influence of a change of FABs on treatment outcome [37]. Whereas changes in FABQ-P and FABQ-W scores were nonpredictive for disability, a small effect was found for change in FABQ-W on pain reduction (Table 4).

Moderating effect of FABs on treatment efficacy in patients with LBP of 6 months and longer

In patients with chronic low back pain, only one study found multidisciplinary rehabilitation in patients with high FABs (TSK) to lead to less disability and an increased chance for RTW (Table 5, Fig. 4) [35]. No moderating effect was found on all other treatments investigated [34-38]. Underwood et al. [38] compared active advice including the Back Book to active advice with additional group therapy session of CBT and found no influence of FABs on treatment efficacy. A summary of the description of the interventions extracted from the publications is provided in Supplementary data.

Differences among studies with nonpredictive and predictive findings

Studies with nonpredictive findings included on average more patients than studies with predictive findings (Table 6). This may be a spurious finding as it is mainly because of one study that included more than 580 chronic LBP patients [37]. The reporting of previously identified prognostic factors for chronic LBP could be improved in all studies [21]. Out of 16 domains, predictive studies

Table 2
Summary of the influence of FABs on treatment outcomes and efficacy in patients with LBP of less than 6 months

Study	Scale: mean (SD)	Predictor	Mediator	Moderator
Fritz and George [17], ID 5	FABQ-W (mean 27.9, SD 8.6), FABQ-P (mean 18.9, SD 5.8)	+ High FABQ-W score predict non-RTW (RTW without restriction) at 4 wk (OR 1.2 [CI 1.07–1.34]) – FABQ-P NR for RTW (RTW without restriction)	Ø	– RTW: no differences between control PT (AHCPR clinical practice guidelines) and intervention (PT Classification System by Delitto)
George et al. [39], ID 7	FABQ-W (mean 15.1, SD 10.5) FABQ-P (mean 16.6, SD 4.6)	+ High FABQ-W predicted less disability (ODI) reduction in men in all treatment groups (beta 0.43 [CI 0.03–0.83]) – FABQ-W women NR for ODI. FABQ-P not reported	Ø	– No moderator for disability (ODI) reduction in all treatments (manipulation+exercise, stabilization exercise, direction-specific exercise)
Jellema et al. [45], ID 12	FABQ-P (mean 18.8, SD 1.8)	Ø	Ø	+ High FABQ-P in MIS more likely to have a CMID in disability (RMQ, OR 1.07, CI 0.99–1.16) compared to UC – FABQ-P in UC NR for RMQ
Hancock et al. [31], ID 9B+C	FABQ-P (mean 17.0, SD 5.4) FABQ-W (mean 14.5, SD 10.4)	– FABQ-P NR for days to recovery from pain (NRS) – FABQ-W univariate associated, multivariate not associated with days to recovery from pain (NR)	Ø	+ In high FABQ-P NSAID more effective than placebo: HR to have a day without pain (NRS) 1.059 (1.002–1.118) and for 7 d HR 1.042 (0.988–1.10) – FABQ-W NR: HR for 1 d without pain (NRS) 0.996 (CI 0.972–1.02), HR for 7 d without pain 0.992 (CI 0.967–1.018)
Staal et al. [40], ID 17	FABQ-P (mean 16.9, SD 5.1) Modified FABQ-W (range 0–36, mean 21.8, SD 9.2) TSK (mean 39.4, SD 6.8) Cutoffs: FABQ-P ≥16, FABQ-W ≥26	+ FABQ-P ≥16 less likely to RTW (>27 d full return to regular work) (NR) + FABQ-W ≥26 predictive: less likely to RTW (NR). TSK not reported	+ Reduction of FABQ-P at 3 mo increase the chance of RTW (FABQ-P HR 2.0 (CI 1.2–3.5) + Reduction in FABQ-W at 3 mo increase the chance of RTW FABQ-W 2.2 (CI 1.3–3.7) + Reduction in TSK at 3 mo increased chance of RTW, TSK 2.3 (CI 1.4–3.9)	+ Compared with UC behavioral-oriented GA increased the chance for RTW (>27 d full return to regular work). The effect was decreased by FABs: low fear-avoidance RTW HR 2.6–3.0 FABQ-P <16 (HR 3.0 [CI 1.6–5.5]), FABQ-W <26 (HR 2.6 [CI 1.5–4.6]) compared with high fear-avoidance HR for RTW 1.6 (FABQ-P ≥16, HR 1.6 [1.0–2.7], FABQ-W ≥26, HR 1.6 [CI 1.0–2.7])

(*Continued*)

Table 2
(*Continued*)

