*Version 6*

*Title***: The fear avoidance model disentangled: Improving the clinical utility of the fear avoidance model**

**Tamar Pincus PhDa, Rob J.E.M. Smeets MD, PhDb, Maureen J. Simmonds PhD. PTc, Michael JL Sullivand**

a Department of Psychology, Royal Holloway, University of London

b Rehabilitation Foundation Limburg and Department of Rehabilitation Medicine, CAPHRI, Maastricht University, The Netherlands

c School of Physical and Occupational Therapy, McGill University, Canada

d Department of Psychology, McGill University

**Keywords: Fear avoidance, sub-grouping, pain.**

Correspondence to: T. Pincus, Department of Psychology, Royal Holloway, University of London, Egham, Surrey, TW20 0EX , Tel: 01784 443523, Fax: 01784 434347, [t.pincus@rhul.ac.uk](mailto:t.pincus@rhul.ac.uk)

*Abstract:*

*Background: The model of fear avoidance proposes that fear of movement in back pain patients is an obstacle to recovery and leads over time to increased disability. Therefore, fear of movement should be targeted explicitly by interventions.*

*Aims: To review the evidence a) for the causal components proposed by the model, and b) about interventions that attempt to reduce fear of movement. In addition, we aim to propose alternatives and extensions to the current model in order to increase the clinical utility of the model.*

*Methods: A collaborative narrative review.*

*Results: The fear avoidance model needs to be conceptually expanded and further tested in order to provide adequate and appropriate clinical utility. Currently, although there is experimental support for the model, observational studies in patients show contradictory results. Interventions based on the model have not delivered convincing results, only partly due to methodological shortcomings. Some assumptions inherent in the current model need adjusting, and other factors should be incorporated to indicate sub-groupings within patients high in avoidance behaviour. In addition, both theoretical and methodological limitations were identified in measurements of fear and avoidance.*

*Conclusion: Future research should elucidate whether the proposed sub-grouping of patients with avoidance behaviour is helpful. Further research should focus on developing more accurate and psychometrically sound assessment tools as well as targeted interventions to improve activities and participation of patients with chronic disabling musculoskeletal pain disorders.*

*Proposed title***: The fear avoidance model disentangled: Improving the clinical utility of the fear avoidance model**

Chronic pain conditions, especially musculoskeletal conditions, impose a huge burden on society and the health care systems [1,2]. Despite increased understanding of the factors contributing to the development of chronic pain, there has been only moderate improvement in the successful management thereof [3, 42]. The prevalence of chronic low back pain has remained more or less constant over the last two decades [4,5,6], and interventions have shown at best only moderate effects in reducing pain and disability [7]. Research has recently focused on identifying sub-groups of individuals at early stages of pain, who are at high risk for developing persistent problems [8,9].

One of the key risk factors thought to lead to long-term problems is fear of movement/re-injury, resulting in avoidance behaviour [10]. The most common and accepted model of this phenomenon is known as the Fear-Avoidance Model (FA-model), which proposes that, for some patients, the catastrophic (mis)interpretation of pain leads individuals to fear the situations and movements associated with their pain. This fear subsequently results in avoidance of such situations and movements and, additionally, in hypervigilance through increased attention to body sensations and difficulty disengaging from such stimuli [11-13]. This avoidance behaviour contributes to physical dysfunction and increased disability, which in turn can lead to depression and increase perceived levels of pain and distress. Thus, dysfunctional interpretations give rise to pain-related fear, and associated safety seeking behaviors such as avoidance/escape and hypervigilance. In contrast, the model suggests that if the injury/pain experience is perceived in a non-threatening manner, patients will confront and deal with it adaptively, thereby leading to recovery.

The perceived significance and validity of this model for the management of musculoskeletal pain is demonstrated by the recent guidelines for the prevention of LBP that include the following: “It is recommended to perform good quality RCTs on the role of information oriented toward reducing fear avoidance beliefs and improving coping strategies in the prevention of LBP” [14]. The position advanced in this paper, however, is that on the basis of current evidence, it may be premature to advocate for fear reduction as a central component of interventions aimed at reducing pain and disability until a better understanding is reached of the relationship between beliefs about pain and movements, fear, and avoidance behaviour.

Before reviewing the evidence we note that the majority of research has used the term ‘fear-avoidance’ to indicate a) beliefs about damage/pain caused by movement; b) fear of certain movements and activities c) avoidance of such movement/activities interchangeably, but that most studies fail to measure these separately, or to explore the relationship between them. This review is set in the context of disentangling these elements, but is restricted by lack of evidence. We therefore aim to increase awareness and promote future research in this area.

