Early Identification and Management of Psychological Risk Factors ("Yellow Flags") in Patients With Low Back Pain: A Reappraisal

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Originally the term "yellow flags" was used to describe psychosocial prognostic factors for the development of disability following the onset of musculoskeletal pain. The identification of yellow flags through early screening was expected to prompt the application of intervention guidelines to achieve secondary prevention. In recent conceptualizations of yellow flags, it has been suggested that their range of applicability should be confined primarily to psychological risk factors to differentiate them from other risk factors, such as social and environmental variables. This article addresses 2 specific questions that arise from this development: (1) Can yellow flags influence outcomes in people with acute or subacute low back pain? and (2) Can yellow flags be targeted in interventions to produce better outcomes? Consistent evidence has been found to support the role of various psychological factors in prognosis, although questions remain about which factors are the most important, both individually and in combination, and how they affect outcomes. Published early interventions have reported mixed results, but, overall, the evidence suggests that targeting yellow flags, particularly when they are at high levels, does seem to lead to more consistently positive results than either ignoring them or providing omnibus interventions to people regardless of psychological risk factors. Psychological risk factors for poor prognosis can be identified clinically and addressed within interventions, but questions remain in relation to issues such as timing, necessary skills, content of treatments, and context. In addition, there is still a need to elucidate mechanisms of change and better integrate this understanding into the broader context of secondary prevention of chronic pain and disability.

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Kendall and colleagues[1] coined the term "yellow flags" to encompass psychological risk factors and social and environmental risk factors for prolonged disability and failure to return to work as a consequence of musculoskeletal symptoms. The concept of yellow flags sparked much attention and debate and was adopted in some guidelines on the early management of work-related low back injuries.[2-4] However, as with many such guidelines, their impact on clinical practice is unclear.[5] Even the definition of psychosocial risk factors has been criticized as so broad as to be meaningless.[6]

Kendall and colleagues[1] identified a number of psychological risk factors and social and environmental risk factors for disability and work loss. These psychological risk factors included fears about pain or injury, unhelpful beliefs about recovery, and distressed affect (eg, despondency and anxiety). The social and environmental risk factors included workers' perceptions that the workplace is unsupportive and overly supportive health care providers. The monograph provided a guide to the assessment of yellow flags that

included a clinical interview and a psychosocial screening questionnaire. This approach assumed that individuals at risk for poor outcomes could be identified on the basis of either a small cluster of highly salient factors or the cumulative combination of several factors. Because many of these factors are potentially modifiable, the monograph also contained additional advice on how to incorporate cognitive-behavioral change principles into early management.

In recent years, the focus of research on yellow flags has been more specifically applied to occupational contexts. Main and Burton[7] have argued that, in these contexts, the term "yellow flags" should be reserved for more overtly psychological risk factors, such as fears and unhelpful beliefs, whereas the social/environmental (workplace) risk factors could be divided into 2 categories: (1) workers' perceptions that their workplace is stressful, unsupportive, and excessively demanding, which they termed "blue flags," and (2) the more observable characteristics of the workplace and nature of the work, as well the insurance and compensation system under which workplace injuries are managed, which they termed "black flags." More recently, a distinction has been drawn between psychological risk factors that might be considered essentially "normal," but unhelpful, psychological reactions to musculoskeletal symptoms (eg, the belief that pain necessarily implies damage) and clearly "abnormal" psychological or psychiatric factors or disorders (eg, posttraumatic stress disorder, major depression) suggestive of diagnosable psychopathology.[8,9] It has been suggested that the normal but unhelpful psychological reactions should be described as yellow flags, and those meeting criteria for psychopathology should be termed "orange flags."[8,9] The primary significance of this distinction

is to differentiate yellow flag factors, which might be amenable to change by suitably trained health care providers such as general medical practitioners and physical therapists, from orange flag factors that probably require specialist mental health referral. A brief summary of the different flags is presented in Table 1.

Given these developments in the flags concept and the length of time they have been in circulation, it seemed timely to reappraise the utility of yellow flags: first, as risk factors for the development of persistent pain and associated disability, and second, in terms of their value in the identification of "at-risk" cases for targeted intervention. Our appraisal was formulated in terms of 2 research questions: (1) Can yellow flags influence outcomes in people with acute or subacute low back pain (LBP)? and (2) Can interventions that target yellow flags achieve better outcomes?

Search Strategy
In our search for risk factors, we canvassed the literature in MEDLINE and PsycINFO for review articles published between 2000 and 2009. Our aim was to provide a representative picture of the existing literature rather than to provide an exhaustive systematic or methodological review. More specifically, the literature search focused first on a combination of pain syndromes such as back pain or neck pain and then on a combination of psychological factors such as yellow flags or psychological factors. These 2 searches then were amalgamated, producing 1,241 citations (the search strategy is detailed in the Figure). These citations were scrutinized for inclusion, and 244 were selected for closer evaluation because they were systematic reviews (45), another form of review (84), randomized controlled trials (RCTs) (32), or clinical trials (83). These articles were examined according to the inclusion cri-

teria, and 28 relevant reviews were identified. Of these 28 reviews, 13 (5 systematic, 8 critical) were included in our examination, as the others either did not pertain to musculo-skeletal pain or did not specifically review the role of psychological yellow flags.

In our examination of the potential use of flags in identifying patients at risk for acute or subacute pain (question 1), we identified and appraised the instruments used to identify yellow flags in published LBP studies (mainly in cohort studies and RCTs). We also were assisted by the evaluation of measurement instruments offered in 2 reviews.[10,11] It transpired, in fact, that very few instruments have been used specifically for case identification. The studies that met these criteria are summarized in Table 2.

Evidence on the use of flags in the context of interventions (question 2), was identified from a search of databases (MEDLINE and PsycINFO), examination of reference lists, and consultation among the authors. Search terms used were "English language," "low back pain," "back pain," "musculoskeletal," "psychosocial risk factors," "early intervention," "secondary prevention," "disability prevention," "rehabilitation," "occupational health," and "controlled trials."