Study	Scale: mean (SD)	Predictor	Mediator	Moderator
George et al. [33]; Beneciuk et al. [44], ID 8A+B	FABQ-P (mean 13.3, SD 11.1) FABQ-W (mean 37.3, SD 26.7) Cutoff FABQ-P >14	+ Patients with high FABQ-P and high catastrophizing experienced more pain (NRS) and disability (ODI) than patients with high FABQ-P alone or patients with low FABQ-P. Furthermore, they experienced more decrease in pain and disability at follow-up	+ Reduction in FABQ-P was associated with less pain (NRS) at 1 mo (beta=0.26 [CI −0.46 to −0.06], 6 mo (beta=0.25 [−0.47 to −0.03] − Reduction in FABQ-W was not associated with less pain (NRS)	Ø
Storheim et al. [41], ID 18A	FABQ-W (patients with RTW mean 25.5, SD 9.0; patients not RTW mean 33.6, SD 5.8)	+ Higher FABQ-W predictive for longer time to RTW (returned to full-time work according to data from the National Insurance Offices) at 1 y (HR 1.082 [CI NR]) for all treatments ↓ − FABQ-P NR	Ø	− No differences between treatments (UC, PT, CBT)
George et al. [42], ID 6	FABQ-W (mean 14.3, SD 12.1) FABQ-P (mean 15.3 [5.5])	+ High FABQ-P predicted more disability (ODI) at 1 mo (beta 0.292, p=.042) and 6 mo (beta 0.469, p=.002) − FABQ-W NR for disability (ODI) (Fig. 4)	Ø	+ FAB treatment reduces FABQ-P baseline effect on disability (ODI) at 1 mo (beta −0.13) and 6 mo (beta −0.15) compared with standard PT. In the FAB-PT subgroup, treatment showed more improvement in disability (ODI) than in the PT subgroup (Fig. 4)
Burton et al. [47], ID 2	FABQ-P (mean NR) Cutoff m/s >14	Ø	+ FABQ-P baseline >14 and reduction of FABQ-P of >4 points at 2 wk and 3 mo are more likely to improve in RMQ (≥3 points) at 3 mo (RR to deteriorate at 0.56 [CI 0.31–1.03] and 0.46 [CI 0.26–0.8] respectively)	+ Experimental booklet more likely to have CMID in FABQ-P (>4 points): at 2 wk (RR 2.72), 3 mo (RR 1.53), 1 y (RR 1.47) compared with control booklet
Woods and Asmundson [46], ID 20B	TSK Cutoff > 38 points=inclusion criteria	− TKS NR for pain-related disability (PDI) at 2 mo	Ø	(+) Mean effect GivE for pain-related disability (PDI) pre- to 6 mo 20.4 ≥12.2, GA 23.3 ≥23.7, control 24 to >18.8. GivE better than GA
Klaber Moffett et al. [43], ID 13A	FABQ-P (mean 1.8, SD 5), FABQ-W (14–24 points 50%) Cutoff high FABQ-P: ≥14	+ FABQ-P <14 NR for disability (RMQ) in all treatments (EG and UC) at 1 y	Ø	+ FABQ-P ≥14: EG more likely to have CMID RMQ (≥2 points) compared with UC. The effect increases over time (OR 6 mo 1.98 [CI 0.72–5.48], 12 mo 3.58 [CI 1.30–9.84]

AHCPR, Agency for Health Care Policy and Research; AM, active management; CBT, cognitive behavioral therapy; CI, confidence interval; CMID, clinical meaningful important difference; EG, exercise group; FAB, fear-avoidance beliefs; FABQ, fear-avoidance questionnaire; FABQ-P, FABQ physical activity subscale; FABQ-W, FABQ work subscale; FU, follow-up; GA, graded activity; GivE, graded in vivo exposure; HR, hazard ratio; LBP, low back pain; m/s, median split; MIS, minimal intervention strategy; NR, not reported; NRS, numeric rating scale; NSLBP, nonspecific low back pain; NSAID, nonsteroidal anti-inflammatory drug; OR, odds ratio; PDI, pain disability index, range 0–70 (Pollard, 1984): higher score indicates more disability; ODI, Oswestry disability index: higher score indicates more disability, range 0% to 100% (Fairbank, 1980): CMID ≥12 points reduction; NR, nonpredictive; PT, physical therapy; RMQ, Roland-Morris Questionnaire: higher score indicates more disability: CMID ≥2–3 points reduction, ≥30% change, range 0–24 (Morris, 1984). RR, relative risk; RTW, return to work; SD, standard deviation; TBC, treatment-based classification; TSK, Tampa Scale of Kinesiophobia; UC, usual care; Ø, not investigated.