*FA and performance of activities: experimental evidence*

Experimental research in fear avoidance has broadly included two directions: studies of patients performing lab-based physical tasks or studies where pain or fear has been experimentally manipulated. In addition to measuring the fear associated with the belief that the action will cause pain and damage and the actual avoidance of pain, several other factors have been shown to be important. These include the patient’s motivation, the emotional state of the patient, their level of pain, self-efficacy and physical deconditioning [15-17]. Because of this, much of the experimental research that has been carried out in healthy populations lacks ecological validity, although some findings, obtained in experimental research have been replicated in clinical settings. There is evidence to suggest that naturally occurring pain differs significantly from induced pain (Simmonds and Claveau, 1997 [18]) in relation to the fear avoidance model. A recent study involving patients with shoulder pain found that measures of pain-related fear uniquely influenced sensitivity to experimental pain, while pain catastrophizing was significantly related to reported clinical pain intensity [18]. Several experimental studies have demonstrated the impact of fear-avoidance on pain behaviour in laboratory conditions [19-23]. Other studies using physical capacity tasks such as lifting, walking, and stair climbing have shown contradictory findings with more studies showing no or only very limited influence of fear of (re)injury /movement on functional behaviour [15, 24-26]. This should not, however, be interpreted as evidence refuting the FA-model, as several methodological limitation may account for studies failing to demonstrate a strong relationship between measures of fear (on self-report questionnaires) and capacity measures (using behavioural observations). For example, this might be due to the fact that the self-report measure used (Tampa Scale for Kinesiophobia) lacks sensitivity, in that it does not measure fear for specific movements or activities. It is possible, for example, for a patient to be highly fearful of a discrete set of movements and to obtain a low score on the TSK, despite demonstrating high avoidance on capacity tasks. Selection of appropriate (individual) capacity tasks is also an important factor: activities such as walking, sit to stand and stair climbing, might evoke less fear, or at least reduce avoidance, because they are constant and unavoidable activities of daily living. Future research testing specific performance in relation to fear could be improved by eliciting individual information about feared movements, and relating this specifically to movements and activities avoided by that particular person.

*Fear avoidance as a risk factor for poor prognosis*

A number of investigations have been conducted addressing the relation between pain-related fears and pain outcomes. The strongest support for the FA model of persistent pain and disability has come from the results of cross-sectional studies. The results of these studies have been consistent in showing that measures of pain-related fears are significantly correlated with measures of catastrophic thinking, hypervigilance and various pain outcomes such as depression, functional disability and work absence (reviewed in 27).

There have been attempts to validate the fear avoidance model through structural equation modelling of cross sectional data [28]. The FA model provided a good fit of data of 469 chronic pain patients, consisting of catastrophizing, pain-related fear, depression, perceived disability, and pain severity. The analysis indicates that catastrophizing influences depression and disability directly, besides its influence via fear of injury. Although supportive of the postulated causal path, however, the data cannot be interpreted as evidence for predictive relationship without a timeline, and, therefore, there is a need for prospective studies that use sensitive and reliable measurements sampled at multiple points over time.

The findings of prospective studies have provided mixed support for the FA model. Prospective research into fear avoidance as a risk factor has used different outcome factors, including self reported disability, persistent pain and return to work. Typically these have been measured at twelve months after the first consultation for a new episode of LBP. The evidence for fear-avoidance as a causal factor for poor recovery is mixed. Some researchers have found epidemiological evidence to support the link. A study in Sweden measured fear avoidance beliefs in 141 patients with back and/or neck pain (duration <1 year). Negative expectations, negative affect and a belief that activity may result in (re) injury or increased pain, explained unique variance in both pain and function at one-year follow up [29]. Sullivan et al (2008, 30) examined predictors of work-disability in a sample of 85 individuals with back or neck injuries who had initially been assessed during the sub-acute period of recovery. High scores on the TSK predicted work-disability at 12-month follow-up, even when controlling for pain, depression and catastrophic thinking. In the same study, Sullivan et al reported that treatment- related reductions in TSK scores were associated with improvements in walking speed. Swinkels et al [31] followed a cohort of 555 acute LBP patients presenting at a general practitioner and/or physiotherapist, during 6 months. They showed that after controlling for several other baseline characteristics including pain intensity, baseline TSK-score predicted future perceived disability, and, to a lesser extent, participation.

In contrast, a systematic review of prospective cohorts of people at early stages of back pain did not support the connection between fear avoidance at early stages and disability at follow-up [32]. The review concluded that none of the studies that measured fear-avoidance provided convincing evidence that fear-avoidance beliefs are a risk factor for poor outcomes. Several studies reported negative findings, and studies that found a relationship between measures of fear avoidance at baseline and long term outcome were compromised in terms of their methodology and/or analysis. The highest scoring study, by Werneke et al. [33] found that fear of work activities significantly predicted pain intensity and (delayed) return to work in the univariate analysis, but not in the multivariate analysis. Sieben et al. (2002, 34) used a sophisticated design and a time series analysis to test relationships across time between scores on the Tampa Scale of Kinesiophobia (TSK, 35), pain catastrophizing, and pain severity and disability in 44 patients. Their results indicate that peaks on all three measures occur together, but were unable to provide evidence for a causal path between the variables. Picavet et al. (2002, 36) reported that scores on the TSK and on a catastrophizing instrument independently predict pain, but the analysis was limited due to uncommon choice of outcome categorisation. Bekkering et al, (2005, 37) used various modelling techniques to evaluate prognostic indicators for outcomes at three and 12 months in 500 patients referred to physiotherapy. Improvement in pain, physical function and sick leave was considerable at 3 and further modest improvement occurred by 12 months. In terms of prognostic indicators, and using a variety of models duration of current episode and having a paid job were the only robust predictors. Neither back beliefs nor pain coping styles – including catastrophizing were significant predictors of outcome. 75% of patients, however, perceived they had good recovery, had significant reductions in pain, and experienced improvements in physical function and disability.

Other factors related to anxiety might play more of a role in predicting outcome.