Although the search was not intended to be exhaustive and methodological assessments were not conducted, the studies were selected on the basis that they met the criteria of being published in peer-reviewed journals and were RCTs; used people with mostly back pain that had persisted or caused clear disability (eg, work time lost) for mostly less than 6 months (ie, generally within the acute and sub-acute range); and reported on functional outcomes, especially return to work or reduced disability. It should

Table 1.
Summary of Different Types of Flags

Flag	Nature	Examples
Red	Signs of serious pathology	Cauda equina syndrome, fracture, tumor
Orange	Psychiatric symptoms	Clinical depression, personality disorder
Yellow	Beliefs, appraisals, and judgments	Unhelpful beliefs about pain: indication of injury as uncontrollable or likely to worsen Expectations of poor treatment outcome, delayed return to work
	Emotional responses	Distress not meeting criteria for diagnosis of mental disorder Worry, fears, anxiety
	Pain behavior (including pain coping strategies)	Avoidance of activities due to expectations of pain and possible reinjury Over-reliance on passive treatments (hot packs, cold packs, analgesics)
Blue	Perceptions about the relationship between work and health	Belief that work is too onerous and likely to cause further injury Belief that workplace supervisor and workmates are unsupportive
Black	System or contextual obstacles	Legislation restricting options for return to work Conflict with insurance staff over injury claim Overly solicitous family and health care providers Heavy work, with little opportunity to modify duties

be noted that in the interest of capturing enough material for a meaningful analysis, studies were not restricted to individuals with only LBP. Many studies included mostly people with LBP, but many also included people with pain in other sites, such as the leg and upper back.

As we were interested in investigating the role of psychological variables as risk factors for disability, there was no obvious reason for limiting this study to individuals with only LBP, even though they are the largest group in most studies of musculoskeletal pain. We have

1. Combination of various pain syndromes
Pain[MeSH:NoExp] OR Abdominal Pain[MeSH] OR Arthralgia[MeSH] OR Back Pain[MeSH] OR Chest Pain[MeSH:NoExp] OR Facial Pain[MeSH:NoExp] OR Headache[MeSH] OR Neck Pain[MeSH] OR Neuralgia[MeSH] OR Pain, Intractable[MeSH] OR Pain, Referred[MeSH] OR Shoulder Pain[MeSH] OR Pain Threshold[MeSH] OR Pelvic Pain[MeSH:NoExp]
Neck/Shoulder Pain[tiab] OR Low Back Pain[tiab] OR Back Pain[tiab] OR Whiplash[tiab] OR Back Disorders[tiab] OR Musculoskeletal Pain[tiab] OR Fibromyalgia[tiab] OR Pelvic Pain[tiab] OR Shoulder Pain[tiab] OR Low Back Disability[tiab]
2. Combination of search words for psychological factors
Psychological Risk Factor*[tiab] OR Yellow Flags[tiab]
Risk Factors[MeSH]
Behavioral Symptoms[MeSH] OR Mental Disorders[MeSH] OR Psychology[MeSH] OR Psychology[Subheading]
3. Combination of 1 and 2=1,241 citations

Figure.
Search strategy.

previously published normative data on psychological factors in patients with chronic pain at different pain sites, and no difference was found across pain sites for these variables.[12] In addition, only studies that included interventions directed at psychological risk factors (eg, unhelpful beliefs, activity avoidance, mood disturbance, fears of pain or reinjury) were included. The studies that met these criteria are summarized in Table 3. Studies that used comparison groups but not randomized assignment to treatment conditions were excluded from this table but are included in the discussion, as they reflect applied research, where randomized allocation to interventions is not always feasible but from which potentially useful information can be gained.

Can Yellow Flags Influence Outcomes in People With Acute or Subacute Low Back Pain?

In this section, we review the available evidence as to whether yellow flags are related to future pain and disability and, therefore, are truly "risk factors." Details of the 12 reviews, their main findings, and implications for the role of yellow flags are shown in Table 2.

Initial Methodological Observations

Before examining the reviews, it is important to consider 2 aspects of musculoskeletal pain that may affect our understanding of the studies: the often recurrent, episodic nature of the pain and the problem of confusing pain intensity with disability as an outcome measure. It is well established that most musculoskeletal pain is recurrent in nature. Thus, a systematic review of 15 prospective studies[13] revealed that 73% of patients with acute LBP had at least one recurrence of LBP in the following year and most continued to have episodes of significant pain and disability. These findings challenge the concept of chronicity as a continuous development and reliance on the number of weeks since onset (eg, using 4 or 12 weeks as a point for determining risk). The recurrent nature of the pain may make time judgments unreliable because the point of onset is difficult to determine and because there is considerable clinical variation, not to mention variation in when help might be sought from primary care providers.

The second issue is defining the outcome point for predictive purposes in studies in which there is a mix of pain intensity and functional outcome variables. Pain and disability often are treated as equivalent, but epidemiological research has shown that significant proportions (at least 40%) of people in the community who report having chronic pain do not report significant levels of disability due to that pain.[14] Similar problems arise in trying to integrate clinical outcomes with return-to-work rates because these rates are known to be influenced by a host of blue and black flag factors rather than treatment alone. There is evidence, for example, that many injured workers return to work despite their persisting pain.[15] This tendency to confuse outcomes from what may be different domains has made it more difficult to draw clear conclusions about predictors and risk factors. Nonetheless, we believe that, with these caveats in mind, there is sufficient clinical material to merit evaluation.

What Do the Data Tell Us?

Within these reviews, a large number of prospective studies have examined the relationship between various yellow flag variables and future clinical and occupational outcomes. The earliest review of predictors[16] identified 37 studies that examined the development of back and neck pain. A consistent relationship was found between psychological factors and the onset of pain, as well as the transition from acute to chronic pain problems. These factors included stress, distress, and anxiety, as well as measures of depressed mood. Linton[16] found that certain beliefs, including fear-avoidance beliefs and catastrophic thoughts, were strongly associated with the development of disability following onset of pain. Passive coping strategies, such as waiting for someone else to help or resting, were associated with poor outcomes, and pain behaviors coupled with disability were a risk factor for future back pain problems. Four additional early reviews also concluded that psychological variables are important determinants of future pain and disability.[17–20]

There is evidence for both yellow flags (fear, beliefs in severity of health conditions, catastrophizing, and poor problem solving) and blue flags (low return-to-work expectancies and lack of confidence in performing work-related activities) as risk factors for long-term work disability.[21] There also is evidence for the influence of pain severity and level of depressive symptoms on the transition to chronicity.[21] Indeed, it appears that depression especially is associated with a number of negative outcomes.[22] There is agreement in a further systematic review[23] on the importance of distress, yet with only limited evidence found for the role of fear-avoidance beliefs in the early development of pain and disability. There also is evidence of risk factors other than yellow flags. In another systematic review of 7 prospective studies meeting stringent criteria, including only using studies of workers who had had less than 6 weeks of sick leave, prognostic factors found for duration of sick leave included higher initial disability levels, specific LBP, older age, female sex, more social dysfunc-

tion and more social isolation, heavier work, and receiving higher compensation.[24] Thus, it is important to understand yellow flags in context and to appreciate that they do not operate in isolation from other factors.