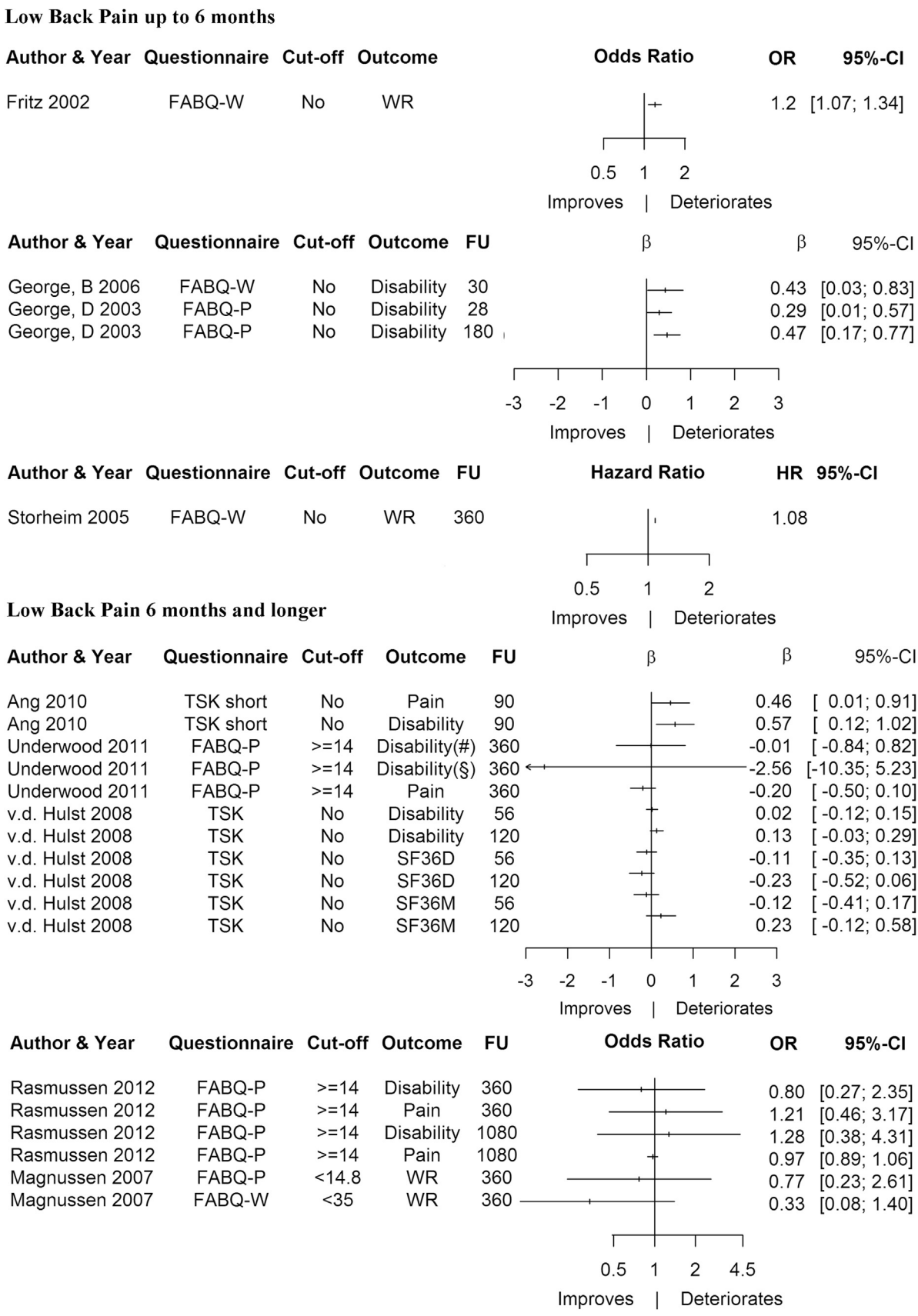

Fig. 2. Influence of fear-avoidance beliefs on treatment outcomes. §, Roland-Morris Questionnaire; #, MVK: modified von Korff, scale 0% to 100%; FU, follow-up given in days; WR, work related; OR, odds ratio; β, beta; SF-36D, SF-36 physical health subscore: higher score indicates higher level of functioning; SF-36M, mental health subscore: higher score indicates higher level of functioning; CI, confidence interval; FABQ-W, work subscale of FABQ; FABQ-P, physical activity subscale of FABQ.

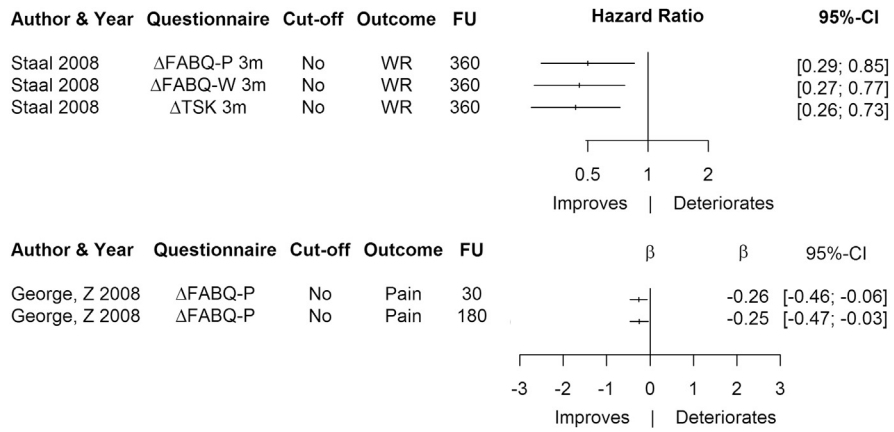

Fig. 3. Mediating effect of change in fear-avoidance belief during treatment in subacute low back pain. Δ, change from baseline to follow-up; 3m, 3 months; FABQ-W, work subscale of fear-avoidance belief questionnaire; FABQ-P, physical activity subscale of FABQ; TSK, Tampa Scale of Kinesiophobia; CI, confidence interval; FU, follow-up; WR, work related.

reported between 5 and 12 and nonpredictive studies between 5 and 10. Thus, reporting of prognostic factors did not differ between predictive and nonpredictive studies.

Most often, FABQ-P was investigated (15 times) followed by FABQ-W (10 times) and TSK (4 times). The most consistent predictor was the baseline FABQ-W value. All nonpredictive studies had low baseline FABQ-W values (range of baseline mean values 14.3–14.5, Table 6) compared with the predictive studies (range of baseline mean values 15.1–30.8), indicating that nonpredictive studies included a low-risk population with little variability in FABQ-W. In nonpredictive studies using FABQ-P, low baseline values could be responsible for nonpredictive findings in two studies with chronic LBP (mean baseline value 13.5 [38], 13.0 [36]). The difference in the FABQ-P baseline values was not as pronounced as in the FABQ-W values. Eight studies (45%) used cutoff values with mixed findings. Most often, the cutoff of 14 or more points for FABQ-P (n=5, once median split) was used. Only two studies used FABQ-W cutoff values (≥26 [40] and median split of ≥35 [35]).