A prospective study in chronic pain patients compared the impact of four different measurements of trait and state fear/anxiety on functioning three months later [38]. The regression analysis suggested that, after controlling for pain intensity at baseline, health anxiety and anxiety sensitivity both predicted unique variance in negative affect at three months, whilst health anxiety alone predicted disability. Pain related anxiety, however, failed to predict outcome, although it was significantly related to pain severity at baseline. Since fear avoidance might be construed as a particular form of health anxiety, this study might not be viewed as critical of the FA- model, but it raises the question of how specific to pain the focus of avoidance is in patients. A well conducted study of a cohort of 174 patients with an acute episode of back pain explored the contribution of fear avoidance measured at baseline to measures of pain and disability at, 3, 6, and 12 months follow-up. Regression analysis showed previous LBP history and pain intensity to be the most important predictors, and of the fear–avoidance model variables, only negative affect added to this model [39]. In a recent prospective study that aimed to examine the sequential relationships proposed by the FA-model, Wideman et al. (in press, 40) evaluated whether early change in catastrophizing predicted late change in fear of movement, and whether these factors influenced post-treatment return to work. Relationships between variables were examined in a sample of 121 individuals with a work-related musculoskeletal injury, and high baseline catastrophizing and fear of movement scores. Although changes both in fear and in catastrophizing predicted return to work, there was no significant sequential relationship between changes in catastrophizing at early stages and changes in fear later on. The results from this study call into question the pivotal role attributed to catastrophizing in the acquisition of fear avoidance.

*Intervention on fear-avoidance*

There are two different approaches to improve patient outcome in reference to the FA-model. Research has explored: a) whether reductions in fear predict positive outcomes (regardless of the nature of the intervention), and b) the efficacy of interventions that specifically focus on fear reduction.

Interventions that have attempted to improve disability in chronic pain patients through use of psychological treatment (without explicit targeting of fear-avoidance) have been only moderately successful [41]. Several factors have been identified explaining the limited success [42]; interventions have been unfocused and lacked a solid theoretical model; trials have been methodologically flawed and under-powered. Several cognitive-behavioural based interventions that have attempted explicitly to change fear avoidance have shown no significant improvement above control/comparison interventions [43, 44]. At least in part, this appears to be due to poor delivery of psychological interventions: In Jellema's study General Practitioners had 3 sessions to address several factors perceived as obstacles to recovery. Treatment integrity was explored and findings indicate that the GPs were insufficiently capable of identifying the psychosocial factors, explaining why the treatment was not more effective than usual care. In the study of Hay and colleagues no treatment integrity was reported, but the therapists were trained for 2 days only. Neither study selected patients high in measures indicating psychosocial risk (such as high scores on fear and catastrophizing), and in the absence of these risk factors, usual care appears to perform equally well as treatment that includes psychological components. In addition, both interventions recruited from primary care settings. Arguably, guideline-based interventions are sufficient at such early stages, explaining why the target interventions showed comparable results to these. Furthermore (and unfortunately) results for patients who undergo graded exposure to a feared activity, do not tend to generalize to other activities. Patients appear to learn an ‘exception to the rule’, i.e. that one activity is not dangerous but other activities are [45], rather than learning to reappraise their (mis)beliefs. More recent approaches include either stepped approaches, in which patients who do not respond to usual guideline compliant care are offered further interventions, including psychological components, and stratified approaches, in which patients are divided at baseline according to factors that are considered to constitute obstacles to recovery and are offered an intervention that matches the typology of the individuals. As this research is in early stages, we hope that this review may contribute to the decisions made about patient typology in reference to obstacles to recovery and choice of intervention.

There are a number of studies that have reported data suggesting that treatment-related reductions in fear of movement are associated with positive rehabilitation outcomes. Sullivan and Stanish (2003, 46) examined psychosocial predictors of return to work in a sample of 104 work-disabled individuals who were enroled in a 10-week psychological intervention designed to target risk-factors for pain-related disability. Analyses revealed that early-treatment reductions in fear of movement and catastrophizing were independent predictors of return to work. In two similar studies, Sullivan et al (2005, 2006, 47, 48) reported that treatment-related reductions in fear of movement were associated with increased probability of return to work, but only in univariate analyses. In multivariate analyses, only reductions in catastrophizing emerged as a significant unique predictor of return to work.

The efficacy of focused intensive interventions, delivered by well-trained professionals explicitly targeting avoidance behaviour and fear of movement requires further research, as results from small studies to date have been promising, but limited. Two focused interventions relate directly to the model of fear-avoidance, and therefore have a strong theoretical basis, with good face validity. These are in-vivo exposure and graded activity. Both treatments aim at improved functioning through reactivation. It has been argued that exposure therapy uses Pavlovian conditioning and cognitive therapeutic techniques, while graded activity uses operant learning principles [49]. Typically, both treatments include a review of pain problems and behaviors, setting of goals, educational sessions, and rehabilitation and exercise advice.

Exposure therapy includes grading of fear-eliciting behaviors, followed by systematic exposure to fear-provoking activities under supervision of the treating practitioner. In contrast, graded activity focuses on treatment goals in terms of patients’ most important specific functional activities confined by their pain problem. Patients are set activities according to their perceived tolerance, and thus, progress in increments towards the set goal. In practice, both interventions provide cognitive challenges to patients in terms of their catastrophic beliefs. Exposure therapy invites patients directly to report these catastrophic fears in reference to specific movements, and includes evaluation of these beliefs after the feared movement has been carried out. Graded activity is often less focused in reference to challenging catastrophic beliefs, but may include feedback sessions about changing cognitions over the intervention period.

To date, there are only a handful of trials exploring such interventions, and for the most part, they suffer from considerable methodological limitations. A study of chronic low back pain patients randomly assigned to in- vivo exposure, graded activity, or a wait-list condition found no differences for pain-related disability measures, but patients in the in -vivo exposure condition improved significantly on measures of fear of pain/movement, fear avoidance beliefs, pain-related anxiety, and pain self-efficacy when compared to those in the graded activity condition, and the wait-list control condition [50]. The findings are, however, limited because of methodological flaws, including low baseline measures of disability, unconventional recruitment procedures, large drop-out rates and lack of power due to small sample size.