Three recent reviews provide insight into the most current investigations where more-sophisticated designs have been used. Leeuw and colleagues[25] in a narrative review of support for the "fear-avoidance model" found an increasing body of evidence that fear-avoidance beliefs, catastrophizing, avoidance behavior, distress, and pain behavior are important in the development of pain, disability, and lowered performance. A systematic review of 45 studies[26] showed that higher pain severity at baseline, longer pain duration, multiple-site pain, previous pain episodes, anxiety or depression, higher somatic perceptions or distress, adverse coping strategies, low social support, older age, higher baseline disability, and greater movement restriction were significant prognostic indicators for poor outcomes. A review of 9 screening instruments showed that work status was best predicted by fear-avoidance beliefs about work and the perceived chance of returning to work, functional limitations were best predicted by poor sleep and fear-avoidance beliefs, and pain was best predicted by baseline pain intensity, pain duration, and coping strategies, whereas depression and function were predictive of all 3 of their outcomes.[27]

What Inferences Can Be Drawn?
Taken as a whole, the evidence shows a clear relationship between psychological yellow flags and future clinical and occupational outcomes. Some factors such as depression, catastrophizing, pain intensity, and beliefs about pain are quite consistently observed to be associated with

outcomes. Those who catastrophize frequently, are depressed, have intense pain, and hold high fear-avoidance beliefs are more likely to develop persistent pain problems. These variables may be considered within a moderator or mediator perspective.

Moderators (or *treatment effect modifiers*) are baseline characteristics that influence the outcome of treatment. Thus, people with leg pain as well as back pain might improve less with a particular type of therapy. *Mediators* are factors that change during or as a consequence of treatment and thereby influence outcome. Thus, it might be hypothesized that an increase in exercise tolerance in physical therapy might be mediated by reduction in fear of movement, or the benefits of an exercise program for a person with heightened anxiety about his or her symptoms should be enhanced if the anxiety were relieved as part of the treatment process.

Despite the strength of the evidence supporting the prognostic value of many yellow flags, it is clear that their strength is variable across studies, and there is dispute among authors as to their relative importance. For example, the influence of fear-avoidance beliefs is questioned in one review[28] and supported in another review.[29] However, the most recent systematic review of individual risk factors for the development of disabling, persistent back pain[30] (published since the data for this review were collated) has confirmed that the weight of current evidence supports the yellow flag hypothesis, with maladaptive pain coping behaviours, anxiety, and depressive features being especially salient factors. Even so, although these factors may have relevance at the group level, there is concern about their reliability at the individual level; therefore, an important

question is whether our knowledge about psychological risk factors can be applied to individual cases in the clinic. In recognition of this concern, most guidelines recommend a 2-phase process, with questionnaires being supplemented by a clinical interview.[31] Despite these cautions, there is reasonably consistent evidence supporting the idea of yellow flags as risk factors for adverse outcomes.

Priorities for Further Research
Priorities for further research are:

- Further clarify the mechanisms by which yellow flags, individually and in combination, affect the development of persistent pain disability.
- Investigate the relationship among yellow flags, occupational factors (blue flags), and wider contextual factors (black flags).

Can Interventions That Target Yellow Flags Achieve Better Outcomes?
Challenges in Developing Screening Tools
In appraising the literature, it is important to reflect initially on the challenges in developing screening tools. First, different factors may be important at different stages, such as initiation, first onset, continuation, and consequences of disease or illness.[32] Second, given that screening is never 100% accurate, there has to be a "trade-off" between false-positives and false-negatives. In other words, there is concern both for missing someone truly at risk and for identifying someone as at risk when, in fact, he or she is not at risk. Given that the purpose of assessing the presence of yellow flags is to identify those possibly at risk of future problems rather than to make a clinical diagnosis, it can be argued it is better to be over-inclusive so as to minimize the chances of missing a positive case, even at the risk of

including more cases that turn out to be negative (false-positive). Thus, it has been argued that although such a measure needs to have high sensitivity, it could have low specificity.[33,34]

Most guidelines on the application of risk assessment in early musculoskeletal pain recommend using a combination of interviews, impressions formed during examination, and brief, validated questionnaires.[31] Two compendiums are now available to assist in identifying psychometrically sound instruments for specific needs.[10,11] However, many of the instruments seem more appropriate for patients with long-standing pain, and because screening is necessarily required to be brief to have a chance of being used, a single composite measure with a small number of items is likely to be preferred over multiple instruments that cover the full range of possible risk factors. One example of a brief, composite measure recommended by the Accident Compensation Commission's compendium is the Örebro Musculoskeletal Pain Screening Questionnaire.[35] This questionnaire contains 24 items and takes about 5 minutes to complete. The items provide a total score that is an estimate of risk, but the instrument also provides a basis for probing possible problem areas in a subsequent clinical interview. A recent systematic review concluded that the instrument has moderate predictive ability and that its use as a screening measure is warranted in clinical guidelines and routines.[36] A short (10-item) form of this scale recently has been developed and may enhance its early use in primary care settings.[37]

Another recent example of an instrument that has some empirical evidence is the STarT Back Screening Tool, which was developed for patients with LBP seeking primary care.[38] This 9-item tool allocates individuals into low-risk, medium-

risk, and high-risk groups. In an initial follow-up study of patients receiving primary care to determine predictive ability, it was shown that 17% of the low-risk group, 53% of the medium-risk group, and 78% of the high-risk group had disability at the 6-month follow-up.[38] These examples indicate there are instruments available that can help clinicians to identify yellow flags and assess risk at the first consultation in primary care.[10,11,36] A direct comparison of the utility of the STarT Back Screening Tool and the Örebro Musculoskeletal Pain Screening Questionnaire is provided elsewhere.[39]

Some Caveats in the Use of Screening Tools

It would appear, therefore, there are a number of tools of potential utility in the identification of patients at risk for acute or subacute pain, but a number of caveats are in order. First, the accuracy of screening is "population-dependent," and a judgment on trade-offs between sensitivity and specificity will depend on the purpose of screening. Second, because the nature of the subgroups that emerge is dependent upon the patient characteristics appraised in the assessment, the clinical validity of the instruments used and differences in validity and reliability between tools purporting to measure the same construct will have an important influence of the utility and relevance of the screening.