Discussion

Main findings

In this systematic review of 17 RCTs, we found convincing evidence that the presence of FABs assessed by the most frequently used questionnaires, the FABQ and the TSK, influences treatment effects in patients with low back pain (LBP) of less than 6 months duration (GRADE high-quality evidence, 831 patients vs. 322 in nonpredictive studies). There was moderate evidence that a decrease in FAB values during treatment was associated with less pain and disability at follow-up (two RCTs with moderate quality, 242 patients). Interventions that addressed FABs (GRADE moderate evidence, 1,051 vs. 227 patients in studies without moderating effects) were more effective than treatments based on the biomedical concepts. In chronic patients with NSLBP, the findings were less consistent. Two studies found baseline FABs to be associated with more pain and disability and less RTW (339 patients), whereas three others (832 patients) found none (GRADE low evidence).

Results in light of the existing literature

To our knowledge, this is the first systematic review summarizing the current evidence on the role of FABs identified by the FABQ or the TSK as a moderator of treatment efficacy in RCTs for acute, subacute, and chronic NLSBP. Several nonsystematic reviews highlighted the importance of the fear-avoidance model [15,50,51], whereas others questioned the impact [13,52,53]. Other systematic reviews [54,55] addressed the efficacy of specific treatment interventions, but to date, none have systematically addressed the influence of baseline level of FABs on treatment efficacy. Therefore, it is unknown if treatments addressing FABs are suitable for all patients with LBP and further if treatments based on biomedical concepts are less effective in patients with high FABs. Our findings suggest that interventions addressing FABs in patients with high FAB score values at baseline are effective in patients with LBP of less than 6 months duration. In patients without or with low FABs, such treatments are no more effective than other treatment strategies and likely unnecessary. To verify this, future studies should include a large enough sample of patients to allow for subgroup analyses.

A recent systematic review [10] of observational studies highlighted the importance of FABs for poor work-related outcomes in subacute LBP patients and therefore recommended systematic assessment of FABs in patients with persistent low back pain. The present study further supports these findings and expands on the influence of FABs on treatment response and treatment outcome. The influence of FABs in patients with persisting pain is less apparent.

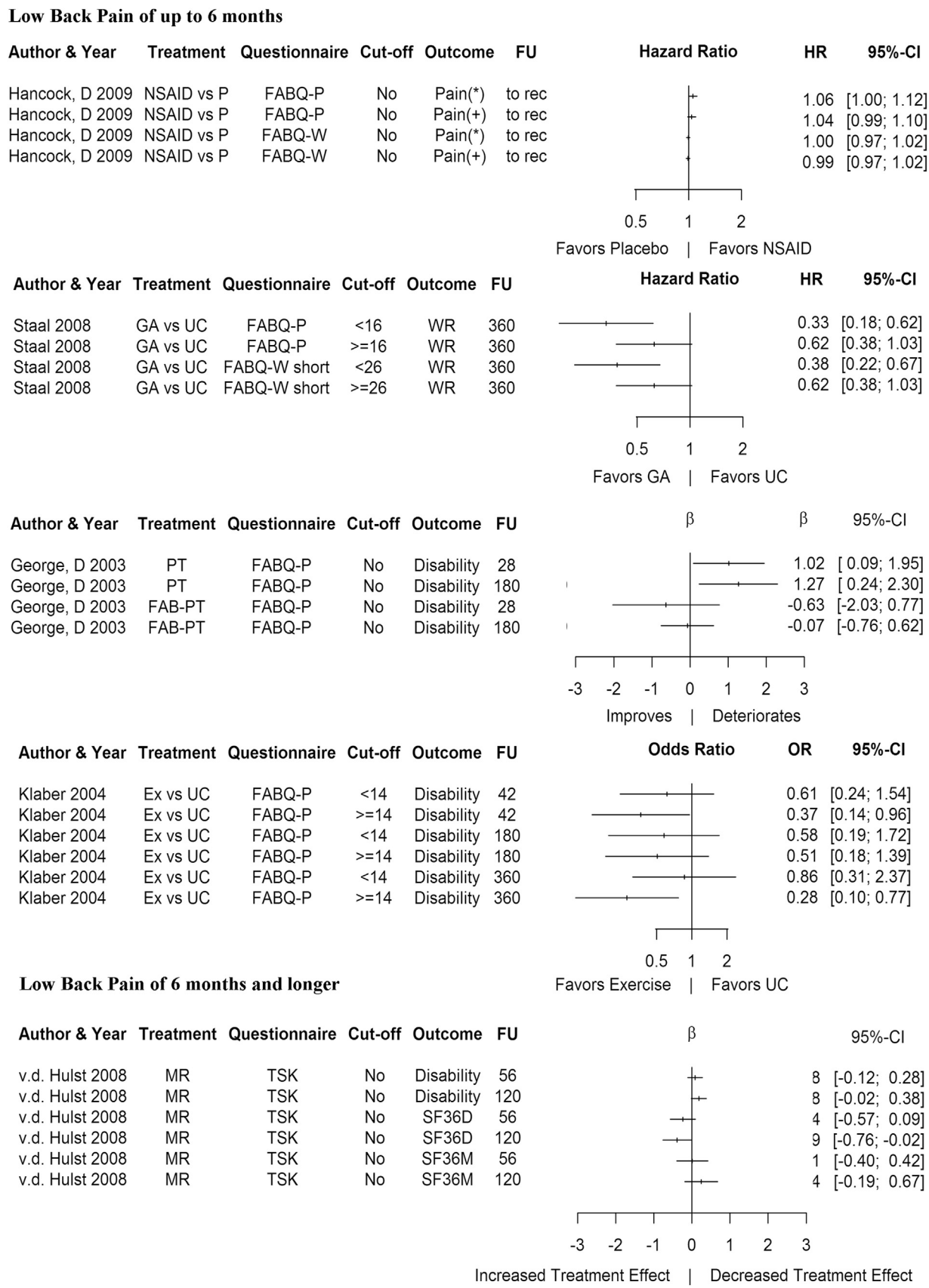

Fig. 4. Moderating effect of fear-avoidance beliefs on treatment efficacy. *, 1 day without pain; +, 7 days without pain; NSAID, nonsteroidal anti-inflammatory drug; P, placebo; Ex, exercise: UC, usual care; MR, multidisciplinary rehabilitation; GA, graded activity; WR, work related; CI, confidence interval; HR, hazard ratio; FU, follow-up; FABQ-W, work subscale of fear-avoidance belief questionnaire; FABQ-P, physical activity subscale of FABQ; PT, physical therapy.