A comparison of exposure with operant graded activity (GA) was also studied in 85 chronic low back pain patients in The Netherlands in a multi-centre randomized controlled trial [49]. Exposure treatment resulted in reduced pain catastrophizing and perceived harmfulness of activities, and was equally effective, as GA in improving functional disability, pain intensity and daily activity at 6 months follow up. However, this study too was under-powered and suffered large drop- out rates. We also note that to date no cost-effectiveness data has been published on in-vivo exposure trials. This information is particularly important, because the interventions as described are costly in terms of number of sessions and personnel involved compared with traditional CBT interventions. Other clinical trials comparing the addition of exposure to treatment-as-usual found a modest effect in improvement on function, but the exposed group consisted of only 13 people, and the drop out was high [51]. Single-case series show better results [52-54].

There is a growing consensus that the findings from interventions, to date, are due to suboptimal identification of fear avoidance, and to the existence of sub-groups within the population of avoidant musculoskeletal patients [42, 55]. There is a clear need for better identification of patients at risk, and for improving interventions by matching them better to patients’ needs [9]. The emerging picture from intervention research suggests that amongst other factors (such as work-related and socio-economic factors), patient characteristics influence outcome regardless of type of treatment. Some of these characteristics may be modifiable, leading to search for the identification of sub-groups within pain populations, with an aim for specific matching between risk factor and treatment. In order to define subgroups of patients who benefit more from a particular intervention, predictors of response to treatment (effect modifiers) have to be assessed, with a priori definition and measurement of probable risk factors, and in studies of sufficient statistical power to identify statistically important effect modifiers [56]. To date, studies have done this type of analysis as a secondary (post-hoc) analysis (e.g. 57-59). Unfortunately, no study has so far included all the factors postulated in the FA-model.

*Improving measurements*

The focus of fear

The comprehensiveness, sensitivity, and focus of measurements could be improved. It may be useful to make a clear distinction between fear of pain, fear of re-injury, fear of movement, fear of rehabilitation-based exercises and fear of activity (including work-related activity) during periods of pain. All of these are distinct from avoidance behaviour *per se*, and the relationship between avoidance behaviour and focus of fear may provide useful indicators for treatment. In addition, measures also seem to confuse fear with beliefs; beliefs can be held without fear, and would result in endorsement of items. It should be possible to distinguish between the belief about avoidance, (such as, for example, the belief that back pain requires rest) and fear-based avoidance.

Current measurements confuse fear of movement/normal activity with fear of exercise. The Fear Avoidance Beliefs Questionnaire (FABQ, 60) presents patients with five questions specific to physical activities, which are accurately labelled fear-avoidance beliefs about physical activity. The second part of the questionnaire is specific to beliefs about work. There is no explicit measurement of fear of pain or general health anxiety in the FABQ, yet, the questionnaire is often used to represent broader fears, and is described as measuring ‘fear-avoidance’ generically, rather than fearful beliefs about physical activity and work (e.g. 61).

The Tampa Scale for Kinesiophobia (TSK, 35) includes two subscales, the first measuring avoidance of activities, and the latter measuring beliefs reflecting fear about (re)injury [62, 63]. The scale, however, includes, additionally to items specific to exercise, other items which could be said to measure general beliefs rather than personal fears (e.g. “when in pain, no one should have to exercise”). Thus, such items can be endorsed without being fearful, avoidant, or indeed, being in pain. A further limitation is that is does not provide information about specific movements or activities a person fears or avoids. It is therefore possible for a patient to score low on the TSK, but still hold fearful beliefs about certain specific movements. Finally, central to the measurement of fear of pain is the problem that acquisition of such fears through association between movement and pain can be non-conscious [64]. This means that self-report measures could both underestimate fear which is non-conscious, and over-estimate fear by confusing it with more general health beliefs. In the former case, where patients may be fearful but are unaware of their fears, explicit measures of behavioural avoidance may be useful in combination with self-report measures. Both the TSK and the FABS are widely used, but could be improved to increase sensitivity to patients’ responses and may account, at least in part for the contradictory findings described above. It would be beneficial to examine the relationship between responses to single items in these (and other) common measurements and avoidance behaviours. It would also be useful to examine the shared and unique variance between clusters of items on several measurements and how these relate to avoidant behaviour, as this may suggest sub-groups for appropriate interventions. We tentatively suggest a hierarchical model to conceptualise the relationship between different aspects of anxiety and fear in pain patients, in terms of their shared and unique variance (see figure 1).

Another useful measure of fear of movement and activities is the Photograph Series of Daily Activities (PHODA, 65). This is an instrument to determine the perceived harmfulness of daily activities in patients with chronic low back pain. It specifically focuses on the person’s judgements about the harmful consequences of the movements/activities shown in each picture. More recently a short electronic version (PHODA-SeV, 66) has been developed. This instrument consist of 40 pictures showing different activities covering lifting, bending, turning, reaching, falling, intermittent load, unexpected movement, long-lasting load in stance or sit with limited dynamics. The person has to drag each picture along a ‘harmfulness thermometer’ ranging form 0 (not harmful at all) to 100 (extremely harmful) while imagining themselves performing the same movement, thus creating a personal hierarchy of fear related to these activities.

This instrument has good psychometric properties (test-retest reliability, stability, factor structure and internal consistency, construct validity) and normative values are provided [66]. Future research should focus on disentangling responses to the photographs in terms of fear (‘how afraid would you be to carry out this movement?’), attribution of pain (‘how much pain would this movement cause you?’ and avoidance (‘how often would you avoid this movement?’).