The Challenge of Prevention

A remaining question is whether interventions initiated in response to someone having been identified as being at risk might prevent the development of long-term disability and poor return-to-work outcomes. Indeed, the identification of potentially modifiable prognostic factors arguably is the most important consideration of all, and this question has been an increasing focus of inter-

vention studies.[40] The results to date are reviewed next.

The Case for Linking Risk Identification With Interventions

The idea of allocating patients to treatment on the basis of their initial presenting characteristics is long-standing.[41,42] However, to date, relatively few studies have shown attempts to link interventions to psychosocial risk factors in people seeking help for musculoskeletal pain. A review of intervention studies for work-related LBP[29] revealed a strong concordance between some workplace risk factors and interventions for acute LBP (eg, workplace technical and organizational interventions, graded activity exposure, cognitive restructuring of pain beliefs), but not other interventions (eg, exercise, back education, and return-to-work coordination). Perhaps surprisingly, even with 2 generally widely accepted psychological risk factors (emotional distress and low job dissatisfaction), there was very little evidence of concordance with interventions.[29]

Inclusion and Exclusion Criteria

In the present review, intervention studies of people seeking help for acute or subacute musculoskeletal pain (mainly back pain), both work related and not work related. (The search strategy was as previously described.)

Initial examination revealed that of the 18 studies that met the inclusion criteria, only 6 studies[43-48] applied psychological interventions to individuals who had high psychological risk factors (eg, a high psychological risk screening score). Of these 6 studies, only 3 specifically selected cases according to high psychological risk levels.[43,46,49] However, 11 studies, including the 6 studies mentioned above, demonstrated that interventions targeting psychological risk factors resulted in better

functional or return-to-work outcomes than those that were more symptom-based and did not target psychological risk factors (often called "usual care"). In contrast, 6 studies[50-56] did not find targeting psychological risk factors for intervention was differentially effective on functional outcomes relative to the alternative (mostly usual care) treatments.

Four other studies did not target psychological risk factors *per se*, but mainly added graded activity or exercise or advice to usual care.[57-60] The results were mixed. Two of the studies[59-60] showed reduced sick-list days from work, but not disability, in the intervention groups at follow-up, 1 study showed increased disability in the treatment group,[57] and another study[58] showed reduced disability. However, a workplace intervention[57] by itself (ie, without graded activity) was found to be associated with reduced sick-list days.

In summary, despite some strong findings that are clearly supportive of the yellow flag hypothesis, the evidence collated here indicates a mixed picture. The possible reasons for this finding are examined next.

Methodological Difficulties in Interpretation of the Findings

First, it was evident that the term "usual care" is potentially misleading, as its meaning varies in different countries. In the Netherlands, for example, usual care can include attention to psychological risk factors and encouragement to resume activities by a general practitioner. In the United Kingdom, it is more general and symptom-relief focused. Furthermore, closer examination of the 7 studies[50-56] that showed no effect for targeting psychological risk factors reveals that none of them selected patients for intervention based on the presence of heightened psychological risk factors. Instead, patients were selected if they were seeking help for back pain of less than 6 months' duration. In addition, the groups treated in these studies generally had low levels of psychological risk factors in the first place, which means there was little room for improvement on these dimensions. Only one placebo-controlled intervention[61] was found, but as the participants generally had low levels of psychological risk factors initially, assessment of this aspect is problematic. However, that study did show that combined advice (education about pain, reassurance, and encouragement to gradually increase avoided activities using cognitive-behavioral principles) combined with a home exercise program did achieve better functional gains than the attention-placebo condition, which is consistent with the yellow flag hypothesis.

These methodological differences among studies, as well as the small number of studies that have directly tested the hypothesis underpinning early intervention for yellow flag factors, constrain the conclusions that can be drawn on this issue. However, as might be expected on theoretical grounds, it appears that when patients are selected for psychological intervention on the basis of psychological risk factors, the results are more consistent with the yellow flag hypothesis.

A second methodological issue concerns the nature of the interventions and the personnel involved in the 18 studies. The interventions varied considerably in content—some were mainly advice,[58] whereas others included exercises or graded activity[59] or advice, graded activity, and psychological strategies.[47] In many studies, the psychological intervention, often described as based on cognitive-behavioral principles or operant-behavioral principles, was provided by physical therapists or general medical practitioners. In other cases, a psychologist (sometimes called a behavior therapist or psychotherapist) provided the psychological intervention, usually working alongside members of other disciplines.

It might be relevant that in the 7 studies in which psychological interventions did not yield any benefit over usual care, none used a psychologist to deliver the psychological intervention. In addition, in 7 of the 11 studies that did demonstrate a benefit for addressing psychological risk factors, a psychologist (or equivalent) was used. This finding suggests that, in addition to selecting patients with psychological risk factors, the intervention may be more effective if someone with clear expertise in this domain administers it. This point is reinforced by recent research indicating that many primary care providers (physicians and physical therapists) lack the skills and confidence in applying psychological interventions as part of their usual work.[62,63] However, in a recent trial in the United Kingdom,[64] significant reductions in disability were achieved by a mixed group of patients with subacute and chronic LBP treated predominantly (81%) by physical therapists using cognitive-behavioral methods. This finding supports the value of providing specific training in these methods for primary care clinicians. There may be merit in exploring conjoint clinical management, as often is found in tertiary pain management programs. However, no studies to date have tested the importance of the discipline delivering the intervention, a possible question for future research.