Table 3
Influence of FABs on treatment arms addressing FABs or based on biomedical concepts

Treatment	FAB predictor	FAB moderator	Outcome	Standardized treatment	Adherence controlled	FU (mo)	Patients	Dropout (%)
Fear-avoidance addressing treatments								
The BB and GP care, ID 2 [47]	Ø	FABQ-P ↑: the BB efficacy ↑	CMID in disability (RMQ)	Yes	No	3	162	22
Minimal intervention (MIS) by GP and GP care, ID 12 [45]	Ø	FABQ-P ↑: MIS efficacy ↑	CMID in disability (RMQ)	Yes	No	1.5	314	19
GA, operant conditioning, Vlaeyen et al., [70], ID 17 [40]	FABQ-P ↑/– FABQ-W↑: less RTW	FABQ-P ↑/– FABQ-W ↑: GA efficacy ↓	RTW	Yes	Yes	12	134	11
GA, operant conditioning (Vlaeyen et al. [70]), ID 20 [46]	No (TSK <39 not included)	TSK >38 no pain reduction	Pain (PDI)	Yes	Yes	2	83	46
TBC-PT (Delitto et al. [67])+GA (George et al. [42]), ID 8 [33]	FABQ-P ↑ more pain and disability	Ø	Pain (NRS) and disability (ODI)	Yes	Yes	6	108	44
TBC-PT [68]+graded exposure (GivE, based on Vlaeyen et al. [48]), ID 8 [33]	FABQ-P ↑ more pain and disability	Ø	Pain (NRS) and disability (ODI)	Yes	Yes	6	108	44
Fear avoidance addressing PT (FAB-PT, Vlaeyen and Linton [68]) using graded (GA) exercise and the BB, ID 6 [42,43]	FABQ-P ↑ more disability	FABQ-P ↑: FAB-PT efficacy ↑	Disability (ODI)	Yes	Yes	6	66	NR
Exercise with CBT approach (EG), ID 13 [43]	FABQ-P ↑ less CMID	FABQ-P ↑ EG efficacy ↑ with more CMID than UC	CMID in disability (RMQ)	Yes	No	12	187	9
CBT and PT, ID 18 [41]	FABQ-W ↑ less RTW	–	RTW	Yes	Yes	12	93	
CBT based education (psychology student under supervision) on FAB (GivE, Vlaeyen et al. [48]) followed by GA, ID 20 [46]	No (TSK <39 not included)	GivE+GA: pain reduction ↑ than GA	Pain-related disability (PDI)	Yes	Yes	6	83	46
Fear avoidance addressing PT (FAB-PT, only in one of the three trials), ID 7 [39]	FABQ-W ↑ less disability in men	Ø	Disability (ODI)	NR	NR	1	165	44
Exercise (PT provided back training, The Norwegian Aerobic Fitness Model), ID 18 [41]	FABQ-W ↑ less RTW	–	RTW	Yes	Yes	12	93	39
NSAID vs. placebo, ID 9C [31,32]	–	FABQ-P↑: NSAID efficacy ↑	Pain (NRS, days without pain)	Yes	Yes	To recovery	239	2
Treatments based on biomedical concepts								
No FAB addressing therapy								
UC by GPs, ID 12 [45]	Ø	–	CMID in disability (RMQ)	No	No	1.5	314	19
UC by GPs, ID 13 [43]	FABQ-P ↑ less CMID	FABQ-P ↑ UC less CMID	CMID in disability (RMQ)	No	No	12	187	9
UC by GPs, ID 18 [41]	FABQ-W ↑ less RTW	No	RTW	No	No	12	93	39
UC by occupational physician, ID 17 [40]	FABQ-P ↑/–FABQ-W↑: less RTW	Difference between UC and GA ↓	RTW	No	Yes	12	134	11
Active exercise and/or manipulation, ID 7 [39]	FABQ-W ↑ less RTW	–	Disability (ODI)	NR	NR	1	165	44

TBC (Delitto et al. [67]): specific exercise, manipulation or mobilization, lumbar stabilization or traction, ID 8 [33]	FABQ-P ↑+catastrophe ↑: more pain and disability	–	Pain (NRS) and disability (ODI)	Yes	Yes	6	108	44	
PT based on recommendations of the AHCPR, ID 5 [17]	FABQ-W ↑ less RTW	–	RTW	Yes	No	1	78	NR	
TBC-PT [68] manipulation, exercise, traction, ID 5 [17]	FABQ-W ↑ less RTW	–	RTW	Yes	No	1	78	NR	
TBC-PT [68]+HH educational pamphlet, ID 6 [42,44]	FABQ-P ↑ more disability	–	Disability (ODI)	Yes	Yes	6	66	NR	
HH Booklet and GP care, ID 2 [47]	Ø	FABQ-P ↑: HH less likely CMID	CMID in disability (RMQ)	Yes	No	3	162	22	
Spinal manipulation, ID 9B [31]	–	Ø	Pain (days without pain)	Yes	Yes	To recovery	239	2	