Measurement of avoidance

Research should also focus on better measurement of avoidance *per-se*, in an attempt to identify sub-groups. Several approaches have been used to date, including measuring specific movements (such as straight leg raising); common activities (such as walking, sit-to stand etc); self report of avoiding daily activities presented photographically (such as ironing); and more broad brush terms, (such as sick leave from work). It would be useful to identify the patients’ rationale for avoiding each of these, and how avoidance of one domain may impact on avoidance of another.

*Future directions*

In their conclusions to a review of fear-related factors as predictors of outcome in back pain, Pincus and colleagues [32] have suggested at least two extensions to the current model of fear avoidance (Figure 2a & b). The first describes avoidance-related disuse without fear and is labelled the social-beliefs approach. According to this pathway, the macro and micro systems of health beliefs within the individuals’ health culture, are sufficient to account for avoidance behaviour without fear, especially when receiving positive reinforcement from significant others. The authors argue that emotional processing, whether through fear or catastrophising is not necessary for the outcome of reduced activity.

The second pathway describes a long term trait-like vulnerability to negative affectivity, with the suggestion that a minority of patients with back pain suffer from co-existing clinical depression (not necessarily as a response to pain, but as a co-existing health problem). The authors propose that such extensions of the originals fear-avoidance model can result in explicit predictions about patterns of avoidance. They propose that depression would result in more general reduced activity, while fear might be associated with particular movements and activities. There is some evidence to suggest that negative affect in combination with pain is closely related to changes in cognitive processing, so that negative information about personal health are better recalled, and ambiguous information is interpreted as being related to negative health [67,68]. Other factors have been suggested as vulnerability factors that pre-dispose towards fear, catastrophizing and negative affect, including anxiety sensitivity [69] and neurotic negativity [70]. Such distinctions also fit in with theories about fear acquisition, and we note that the pathways to acquiring both fear and avoidance are a neglected area of research. In a seminal review of the topic, Rachman (1977) proposed three pathways for the acquisition of fears: conditioning, vicarious exposures and by the transmission of information and instruction, even in in the absence of direct contact with the fear stimuli [71]. Future research in fearful pain patients could explore their personal narratives and explanations for the acquisition of fear, and beliefs about movement and avoidance.

An emerging priority is therefore to identify sub-groups within chronic musculoskeletal pain, to allow effective screening, referral and treatment. A logical starting point for examining sub-groups is by considering the proposed models for the development of avoidant behaviours in pain patients. The traditional FA-model postulates that catastrophic thought lies at the core of the fear-avoidance mechanism, but we have argued that avoidant behaviours can also be acquired through social influence, modelling, and simple learning mechanisms [32]. The relationship between fear-avoidance and catastrophizing is not well understood [34]. Catastrophic coping and fear avoidance are only moderately correlated, suggesting that at least some people with high fear-avoidance have low or no catastrophic thinking. If this is so, it is possible that within people reporting high levels of fear-avoidance there are at least two sub-groups: one group in which catastrophic thoughts and beliefs are present and disabling, and one group for whom avoidance does not include aspects of catastrophizing. In the general population, fear-avoidance beliefs have been found to be equally prevalent in people with no pain as in people with mild or moderate pain [72,73], thus providing some support for the idea that avoidant beliefs may sometimes be socially influenced, rather than always being a consequence an episode of pain followed by catastrophizing.

Theoretically, we would therefore like to propose three tentative sub-groups within patients who exhibit avoidance behaviours; 1.) Affective avoiders: People who are distressed and fearful, engage in catastrophic thinking, ruminate on pain-associated experiences, and report feeling helpless and threatened by their pain. 2.) Misinformed avoiders: People who hold beliefs about movement and activities leading to re-injury and further pain. These beliefs may be reinforced by family and sometimes by treating clinicians. Such patients may be high in hypervigilance, but not necessarily distressed, nor would they report low self-efficacy. 3.) Learnt avoidance: Learning theory suggests avoidance behaviour can be acquired without awareness simply through a Pavlovian association between making certain movements and experiencing pain. In this subset of people there need be neither elevated affect (fear) nor explicit beliefs about avoidance. These tentative sub-groups would require a different emphasis in treatment. It is logical to suppose that affective avoiders will benefit most from exploring dysfunctional cognitions and catastrophic thinking; that misinformed avoiders will benefit most from educational aspect of management and that learnt avoidance will be best overcome through exposure or graded activity. It is also probable that work-related avoidance will benefit most from interventions focused on aspects specific to the work setting. Clearly these ideas have implications for the primary outcomes selected for each intervention.