A third methodological issue is the variable nature of the psychological interventions found in this review, raising questions about the impor-

tance of treatment content and fidelity. In some studies, psychological interventions amounted to little more than education about pain and injury, attempted reassurance that all was well, and encouragement to return to normal activities, including work.[65,66] In some studies, these interventions appeared quite similar to those provided to the comparison group,[50,51] which could have diluted the findings. In other cases,[46,48] the psychological interventions also involved training in basic problem-solving strategies, ways of identifying and dealing with unhelpful thoughts, graduated upgrading of activities using goal setting, and consistent reinforcement by the staff for progress. Interestingly, in one study,[47] those patients in the fear-avoidance–based therapy who had higher fear-avoidance beliefs seemed to benefit more from that intervention relative to those who did not share this characteristic.

Other researchers have identified a range of methodological issues that might explain the lack of consistent treatment effects for psychosocial interventions across trials.[53,54,66] Without therapists appropriately trained in flag identification and management, provision of an adequate course of specified treatment, and demonstration of treatment fidelity, it is not possible to form a clear view on the efficacy or cost-effectiveness of psychosocial interventions in controlled trials.

Finally, we identified patient selection as a potentially important influence on the findings reported. In the studies that did identify patients who had marked psychological risk factors[43-48] and provided interventions (by a psychologist or equivalent) that targeted these risk factors, the outcomes were consistent with the yellow flag hypothesis in every case.

Concordant with this observation, in one of the few RCTs to test the role of risk factors for disability in patients with chronic pain,[67] it was found that matching patients identified by these risk factors to level of intervention was important in achieving better and more economic return-to-work outcomes. In that study, those individuals identified as at high risk benefited more from a more-comprehensive intervention, whereas those at low risk were treated effectively with a simpler and cheaper intervention.

Further support for the importance of selecting patients for psychological intervention can be found in a number of nonrandomized controlled trials, as well as in a recent RCT with a mixed-injury sample. One nonrandomized controlled study[68] showed that a structured psychological intervention by psychologists for injured workers who had been selected on the basis of having one or more elevated psychological risk factors was significantly more effective in achieving return to work than a usual care comparison sample treated earlier. A similar intervention aimed at reducing risk factors for prolonged work disability (eg, pain catastrophizing, fear of movement and reinjury, perceived disability) and conducted mainly by physical therapists and occupational therapists, with individuals selected on the basis of elevated scores on measures of these psychological risk factors, also appeared quite effective.[69] In that nonrandomized clinical trial with a sample of individuals who had been work disabled due to whiplash symptoms, 75% of individuals in the psychologically informed treatment group returned to work compared with 50% who followed usual treatment.[69]

More recently, in another nonrandomized controlled trial that used injured workers from a separate site

as a comparison group,[70] it was found that an integrated occupational, clinical, case management intervention that was individually tailored, cognitive-behavioral methods achieved better return-to-work outcomes at 6 months posttreatment, but only in those workers who were assessed as at high risk for long-term disability. At 3 months posttreatment in those workers assessed as being at only moderate risk for poor outcomes, there was no difference between the treatment group and the usual care group.

Similar results were reported in another RCT of workers who were not seeking help.[71] Those workers considered at high-risk for long-term sickness absence, as determined by a 34-item self-report questionnaire (the Balansmeter), received either a standard care intervention or an experimental intervention that targeted identified specific concerns according to the case. In most cases, the treatment was provided by an occupational physician trained in this type of intervention. A small proportion of workers also received some form of problem-focused counseling. At the 1-year follow-up, the results indicated significantly fewer sick-list days for those in the experimental group.

What Can We Conclude From the Available Evidence?

Overall, from the evidence gathered here, the studies that targeted interventions on known psychological risk factors for disability seemed to report more consistently positive results relative to those interventions that either ignored these risk factors or provided omnibus interventions to people regardless of psychological risk factors. It seems that the identification of those with these risk factors is an important precursor to psychological interventions. However, simple application of these interventions to all patients, regardless of risk

status, is ineffective and likely to be uneconomical.

When this evidence is considered alongside a recent article on blue flags[72] that described the benefits to be gained from linkages between interventions and the workplace, there does seem to be an increasingly compelling case for early interventions targeting yellow flags specifically in those with these risk factors combined with an associated and simultaneous workplace intervention.[6,73] Some preliminary evidence in support of this model was found in a nonrandomized study[74] in which early screening (risk identification) leading to fast-track intervention (that included simultaneous clinical and workplace elements) was associated with substantially improved outcomes in patients identified as at high risk compared with similar patients treated previously using more-traditional, sequential approaches.

Priorities for Further Research
Priorities for further research are:

- Developing specific treatments that address yellow flags in the acute and subacute period.
- Developing a system for matching interventions to the yellow flags.
- Integrating such interventions into the broader treatment of patients with musculoskeletal pain.

Summary
The idea that psychological yellow flags may instrumentally influence the development of persistent pain disability has generated a plethora of research articles. As this database grows, various psychological factors have consistently been linked with poor prognosis. A point of contention is not whether yellow flags have an impact, but rather *which* variables are the central ones. Theoretical models have been helpful in guiding this research, but none fully account for all cases. Despite gaps in our knowledge of yellow flags, there now exist instruments for assessing yellow flags that work reasonably well from a clinical standpoint.

The yellow flag proposition carries with it the promise of early interventions that might avert the development of disability. This is an enormously challenging task because it builds directly on integral knowledge of the *causal* factors, as well as developing interventions that can alter these causal factors effectively. If this task were not enough, it also requires the application of the intervention early enough to actually have a preventive effect. The studies conducted to date have been bold attempts to achieve this task. However, in their boldness, various methodological, logistic, and theoretical barriers have been side-stepped, requiring caution in drawing firm conclusions. Yet, our sense is that when candidates are carefully selected on the basis of the presence of yellow flags and when an intervention known to address these factors is competently applied, good outcomes are to be expected. On the contrary, when patients are not selected for yellow flags and psychological interventions are provided indiscriminately, the outcomes tend to be disappointing.