AHCPR, Agency for Health Care Policy and Research; AM, active management; BB, Back Book; CBT, cognitive behavioral therapy; CMID, clinical meaningful important difference; EG, exercise group; FU, follow-up duration in months; GA, graded activity; GivE, graded in vivo exposure; GP, general practitioner; HH, handy hints; ODI, Oswestry disability index: higher score indicates more disability, range 0% to 100% (Fairbank, 1980): CMID ≥12 points reduction; MIS, minimal intervention strategy; NSAID, nonsteroidal anti-inflammatory drug; PDI, pain disability index, range 0–70 (Pollard, 1984): higher score indicates more disability; PT, physical therapy; RMQ, Roland-Morris Questionnaire: higher score indicates more disability: CMID ≥2–3 point reduction, ≥30% change, range 0–24 (Morris, 1984); RTW, return to work; TBC, treatment-based classification; UC, usual care; TSK, Tampa Scale for Kinesiophobia; Ø, not investigated; –, no effect; ↑, increase; ↓, decrease.

It is reasonable to believe that a chronic population has already solidified their beliefs, and there may be less variation in beliefs about the effect of activity on pain in this group. It therefore makes sense that these beliefs are more important in guiding the course of LBP in the subacute phase when individuals are at risk of becoming chronic, and beliefs may be more disparate as shown in a recent study [10]. Because there was an absence of assessment of additional psychological constructs with potential overlap in the studies reviewed here, this is a topic for future study.

Strength and limitations

The strengths of this systematic review are the assessment of FABs in light of disease duration and the comprehensive evaluation of the currently available literature. The search was inclusive, no language limitations were applied, and a thorough bibliographic search was conducted to include all relevant studies. The extraction process was done in accordance with current guidelines and with the help of an experienced statistician. Potential factors of influence were identified by a multidisciplinary team (a psychologist, internist, physical therapist, statistician, rheumatologist, and methodologist).

The study's main limitation is a possibility of bias because of the moderate quality of most studies. Some studies did not meet the required sample size calculated for the primary outcome. None of the studies provided a power analysis for moderator effect. For reliable subgroup analysis, even more patients are needed. We are aware of some limitations with regard to generalizability by limiting our search to studies that used FABQ or TSK only to assess FABs. Other available questionnaires include questions that address FABs but were not included into this analysis. The strength of our approach is that FABQ and TSK are widely used questionnaires and assess FABs exclusively that allowed us to make comparisons among studies. Furthermore, some of the recent questionnaires that assess different coping strategies including the STarT Back Tool or the Orebro questionnaire included questions that were derived from the FABQ or TSK [6,56,57]. Therefore, it is likely that our findings would apply to studies that use such questionnaires with regard to the importance of FABs. The heterogeneity of studies and the methodological limitations impeded us from conducting a meta-analysis [20]. We have tried to balance these limitations by providing a comprehensive comparative description of all the studies included and the prognostic factors reported.

Implications for research

Addressing FABs leads to the better outcome compared with treatments that are based on biomedical concepts in particular in patients at risk for chronic LBP. Although

Table 4
Summary of influence of FABs on treatment outcomes and efficacy in patients with LBP of 6 months and more

Study	Scale: mean (SD)	Predictor	Mediator	Moderator
Ang et al. [34], ID 1	Modified 10-item TSK (mean value NR)	+ High TSK associated with an increased pain (GCPS pain intensity, beta 0.46, [CI 0.0092–0.91]) and GCPS activity interference (beta 0.57 [CI 0.119–1.02]) at 3 mo	Ø	– No difference between optimized antidepressant therapy, pain self-management program, and UC
Rasmussen-Barr et al. [36], ID 3B	FABQ-P, (median 13, range 0–24) cutoff high ≥14	– Baseline FABQ-P ≥14 does not predict pain (VAS) and disability (ODI) after 12 (pain OR 1.21 [CI 0.46–3.17], disability OR 0.8 [CI 0.27–2.35]) and 36 mo (pain OR 0.97 [CI 0.89–1.06], disability OR 1.28 [0.38–4.31])	Ø	– No differences between the reference group (advice) and exercise group
Mannion et al. [37], ID 16	FABQ-P (mean 13.8, SD 5.3) FABQ-W (mean 15.7, SD 11.3)	Ø	+ Decrease of FABQ-W associated with pain (VAS) reduction at 6 mo (10% variance in combination with reduction of disability [RMQ]) – Decrease in FABQ-P and FABQ-W nonpredictive for change in RMQ	– No difference between "modern active PT," muscle conditioning on training devices, and low-impact aerobic
van der Hulst et al. [49], ID 19	TSK (mean 39, SD 7)	– TSK not associated with RMQ, SF-36D and SF-36M (end of treatment), and RMQ at 4 mo (beta −0.13 [CI −0.29 to 0.027]). Tendency to more decrease in SF-36D (beta 0.23 [CI −0.06 to 0.52]) and worsening of SF-36M (beta −0.23 [CI −0.58 to 0.123]) at 4 mo	Ø	+ MR better than UC: higher TSK leads to less disability (more increase in SF-36D beta 0.16 [CI 0.018–0.762]) in MR after 4 wk – No influence on treatment efficacy for RMQ and SF-36M at end of treatment and 4-wk FU or SF-36D at end of treatment
Underwood et al. [38], ID 14C	FABQ-P (mean 13.5, SD 6.4) cutoff high: ≥14	– FABQ-P nonpredictive for RMQ, MVK pain and disability at 1 y		– No difference between AM vs. AM+CBT
Magnussen et al. [35], ID 15	FABQ-P (cutoff m/s <14.8, mean 14.6, SD 6.1) FABQ-W (m/s <35, mean 30.8, SD 10.7)	+ FABQ-W <35: three times more likely to have entered RTW process at 1 y (self-reported three-point scale: "Have you succeeded in returning to work?": "Yes," "No," and "Still in the process"), but small sample size and wide CI (0.4–4.6), FABQ-P nonpredictive		– No difference between control group and intervention with FAB reducing information