References

1. Underwood, M.. Crisis what crisis? *Eur Spine J* 1998; 7: 2-5.
2. Waddell, G, Aylward, M & Sawney, P. *Back pain, incapacity for work and social security benefits: An international literature review and analysis*. London: Royal Society of Medicine Press, 2002
3. Croft, P. Is life becoming more of a pain? *BMJ* 2000; 320: 1552-53.
4. Airaksinen, O, Brox, JI, Cedraschi, C et al. *European guidelines for the management of chronic non-specific low back pain.* European Commission, Research Directorate General, 2004.
5. Palmer, K, Walsh, K, Bendall, H, Cooper, C & Coggon, D. Back pain in Britain: comparison of two prevalence surveys at an interval of 10 years. *BMJ* 2000; 320: 1577-78.
6. Maetzel, A & Li, L. The economic burden of low back pain: a review of studies published between 1996 and 2001. Best Practice & Research. *Clin Rheumatol* 2001, 16, 23-30
7. Chou, R, Huffman, LH. Nonpharmacologic therapies for acute and chronic low back pain: A review of the evidence for an American Pain Society/American College of Physicians clinical practice guideline. *Ann Intern Med* 2007; 147: 492-504.
8. [Boersma, K, Linton, S.J.](http://www.ncbi.nlm.nih.gov/pubmed/16428950?ordinalpos=2&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum) . Psychological processes underlying the development of a chronic pain problem: a prospective study of the relationship between profiles of psychological variables in the fear-avoidance model and disability. *Clin J Pain* 2006; 22: 160-6.
9. Vlaeyen, JWS, Morley, S. Cognitive-behavioral treatments for chronic pain: what works for whom? *Clin J Pain* 2005; 21(1): p. 1-8
10. [Vlaeyen, JW, Linton, SJ.](http://www.ncbi.nlm.nih.gov/pubmed/10781906?ordinalpos=5&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum) Fear-avoidance and its consequences in chronic musculoskeletal pain: A state of the art. *Pain* 2000; 85: 317-32
11. Asmundson, GJ, Wright, KD and Hadjistavropoulos, HD. Hypervigilance and attentional fixedness in chronic musculoskeletal pain: consistency of findings across modified stroop and dot-probe tasks. *J Pain* 2005; 6(8): 497-506.
12. Crombez, G, Van Damme, S and Eccleston, C. Hypervigilance to pain: an experimental and clinical analysis. *Pain* 2005; 116(1-2): 4-7.
13. Roelofs, J., et al., The role of fear of movement and injury in selective attentional processing in patients with chronic low back pain: a dot-probe evaluation. *J Pain* 2005; 6(5): 294-300.
14. Burton, AK, Balagu, F, Cardon, G. et al. *European guidelines for prevention in low back pain* European Commission, Research Directorate General 2004: 4
15. Smeets, RJ et al. Physical capacity tasks in chronic low back pain: what is the contributing role of cardiovascular capacity, pain and psychological factors? *Disabil Rehabil*, 2007; 29(7): 577-86.
16. Verbunt, JA et al. Pain-related factors contributing to muscle inhibition in patients with chronic low back pain: an experimental investigation based on superimposed electrical stimulation. *Clin J Pain*, 2005; 21(3): 232-40.
17. Watson, PJ, Non-psychological determinants of physical performance in musculoskeletal pain., in *Pain 1999- an updated review: Refresher course syllabus 9th World Congress on Pain*., M. Mitchell, Editor. IASP Press: Seattle. 1999;153-58.
18. George SZ, Hirsh AT. Psychologic Influence on Experimental Pain Sensitivity and Clinical Pain Intensity for Patients with Shoulder Pain, *J Pain*. 2008 Dec 11. [Epub ahead of print].
19. Crombez, G., et al., Avoidance and confrontation of painful, back-straining movements in chronic back pain patients. *Behav Modif*, 1998; 22(1): 62-77.
20. Crombez, G., et al., Pain-related fear is more disabling than pain itself: evidence on the role of pain-related fear in chronic back pain disability. *Pain*, 1999. 80(1-2): p 329-39.
21. Leeuw, M., et al., The fear-avoidance model of musculoskeletal pain: current state of scientific evidence. *J Behav Med*, 2007; 30(1): 77-94.
22. McCracken, LM, Zayfert, C , Gross, RT. The Pain Anxiety Symptoms Scale: development and validation of a scale to measure fear of pain. *Pain*, 1992; 50(1): 67-73.
23. Vlaeyen, JWS et al., Fear of movement/(re)injury in chronic low back pain and its relation to behavioral performance. *Pain*, 1995; 62(3): 363-72.
24. Geisser, ME, Haig, AJ Theisen, ME Activity avoidance and function in persons with chronic back pain. *J Occup Rehabil*, 2000; 10(3): 215-27.
25. Lackner, JM,. Carosella, AM Feuerstein, M. Pain expectancies, pain, and functional self-efficacy expectancies as determinants of disability in patients with chronic low back disorders*. J Consult Clin Psychol*, 1996; 64(1):.212-20.
26. Reneman, MF, et al., Relationship between kinesiophobia and performance in a functional capacity evaluation. *J Occup Rehabil* 2003; 13(4): 277-85
27. [Leeuw, M, Goossens, ME, Linton, SJ, Crombez, G, Boersma, K, Vlaeyen, JW.](http://www.ncbi.nlm.nih.gov/pubmed/17180640?ordinalpos=2&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum) The fear-avoidance model of musculoskeletal pain: Current state of scientific evidence. *J Behav Med*, 2007; 30: 77-94.
28. Cook AJ, Brawer PA, Vowles KE. The fear-avoidance model of chronic pain: validation and age analysis using structural equation modeling. *Pain*. 2006; 121(3):195-206. Epub 2006 Feb 21