The available evidence provides a consistent picture that yellow flags are prominent in the development of disability due to musculoskeletal pain. Tomorrow's challenge is to build upon this base to provide timely and feasible interventions to achieve more consistently the results that should be obtainable. This goal would be facilitated by integrating such interventions into normal primary care practice and attending to factors, especially occupational factors (ie, the blue flags[72]), which are discussed further elsewhere in this special issue.[75]

Table 2.
Yellow Flags as Prognostic Factors for Persistent Pain and Pain-Associated Disability[a]

Review Article	Scope	Main Findings	Comments	Conclusions
Linton,[16] 2000	Critical review of 37 prospective investigations (11 prior to onset of back or neck pain, 18 of patients with acute or subacute pain, 8 of patients with chronic pain); 29 studies included here (not chronic pain)	29 studies pertained to prior to onset of pain to subacute pain. Psychological variables were related to pain onset, particularly to the transition from acute pain to subacute or chronic pain. Emotional variables (eg, distress, anxiety, stress, mood), cognitive variables (eg, fear-avoidance beliefs, catastrophizing, expectations to get better), and behavioral variables (eg, coping, function) were related to future disability	This review also looked at the risk factors in relation to the setting and time point and found good generality	Emotional, behavioral, and cognitive variables are related to the transition from acute to chronic pain. Support
Truchon and Fillion,[17] 2000	Critical review of 18 studies	Predictors of chronic disability included a previous history of LBP, results of certain clinical tests (SLR, range of motion, neurological deficits), a negative self-appraisal of one's ability to work, and job dissatisfaction. The role of certain psychological variables, including catastrophic beliefs about LBP, were promising. Distress and pain severity in first 3 wk were not good predictors of long-term disability.	Noted limited number of suitable, prospective studies, but some of the early findings appear at variance with those of more recent studies, especially distress and pain severity	Some yellow flags were found as predictors, whereas distress and pain severity were not found as predictors. Partial support
Shaw et al,[20] 2001	Critical review of 22 prognostic investigations of workers with back pain	Self-perceived function, pain reports, coping strategies, and pain behavior were found to be related to future work status	Focused on a large number of prospective studies	Good evidence for perceived function and pain intensity. Limited evidence for coping (avoidance) and pain behavior. Support
Crook et al,[18] 2002	Systematic search and methodological evaluation. Included 19 prospective studies of people within 6 mo of injury	Psychological distress, self-perceived dysfunction, and pain were risk factors for future sick absenteeism	A rigorous review, with clear criteria for inclusion and of the factors	Found distress, dysfunction, and pain to be risk factors. Support
Pincus et al,[19] 2002	Systematic review of 25 prospective articles on patients with acute or subacute pain	Moderate effect (depression or distress) and small effect (somatization) on future pain and disability problems	Selected studies based on prospective design and acute or subacute pain, estimates size of the effect	Distress (moderate effect) and somatization (small effect). Partial support
Bair et al,[22] 2003	Narrative review of 10 clinical trials examining the relationship between depression and back pain	Depression was found to be related to the onset of back pain, higher levels of pain intensity reports, more dysfunction, poorer treatment outcome, and chronicity	A very exhaustive review focusing on depression and pain	Depression is a very important, but often overlooked, aspect. Support

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Table 2.
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Review Article	Scope	Main Findings	Comments	Conclusions
Sullivan et al,[21] 2005	Selective review of 8 studies with psychological variables	Pain-related fears, self-perceived health, pain catastrophizing, poor problem-solving skills, and expectations concerning recovery were found to be related to future work disability	A selective review of worker-related psychosocial risk factors for work disability Selection of studies may lead to bias in conclusions Emphasizes the need to integrate workplace risk factors	Worker-related psychological variables increase risk for future work disability Support
Steenstra et al,[24] 2005	Systematic review of 7 studies with psychological variables and recruitment between 1 and 42 d of sick leave	Self-perceived function (ES=2.4), pain intensity (ES=1.1), and severe depression (ES=2.47) were found to predict duration of sick leave Anxiety (2 studies) not found to be reliable predictor	Included only 7 studies Strict inclusion criteria of only 6 wk sick-leave duration	Function, pain, and depression found to have rather large effects Support
Pincus et al,[23] 2006	Critical review of 9 prospective studies where patients were recruited <3 wk from onset	3 of 7 relevant studies found fear-avoidance beliefs to have a small effect on future pain and disability	Only 7 studies Focus is on fear, but article points out the role of distress	Fear beliefs may not be as relevant in the early stages as later on Distress seems more important Partial support
Leeuw et al,[25] 2007	Narrative, critical review of studies of relevance to the "fear-avoidance" model	Fear-avoidance beliefs, catastrophizing, avoidance behavior, and pain intensity were found to be important for future pain, disability, and performance	Extended review that places studies in relation to the fear-avoidance model Discusses dysfunction as avoidance behavior	There is mounting evidence to support the main features of the fear-avoidance model Support
Mallen et al,[26] 2007	Systematic review of 45 studies of prognostic factors in primary care	11 factors at baseline found to be associated with poor outcome: pain severity, pain duration, multiple pain sites, previous pain, anxiety or depression, distress, coping strategies, social support, age, dysfunction, and movement restriction	An exhaustive review, with special relevance for primary care services	11 factors, including yellow flags, may be generic prognostic indicators Support
Melloh et al,[27] 2009	Systematic review of screening instruments published between 1970 and 2007 predicting work status, function, and pain Extracted variables from studies to determine what predicts outcome 13 studies included	Work status best predicted by fear-avoidance beliefs about work and perceived chance of being able to work; occupational factors also important Functional limitations best predicted by sleep and fear avoidance Pain best predicted by intensity, duration, and coping Depression and function are predictive of all 3 outcomes	Review focuses on actual screening instruments and thus is a relevant test of the yellow flags' utility to predict	Psychological and occupational variables are good predictors and should be included in early identification screening Depression and function predict all 3 outcomes, whereas fear, sleep, and expectations about outcome were more specific Support

[a] LBP=low back pain, SLR=straight leg raise, ES=effect size.