AM, active management; CBT, cognitive behavioral therapy; CI confidence interval; CMID, clinical meaningful important change; FABs, fear-avoidance beliefs; FABQ, fear-avoidance questionnaire; FABQ-P, FABQ physical activity subscale; FABQ-W, FABQ work subscale; FU, follow-up; LBP, low back pain; m/s, median split; NR, not reported; ODI, Oswestry disability index: higher score indicates more disability, range 0%–100% (Fairbank, 1980): CMID ≥12 points reduction; MR, multidisciplinary rehabilitation; MVK, modified von Korff (Underwood, 1999), scale 0%–100%; OR, odds ratio; RMQ, Roland-Morris Questionnaire: higher score indicates more disability: CMID ≥2–3 point reduction, ≥30% change, range 0–24 (Morris, 1984); PT, physical therapy; RR, relative risk: CMID, clinical meaningful important difference; RTW, return to work; SD, standard deviation; SF-36D, short-form 36 physical health subscore: higher score indicates higher level of functioning; SF-36M, short-form 36 mental health subscore: higher score indicates higher level of functioning (Aaronson, 1998); TBC, treatment-based classification; TSK, Tampa Scale of Kinesiophobia; UC, usual care; VAS, visual analog scale; Ø, not investigated.

Table 5
Effect of FABs on treatment efficacy for fear addressing treatments

Treatment	FAB predictor	FAB moderator	Outcome	Standardized treatment	Adherence controlled	FU (mo)	Patients	Dropout (%)
Fear avoidance addressing treatments								
Active management advice (primary care nurse)+the BB, ID 14 [38]	–	–	Pain and disability (RMQ, MVK pain and disability)	Yes	Yes	12	598	15
Active management advice+the BB+six group therapy sessions with CBT, ID 14 [38]	–	–	Pain and disability	Yes	Yes	12	598	15
Individual guidance how to improve physical fitness+two group sessions with lectures aiming to reduce FAB and motivational interviewing, ID 15 [35]	FABQ-W ↑ less RTW	–	RTW	Yes	Yes	12	89	36
Graded stabilizing exercises (protocol by Jull and Richardson [69]), ID 3 [36]	–	–	Pain (VAS) and disability (ODI)	Yes	Yes	36	71	23
Pain self-management program and antidepressant therapy, ID 1 [34]	TSK ↑ more pain and disability	–	Pain (GCPS), disability (GCPS)	Yes	No	3	250	0
MR, ID 19 [49]	–	TSK ↑ MR better than waiting list (SF-36 function)	Disability (SF-36 function, RMQ)	Yes	Yes	4	163	13
Treatments based on biomedical concepts								
No FAB addressing therapy								
Waiting list, ID 19 [49]	–	Ø	Disability (SF-36 function, RMQ)	No	No	4	163	13
Information about daily walks, ID 3 [36]	–	Ø	Pain (VAS) and disability (ODI)	Yes	Yes	36	71	23
Advice should seek care for depressive symptoms, ID 1 [34]	TSK ↑ more pain and disability	–	Pain (GCPS), disability (GCPS)	No	No	3	250	0
Individual guidance how to improve physical fitness, ID 15 [35]	FABQ-W ↑ less RTW	–	RTW	Yes	No	12	148	36
PT instruction for therapy, ID 16 [37]	Ø	–	Pain (VAS)	Yes	Yes	6	148	11
Muscle reconditioning group, ID 16 [37]	Ø	–	Pain (VAS)	Yes	Yes	6	148	11
Aerobics/stretching group, ID 16 [37]	Ø	–	Pain (VAS)	Yes	Yes	6	148	11

AM, active management; CBT, cognitive behavioral therapy; CPG, chronic pain grade (von Korff, 1992) questionnaire: higher score indicates more pain; FAB, fear-avoidance belief; FU, follow-up duration in months; GA, graded activity; GCPS, Graded Chronic Pain Scale; GivE, graded in vivo exposure; MIS, minimal intervention strategy; MR, multidisciplinary rehabilitation; PT, physical therapy; TBC, treatment-based classification; UC, usual care; ODI, Oswestry disability index: higher score indicates more disability, range 0%–100% (Fairbank, 1980), CMID, clinical meaningful important change, ≥12 points reduction; RMQ, Roland-Morris questionnaire: higher score indicates more disability: CMID ≥2–3 point reduction, ≥30% change, range 0–24 (Morris, 1984); MVK, modified von Korff (Underwood, 1999), scale 0% to 100%; RTW, return to work; SF-36D, short-form 36 physical health subscore: higher score indicates higher level of functioning; SF-36M, short-form 36 mental health subscore: higher score indicates higher level of functioning (Aaronson, 1998); VAS, visual analog scale; Ø, not investigated; –, no effect; BB, Back Book.