29. Boersma K, Linton SJ. Psychological processes underlying the development of a chronic pain problem: a prospective study of the relationship between profiles of psychological variables in the fear-avoidance model and disability. *Clin J Pain*. 2006; 22(2):160-166
30. Sullivan, MJL, Adams, H, Horan, S, Maher, D, Boland, D, Gross, R. The role of perceived injustice in the experience of chronic pain and disability: Scale development and Validation. *J Occup Rehabil* 2008; 18(3): 249-61
31. Swinkels-Meewisse JEJ, Roelofs J, Schouten EGW, Verbeek ALM, Oostendorp RAB, Vlaeyen JWS. Dear of Movement/(re)injury predicting chronic disabling low back pain: a prospective inception cohort study. *Spine* 2006;31(6):658-664)
32. [Pincus, T, Vogel, S, Burton, AK, Santos, R, Field, AP](http://www.ncbi.nlm.nih.gov/pubmed/17133530?ordinalpos=6&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum) Fear avoidance and prognosis in back pain: A systematic review and synthesis of current evidence. *Arthritis Rheum*, 2006; 54: 3999-4010.
33. Werneke M, Hart DL. Centralization phenomenon as a prognostic factor for chronic low back pain and disability. *Spine* 2001; 26(7): 758-765.
34. Sieben, JM, Vlaeyen, JW, Tuerlinkx, S, Portegijs, PJ. . Pain-related fear in acute low back pain: The first two weeks of a new episode. *Eur J Pain* 2002; 6: 229-37
35. Kori SH, Miller RP, Todd DD. Kinesophobia: A new view of chronic pain behaviour. *Pain Manag* 1990; Jan/Feb: 35-43.
36. Picavet HSJ, Vlaeyen JWS, Schouten JSAG. Pain catastrophizing and kinesiophobia: Predictors of chronic low back pain. *Am J Epidem* 2002; 156(11): 1028-1034.
37. Bekkering GE, Hendricks HJM, van Tulder MW, Knol DL, Simmonds MJ, Oostendorp RA, Bouter LM. Prognostic factors for low back pain in [patients referred for physiotherapy: comparing outcomes and varying modelling techniques. *Spine* 2005:30(16): 1881-1886
38. Hadjistavropoulos HD, Asmundson GJG, Kowalyk K. Measures of various anxiety constructs: Is there a difference in their ability to predict long-term functioning among pain patients? *Eur J Pain* 2004; 8: 1-11.
39. Sieben JM, Vlaeyen JW, Portegijs PJ, Verbunt JA, van Riet-Rutgers S, Kester AD, Von Korff M, Arntz A, Knottnerus JA. A longitudinal study on the predictive validity of the fear-avoidance model in low back pain. *Pain* 2005; 117(1-2): 162-70.
40. Wideman HT, Adams H, Sullivan MJL. A prospective sequential analysis of the fear-avoidance model of pain *Pain* 2009; in press.
41. Eccleston et al., systematic review of psychological therapies for the management of chronic pain, *Cochrane review, update* 2009.
42. [van der Windt, D, Hay, E, Jellema, P Main, C.](http://www.ncbi.nlm.nih.gov/pubmed/18165752?ordinalpos=7&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum) Psychosocial interventions for low back pain in primary care: lessons learned from recent trials. *Spine* 2008; 33: 81-89.
43. [Jellema, P, van der Windt, DA, van der Horst, HE, Twisk, JW, Stalman, WA & Bouter, LM](http://www.ncbi.nlm.nih.gov/pubmed/15967762?ordinalpos=3&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum) . Should treatment of (sub)acute low back pain be aimed at psychosocial prognostic factors? Cluster randomised clinical trial in general practice. *BMJ* 2005; 331: 84.
44. [Hay, E, Mullis, R, Lewis, M, Vohora, K, Main, C, Watson, P, Dziedzic, K, Sim, J, Lowe, C & Croft, P](http://www.ncbi.nlm.nih.gov/pubmed/15950716?ordinalpos=9&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum) Comparison of physical treatments versus a brief pain-management programme for back pain in primary care: A randomised clinical trial in physiotherapy practice. *Lancet* 2005; 365: 2024-30.
45. Simmonds MJ, Goubert L, Moseley GL, Verbunt JA. Moving with Pain. In. Flor H, Kalso E, Dostrovsky JO eds *Proceedings of the 11th World Congress on Pain*. IASP Press Seattle, 2006; 799-811
46. Sullivan MJL & Stanish WD. Psychologically based occupational rehabilitation: The Pain Disability Prevention Program, *Clin J of Pain* 2003; 19: 97-104
47. Sullivan MJL, Ward LC, Tripp D, French, DJ, Adams H, Stanish WD. Secondary prevention of work disability: Community based psychological intervention for musculoskeletal disorders. *J Occup Rehabil* 2005;15(3): 377-392.
48. Sullivan MJL Adams H, Rhodenizer T, Stanish WD. A Psychological risk-factor targeted intervention for the prevention of chronic pain and disability following whiplash injury, *Phys Ther* 2006; 86: 8-18.
49. [Leeuw, M, Goossens, ME, van Breukelen, GJ, de Jong, JR, Heuts, PH, Smeets, RJ, Köke, AJ & Vlaeyen, JW](http://www.ncbi.nlm.nih.gov/pubmed/18242858?ordinalpos=6&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum). Exposure in vivo versus operant graded activity in chronic low back pain patients: results of a randomized controlled trial. *Pain* 2008; 15: 192-207.
50. [Woods, MP & Asmundson, GJ](http://www.ncbi.nlm.nih.gov/pubmed/17716819?ordinalpos=1&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum). Evaluating the efficacy of graded in vivo exposure for the treatment of fear in patients with chronic back pain: A randomized controlled clinical trial. *Pain* 2008;136, 271-80.