Table 3.
Early Intervention Randomized Controlled Studies (2000–2008) in Patients Seeking Help for Musculoskeletal (Mainly Spinal) Pain[a]

Study	Sample and Design: CT/RCT	Intervention	Control	Outcome	Comment
Linton and Andersson,[43] 2000	243 patients with subacute LBP (mainly) (still working but missing days); self-perceived risk of developing chronic problem (RCT)	Six 2-hr group CBT sessions with psychologist	2 levels of information on back care, physical therapy	All groups improved on pain, disability, and mood, with significantly less lost work time over 12 mo.	Sample of patients with mixed pain durations, but all working and missing days due to pain. Results consistent with role of skills in managing work despite pain vs information alone. Pain self-management skills also taught. Consistent with yellow flag hypothesis.
Hagen et al,[65] 2000	457 patients sick-listed 8 to 12 wk for LBP (RCT)	At spine clinic, 1 session with advice on good prognosis and importance of remaining active to avoid development of muscle dysfunction. Walking encouraged, advice on exercising at home. Advice on how to manage the back pain and how to resume normal activities.	Usual care by GP	At 12-mo follow-up, 68.4% in intervention group vs 56.4% in control group had full RTW.	Results similar to those of previous studies of this type, but raise the question of whether more-extensive intervention might have achieved better results for those not RTW at 12-mo follow-up. Consistent with yellow flag hypothesis.
Verbeek et al,[56] 2002	Patients with LBP on sick leave for at least 10 d (RCT)	Occupational physician (based on guidelines, biopsychosocial assessment, intervention in identified RTW obstacles, encouragement to remain active); other treatments via GP or physical therapist on case basis. Workplace supervisor also advised on management.	Reference group: no review with occupational physician in first 3 mo, but treatment as usual by GP, physical therapist, or specialist. Workplace supervisor given same management advice as intervention group.	At 3- and 12-mo follow-ups, no difference between groups on work time lost and health outcomes (both improved), but recurrences more frequent in intervention group.	Many similarities in content of control and treatment groups. Low distress in both groups. Not really testing yellow flag hypothesis.
Loisel et al,[44] 2002	104 workers absent from work >4 wk due to work-related LBP (mean=38–43 days across 4 groups) (RCT)	Comprehensive Sherbrooke model (combined occupational and clinical interventions)	3 groups (clinical intervention, usual care, and occupational intervention)	At 6.4-yr follow-up, all interventions achieved gains, but intervention group had fewer days on benefits and more cost beneficial.	Including workplace in intervention (in addition to clinical input) seems important for retention at work, consistent with other findings and importance of blue flags. Also addressed problems at individual level regarding RTW. Consistent with yellow flag hypothesis.
van den Hout et al,[45] 2003	84 employees, recently on sick leave due to nonspecific LBP; mean sick leave=8 wk, but mean pain duration of current episode=1.5 y (RCT)	Graded activities with behavioral principles + problem-solving training	Graded activities + education	Intervention was associated with better long-term work status.	Mixed group of patients with acute and chronic pain, but all had been working despite pain until mean of 8 wk before treatment. Consistent with yellow flag hypothesis.

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Table 3.
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Study	Sample and Design: CT/RCT	Intervention	Control	Outcome	Comment
Damush et al,[58] 2003	211 patients with acute LBP (<90 d); excluded any receiving disability insurance payments or in the process of applying for back pain disability (RCT)	Brief (3-session) group program, with telephone follow-up, aimed at increased function, health status	Usual care	At 12 mo, intervention group significantly better on the Roland-Morris Disability Questionnaire, mental functioning, self-efficacy to manage acute LBP, time spent in physical activity, reduced fears of movement/reinjury.	Brief intervention may have been enhanced by lack of patients involved in disability insurance, but results consistent with yellow flag hypothesis.
Gatchel et al,[46] 2003	124 selected (high risk of disability) patients with acute LBP (all <10 weeks since onset) (RCT)	Functional restoration (individualized psycho-social and physical reconditioning) over 3 wk	Individualized usual care (medical, physical therapy, chiropractic, injections, electrical stimulation)	Intervention group had significant gains over control group in work, health care utilization, medication use, and self-reported pain.	One of few studies to select for high psychosocial risk factors and then intervene on basis of those factors. Findings consistent with yellow flag hypothesis.
George et al,[50] 2003	66 patients with LBP of <8 wk duration seen at physical therapy clinics; selection not based on presence of psycho-social risk factors (RCT)	Fear-avoidance-based physical therapy (4 wk); both inter-ventions 1 hr per session, with content including exercises, education, exercise upgrading. Nature of education and exercises differed. In the fear-avoidance group, a specific graded-exercise program based on quota was used.	Standard physical therapy (4 wk), similar format to other intervention, but education more about anatomy and pathology. Home exercises encouraged and monitored by log.	Both groups improved on disability and pain measures at 4 wk and 6 mo post-treatment. Fear-avoidance beliefs about activity (not work) were more reduced in the intervention that targeted the fear-avoidance beliefs on both follow-up occasions.	As patients were not selected on basis of high fear-avoidance beliefs, difficult to show a differential outcome. Treatments may have been too similar as well, but those with higher fear-avoidance beliefs did seem more responsive to the relevant intervention.
Staal et al,[60] 2002	134 workers with >4 wk of sick leave due to LBP (mean=41–43 d); mean duration of symptoms=8–8.5 wk (RCT)	Individually supervised graded activity using operant behavioral principles; education about pain, exercising to quota, set RTW goal, graduated RTW	Usual care: guidance and advice from occupational physician and GP according to LBP guidelines (included physical therapy, manual therapy, chiropractic)	At 6 mo, graded activity group had significantly fewer days absent from work vs usual care group. Functional status and pain not significantly different between groups.	Results might be contrasted with those of Anema et al.[57] Suggest need to examine content of interventions with same name. Another study that finds sustained RTW is not synonymous with absence of pain and disability. Results consistent with yellow flag hypothesis.
Karjalainen et al,[59] 2004	164 workers with subacute LBP of >4 wk and <3 mo duration (mean days on sick leave in previous 3 mo=14.7–15.8) (RCT)	2 interventions: (1) brief "back school" (2.5–3 hr) (exercise, advice, discussion about pain, encouragement for RTW, being active despite pain, body mechanics; conducted by occupational physician and physical therapist) and (2) same as above, plus worksite visit and advice by physical therapist	Usual health care by GP (ie, did not attend special occupational health center in contrast to other 2 groups) + leaflet of information about LBP	At 2-yr follow-up, no differences between groups on pain, disability, and quality-of-life measures. Costs of LBP treatment lower in both intervention groups vs usual care group; days absent from work fewer in both intervention groups vs usual care group.	Usual health care may be different from others of same name, especially in Netherlands, but both intervention groups were given very brief treatment, which may explain why there were no differences in disability and quality-of-life measures. More-extensive interventions might have been more effective. Information insufficient for retention at work. Although patients not selected for high psychosocial risk factors, results broadly consistent with yellow flag hypothesis.