our review might suggest that distributing educational information will reduce FABs equally compared with more intensive interventions, there is some evidence from one study that interventions that expose the patient to the feared activities are more effective than education alone [58]. However, this study population was small and, therefore, omitted from this review. Future research should further investigate how treatment interventions designed to address FABs work. Furthermore, the mechanism by which FABs affect the outcome should be investigated. It has been suggested that fear of activities may be motivated by different aspects of injury, such as pain or likelihood of reinjury [14,59]. It has also been suggested that pain intensity may influence FABs separate from cognitive appraisal [60,61]. However, these constructs are difficult to disentangle and need to be clarified for future study. Because we used results from multivariate analyses where the main confounders including baseline pain are included in the model, our findings suggest that FABs have an effect regardless of the influence of baseline pain. In addition, the process delineated in the fear-avoidance model has been questioned. It has been suggested that one may show FABs with or without

Table 6
Differences between predictive and nonpredictive studies

	All		<6 mo LBP		≥6 mo LBP	
Predictive: + yes, − no	+	−	+	−	+	−
Publications: n	9	5	7	2	2	3
n: range	78–250	71–598	78–187	83–239	89–250	71–598
Age: mean (range)	36.2–55	40.7–54	36.2–41	40.7–46.5	49–55	38–54
Disease duration: range of mean disease duration	5 d to 11 y	9 d to 13 y	5.5–120 d	9–35 d	9–11 y	5–13 y
Follow-up: range (mo)	1–12	2–36	1–12	To recovery to 2 mo	3–12	4–36
Prognostic domain*: range	5–12	5–10	5–12	5–6	7–8	7–10
FABQ-W: range baseline mean values	15.1–30.8	14.3–14.5	15.1–27.9	14.3–14.5	30.8	–
FABQ-P: range baseline mean values	13.3–16.9	13.5–18.9	13.3–16.9	17.0–18.9	–	13.5–14.6
TSK: range baseline mean values	39.4	39	39.4	–	NR	39
SIGN quality	+ (n=7), ++ (n=2)	+ (n=3), ++ (n=2)	+ (n=6), ++ (n=1)	+ (n=1), ++ (n=1)	+ (n=1), ++ (n=1)	+ (n=2), ++ (n=1)

FABQ, fear-avoidance belief questionnaire; FABQ-P, physical activity subscale of the FABQ; FABQ-W, work subscale of the FABQ; LBP, low back pain; NR, nonreported; SIGN, Scottish Intercollegiate Guidelines Network risk of bias; (++), high quality: most of the criteria have been fulfilled; (+), moderate quality: some criteria fulfilled; NR, nonreported; TSK, Tampa Scale of Kinesiophobia.

* Number of prognostic domains reported (modified from Hayden et al. [22]).

catastrophizing as a prerequisite [59]. Therefore, the interaction between FABs and the presence of catastrophizing or other coping strategies and their effects on outcome should be investigated further. One way to approach this is to include tools that assess different aspects of coping such as FABs, catastrophizing, self-efficacy, and positive outcome expectations to test their relative utility. Another approach proposed by researchers [15,59] is to further categorize patients in different types of avoiders (eg, misinformed avoiders, learned pain avoiders, affective avoiders) [15,59]. Those subjects who fall into these subgroups could then be assigned to different treatment strategies.

The various outcome measures reported impeded us from conducting the meta-analysis. In future studies, a core set of information should be collected as proposed by the Multinational Musculoskeletal Inception Cohort Study Collaboration [62]. This will allow researchers to conduct subgroup analyses for specific prognostic risk factors and ultimately to pool study populations in future systematic reviews.

The current available literature does not support one scale over the other. Tampa Scale of Kinesiophobia was used less often than the FABQ. It seems that FABQ-W and FABQ-P are complementary, and, depending on the patient population, study participants express more fear of physical activity or fear of work. The independents of these constructs argue for the use of both, regardless of how they are measured. This information is particularly important for researchers that strive for including different coping strategies in one questionnaire by using single-item questions. Whether the proposed cutoff values are valid for identifying patients at risk for poor outcome has not been shown to date. In the current review, few studies used cutoff values and the results were inconsistent. For clinicians, it is important to know at what point treatments addressing FABs should be initiated. Recently, the use of the following cutoff values for high FABs has been proposed: FABQ-P of 16 and more points, FABQ-W of 25 and more points, and TSK of 38 and more points [10]. For low fear avoidance, the following cutoff values have been proposed: FABQ-P 14 or less points, FABQ-W 20 or less [10]. Future research should aim at validating these proposed cutoff values in the randomized clinical trial setting and clarifying the role of cutoff values.

Implication for practice

Treatment recommendations for LBP vary widely and often reflect the personal beliefs of physicians and other health-care providers [63–65] without taking patient preference or need into consideration. In addition, the clinical judgment of therapists in the studies reviewed generally failed to correlate with patients' self-reported FAB [66]. In clinical practice, a screening instrument can allow clinicians to accurately identify risk factors like FABs that have been shown to be modifiable [42,45]. Therefore, standardized measurement methods are needed to improve outcomes. This systematic review supports a proactive standardized assessment of psychological risk factors when LBP persists. Furthermore, it also supports the recommendation that patients with high FABs should be treated with interventions targeting FABs. The distribution of information material addressing FABs has been shown to be effective in patients with high FABs. It is an inexpensive and widely available intervention. Further physical therapy addressing FABs also led to better outcome compared with physical therapy based on biomedical concepts. Fear-avoidance beliefs should be taken into account in the treatment of patients with LBP. The comparison of the efficacy of different treatment interventions was beyond the scope of this review.

Conclusions

Evidence suggests that FABs are associated with poor treatment outcome in patients with LBP of less than 6

months, and thus early treatment, including interventions to reduce FABs, may avoid delayed recovery and chronicity. Patients with high FABs are more likely to improve when FABs are addressed in treatments than when these beliefs are ignored, and treatment strategies should be modified if FABs are present.

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Appendix

Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.spinee.2014.02.033.

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