51. [Linton, SJ, Boersma, K, Jansson, M, Overmeer, T, Lindblom, K Vlaeyen, JW.](http://www.ncbi.nlm.nih.gov/pubmed/18155934?ordinalpos=2&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum) A randomized controlled trial of exposure in vivo for patients with spinal pain reporting fear of work-related activities. *Eur J Pain* 2008; 12: 722-30.
52. [de Jong, JR, Vlaeyen, JW, Onghena, P, Cuypers, C, den Hollander, M Ruijgrok, J.](http://www.ncbi.nlm.nih.gov/pubmed/15964686?ordinalpos=7&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum). Reduction of pain-related fear in complex regional pain syndrome type I: the application of graded exposure in vivo. *Pain* 2005;116: 264-75.
53. [Boersma, K, Linton, S, Overmeer, T, Jansson, M, Vlaeyen, J de Jong, J.](http://www.ncbi.nlm.nih.gov/pubmed/15109502?ordinalpos=3&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum) Lowering fear-avoidance and enhancing function through exposure in vivo. A multiple baseline study across six patients with back pain. *Pain* 2004; 108: 8-16
54. [Vlaeyen, JW, de Jong, J, Geilen, M, Heuts, PH, van Breukelen, G.](http://www.ncbi.nlm.nih.gov/pubmed/11153970?ordinalpos=10&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum) Graded exposure in vivo in the treatment of pain-related fear: A replicated single-case experimental design in four patients with chronic low back pain. *Behav Res Ther*  2001; 39: 151-66
55. [Jellema, P, van der Windt, DA, van der Horst, HE, Blankenstein, AH, Bouter, LM Stalman, W.A.](http://www.ncbi.nlm.nih.gov/pubmed/16289797?ordinalpos=1&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum) Why is a treatment aimed at psychosocial factors not effective in patients with (sub)acute low back pain? *Pain 2005;* 118: 350-9.
56. Brookes, ST et al., Subgroup analyses in randomized trials: risks of subgroup-specific analyses; power and sample size for the interaction test. *J Clin Epedemiol*, 2004; 57(3): 229-36.
57. Underwood, MR, Morton, V, Farrin, A. Do baseline characteristics predict response to treatment for low back pain? Secondary analysis of the UK BEAM dataset. *Rheumatology* 2007; 46(8):1297-302.
58. Karjalainen, K, et al., Mini-intervention for subacute low back pain: two-year follow-up and modifiers of effectiveness. *Spine* 2004; 29(10): 1069-76.
59. Hagen, EM, Svensen, E, Eriksen, HR. Predictors and modifiers of treatment effect influencing sick leave in subacute low back pain patients. *Spine ISE: 1528 1159*, 2005. 30(24): 2717-2723.
60. Waddell G, Newton M, Henderson I, Somerville D, Main C. A fear-avoidance beliefs questionnaire (FABQ) and the role of fear-avoidance beliefs in chronic low back pain and disability. *Pain* 1993; 93: 157ndash168.
61. Burton AK, Tillotson, KM, Main, CJ, Hollis, S. Psychosocial Predictors of Outcome in Acute and Subchronic Low Back Trouble. *Spine* 1995; 20 (6): 722-728
62. Geisser ME, Haig AJ, Theisen ME (2000) Activity avoidance and function in persons with chronic back pain. *J Occup Rehabil* 2000; 10(3): 215-217
63. Goubert L, Crombez G, Van Damme S, Vlaeyen JWS, Bijttebier P, Roelofs J. Confirmatory factor analysis of the Tampa Scale for Kinesiophobia: invariant two-factor model across low back pain patients and fibromyalgia patients. *Clin J Pain* 2004; 20(2):103-10.
64. Mineka S, Ben Hamida S. Observational and nonconscious learning. In W O’Donohue ed, *Leaning and behaviour therapy* Boston, Allyn and Bacon 1998; 421-39..
65. Kugler K, Wijn J, Geilen M, deJong D, Vlaeyen JVV. *The Photograph series of daily activities (PHODA)*, Institute for rehabilitation research and school for physiotherapy. The Netherlands. Heerlen 1999.
66. Leeuw, M., et al., Measuring perceived harmfulness of physical activities in patients with chronic low back pain: the photograph series of daily activities-short electronic version. *J Pain* 2007; 8(11): 840-849.
67. Pincus T, Morley S, Cognitive biases in chronic pain, *Psychol Bull* 2001; 127(5): 599-617.
68. Pincus T, Santos R & Morley S. Depressed cognition in chronic pain patients are focused on health: Evidence from a sentence completion task, *Pain*. 2007; 130(1-2):84-92.
69. Asmundson GJ. Anxiety and related factors in chronic pain. *Pain Res Manag*. 2002; 7(1):7-8.
70. Gheldof EL, Vinck J, Van den Bussche E, Vlaeyen JW, Hidding A, Crombez G. Pain and pain-related fear are associated with functional and social disability in an occupational setting: evidence of mediation by pain-related fear. *Eur J Pain*. 2006;10(6):513-25
71. Rachman S, The conditioning theory of fear acquisition : a critical examination. *Behav Res Ther* 1977; 15 : 375-387.
72. Buer, N. & Linton, SJ Fear-avoidance beliefs and catastrophizing: Occurrence and risk factor in back pain and ADL in the general population. *Pain* 2002; 99: 485-491.
73. [Goubert, L, Crombez, G, de Bourdeaudhuij, I..](http://www.ncbi.nlm.nih.gov/pubmed/15207520?ordinalpos=4&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum) Low back pain, disability and back pain myths in a community sample: prevalence and interrelationships. *Eur J Pain* 2004; 8: 385-94.

Figure 1

Title: The shared and unique variance of aspects of fear and anxiety in pain patients

AS=Anxiety Sensitivity

HA=Health Anxiety

PF= Fear of Pain

FM=Fear of Movement

FE= Fear of exercise

Figure 2a & b:

a) The Social Pathway Model



b) 