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Table 3.
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Study	Sample and Design: CT/RCT	Intervention	Control	Outcome	Comment
Schiltenwolf et al,[47] 2006	64 patients with a first-time sick leave of 3–12 wk due to LBP (RCT)	BT group: received same functional restoration program as the control group, but included a behavioral therapy component (problem solving, stress management, and partner involvement, as indicated)	MT group: received same functional restoration program of individual physical therapy, group therapy in water, workout, back school with stretching and strengthening, improving mobility and body control, plus passive treatments (massage and physical therapy)	Both groups improved posttreatment, but at 6 mo, the BT group improved on multiple parameters relative to the MT group, which deteriorated. At 2 y, no sick leave by 59% in BT group vs 10% in MT group.	The addition of behavioral therapy for dealing with stress and problems generally seems to have added significantly to the exercise/activity program. Results consistent with yellow flag hypothesis.
Linton et al,[48] 2005	185 patients seeking care for nonspecific back or neck pain (all employed), at risk for developing long-term disability; 96% employed, all with <4 mo sick leave in previous year (RCT)	(1) CBT (with psychologist) group (2) CBT (with psychologist) + exercise (with physical therapists) group	Minimal treatment group; usual care (examination, reassurance, advice on activities based on current guidelines)	At 12-mo follow-up, less health care use and work absence for both treatment groups vs minimal treatment group. No difference in work absence between the 2 treatment groups.	Suggests that exercise program did not add to outcome. Skills in dealing with demands of functioning despite pain seem important. Results consistent with yellow flag hypothesis.
Jellema et al,[53] 2005	314 patients consulting with nonspecific back pain of <12 wk duration or an exacerbation of mild symptoms (RCT)	"Minimal Intervention Strategy," 1–3 sessions; intervention by GP only using guidelines	Usual care by GPs	Both groups had large improvements in median level of disability within 3 mo after first session with GP. No real differences between groups on other outcome measures (perceived recovery, sick leave due to LBP, and psychosocial measures).	Low level of psychosocial risk factors at baseline and treatments not matched to need. Not really testing the yellow flag hypothesis.
Hlobil et al,[55] 2005	134 workers with non-specific LBP for at least 4 wk prior to study, with either full or partial sick leave due to LBP (RCT)	Graded activity group, 1-hr exercise session twice a week until the workers achieved full regular RTW or when the maximum therapy duration of 3 mo was completed	Usual care by GP	Graded activity group achieved RTW sooner than the usual care group, but no significant differences in functional status or pain.	No specific psychosocial risk factors identified or addressed in either group, other than encouragement for RTW and explanation about benign nature of pain in the graded activity group. Suggests specific encouragement for RTW early is helpful. Consistent with yellow flag hypothesis, but not specifically addressing the concept of yellow flags.
Hay et al,[52] 2005	402 patients seen by their GP for LBP of <12 wk duration (RCT)	Brief individualized pain management program (median=3 sessions) by physical therapists (basic cognitive behavioral techniques over a course of 2 d with follow-up study days and mentoring)	Brief (median=4 sessions) standard physical therapy including manual techniques	Both groups improved; similar outcomes on Roland-Morris Disability Questionnaire at 3 and 12 mo; no significant differences for pain, time off work, or psychological measures.	Average baseline catastrophizing and depression low in both groups, which may mean that CBT unlikely to confer advantage over standard care. Not really testing the yellow flag hypothesis.

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Table 3.
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Study	Sample and Design: CT/RCT	Intervention	Control	Outcome	Comment
Anema et al,[57] 2007	196 workers sick-listed 2 to 6 wk due to nonspecific LBP (RCT)	Workplace intervention: workplace assessment, work modifications, and case management involving all stakeholders. Those still sick-listed at 8 wk randomly assigned to graded activity group or usual care group.	(1) Graded activity: biweekly 1-hour exercise sessions based on operant-conditioning principles (2) Usual care	Time to RTW significantly less for workplace intervention. Graded activity had negative effect on RTW and functional status. Combined intervention had no effect.	Different results for graded activity in this study relative to others may be related to nature and extent of this intervention here, which may not have addressed yellow flags. Compare with Staal et al.[60] As with some other studies, supports importance of focus on RTW in intervention, which is consistent with yellow flag hypothesis in occupational settings.
Pengel et al,[61] 2007	259 patients with subacute LBP treated in physical therapy clinics. All patients recruited <12 wk since onset, but not selected on basis of psychosocial risk factors.	Factorial design study, with advice (education, goal setting, activity upgrading, reinforcement for attempts) compared with exercises and a combination of advice and exercise	Placebo/attention control, with discussion and interest from physical therapist (no advice), plus sessions of detuned short-wave and ultrasound treatments. Patients asked not to have other back treatments during 6-wk treatment phase of study.	All groups improved over treatment period and all maintained gains at 1-y follow-up. The combined advice and exercise treatment was slightly more effective than either intervention individually and the placebo/attention control on measures of pain and functional activities at 1-y follow-up.	As patients not selected for presence of psychosocial risk factors and the levels of these factors were generally low, this study provided only limited support for the yellow flag hypothesis.
George et al,[51] 2008	108 patients attending 3 physical therapy clinics; patients divided into 3 treatment conditions; across conditions, mean number of weeks of present episode of LBP=5.8–9.8, 50%–69% had prior history of LBP, and 70%–74% employed (RCT)	All 3 groups received same standard physical therapy described by George et al.[50] In addition, 1 group was given graded activity, and 1 group was given graded exposure (performance of feared activities under supervision).	Standard physical therapy (TBC protocols), as described by George et al.[50]	All 3 groups improved; no differences at 4-wk and 6-mo follow-ups on disability, pain, pain catastrophizing, and physical impairment. Fear-avoidance beliefs reduced in TBC and graded exposure groups, relative to graded activity group, only at 6 mo. No benefit to TBC by adding graded activity or graded exposure.	As in the 2003 study George et al,[50] patients not selected on basis of psychosocial risk factors, and interventions in TBC had many elements in common with graded activity and graded exposure, so the additional elements may not have been different enough.

[a] CT=clinical trial, RCT=randomized controlled trial, CBT=cognitive-behavioral treatment, RTW=return to work, GP=general practitioner, TBC=treatment-based classification protocols, BT=behavior therapy, MT=biomedical therapy.

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