

Fear-avoidance as a risk factor for chronic pain.

Citation for published version (APA):

Vancleef, L. M. G., Flink, I. K., Linton, S. J., & Vlaeyen, J. W. S. (2012). Fear-avoidance as a risk factor for chronic pain. In M. Hasenbring, A. Rusu, & D. Turk (Eds.), *From acute to chronic pain: risk factors, mechanisms, and clinical implications* (pp. 269-295). Oxford University Press.

Document status and date:

Published: 01/01/2012

Document Version:

Publisher's PDF, also known as Version of record

Document license:

Taverne

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

www.umlib.nl/taverne-license

Take down policy

If you believe that this document breaches copyright please contact us at:

repository@maastrichtuniversity.nl

providing details and we will investigate your claim.



Chapter 14

Fear-Avoidance as a Risk Factor for the Development of Chronic Back Pain and Disability

Linda Vancleef, Ida Flink, Steven Linton, and Johan Vlaeyen

14.1 Introduction

Chronic musculoskeletal pain syndromes are responsible for enormous costs for healthcare and society (Linton 1998; Phillips et al. 2008; Picavet and Schouten 2003; Verhaak et al. 1998). Nowadays, the biopsychosocial perspective on pain offers a good foundation for a better insight into how pain can become a persistent problem (Fordyce 1976; Turk and Flor 1999). In this perspective, pain and pain disability are influenced by the dynamic interaction among biological, psychological, and social factors.

The present chapter focuses on the role of fear and avoidance in the development and maintenance of chronic low back pain (CLBP). In the following paragraphs, an overview on the aetiology of low back pain (LBP), the conceptualization of fear and avoidance, and the development of fear-avoidance models will be provided. Furthermore, empirical evidence on the role of fear and avoidance behaviour in chronic pain, stemming from studies conducted in pain patients and in healthy volunteers, will be reviewed. This chapter will then continue with a discussion on how to assess fear of pain both at a direct and indirect level. Finally, this chapter will end with perspectives on the cognitive-behavioural management of chronic pain in patients who are characterized by increased pain-related fear and avoidance behaviour.

14.1.1 Chronic low back pain

LBP is one of the most prevalent complaints in the musculoskeletal apparatus. LBP refers to pain in the area of the lower back that often radiates to the buttocks or the legs. Recent reviews indicated that about 60–90% of the general population report to have experienced complaints in the lower back at some point throughout the course of their lives (Picavet and Schouten 2003). Population-based studies estimate the lifetime prevalence of LBP between 60–80% (Nachemson et al. 2000; Walker 2000). A study in the Belgian population showed that 41.8% of the respondents indicated to have experienced LBP for at least one day in the past period of 6 months. Moreover, 8.2% of this group reported that the pain in their lower back was seriously impeding daily functioning (Goubert et al. 2004a). These figures are comparable to other Western countries (e.g. Schmidt et al. 2007; Walker et al. 2004).

Only in a minority of people with LBP specific causes such as nerve injury, fractures, inflammation or malign disease are found to be responsible for the pain (Waddell 2004). In most cases the pain is denoted as non-specific, meaning that no specific biomedical cause can be found for LBP. For the majority of back pain patients who seek care and refrain from work, the problem of pain





1 resolves within a few weeks. These patients return to work and resume their daily activities within
2 4–6 weeks after the onset of the complaints. However, there is a small subgroup of patients
3 (5–10% of the total population), in whom back pain persists for longer than 3 months, and who
4 develop a chronic pain problem (Waddell 2004). Ironically, this relatively small group of back
5 pain patients is responsible for the largest amount of healthcare and societal costs of back prob-
6 lems (Phillips et al. 2008; Waddell 2004). In addition, chronic pain is known to have an enormous
7 impact on the personal and social relations of these chronic back pain patients (Sullivan et al.
8 2004; Morley and Eccleston 2004).

9 14.1.2 General explanatory models

10 Throughout time, several explanatory models have been put forward to explain why a small
11 group of back pain patients become chronic pain sufferers. Biomedically oriented specialists have
12 suggested that these patients have more serious impairments than those who resume daily activi-
13 ties earlier. However, no research supports this assumption. On the contrary, numerous studies
14 have shown that there is no perfect relationship between impairment, pain, and disability. Patients
15 with back problems often show no physical injury, and conversely, it happens that persons who
16 do show physical injury do not report pain or disability (e.g. Jensen et al. 1994). The biomedical
17 perspective that any pain is the result of structural and biomechanical abnormalities can also not
18 account for phantom limb pain, where pain is experienced in missing body parts (Giummarra
19 et al. 2007) or for the large interindividual differences that exist in the way persons experience,
20 respond to, and cope with pain.

21 A biopsychosocial approach offers a better insight into how pain can become a persistent prob-
22 lem (Turk and Flor 1999; Waddell 2004). According to this approach, pain and pain disability are
23 not only influenced by organic pathology, if present, but also by psychological and social factors.
24 The interrelationship between the biological, psychological, and social factors, as well as their
25 influence on the pain experience can be complex. As such, small content overlap does exist
26 between the various factors, but different processes are assumed in each individual component of
27 the model (Turk and Gatchel 2002; Waddell 2004). For example, processes and factors that influ-
28 ence the biomedical aspects of pain, like an injury, are different from those that influence the daily
29 functioning of individuals in pain, like the affective evaluation of the sensory experience. In this
30 multidimensional approach to pain, pain is conceived as a unique experience that can have diver-
31 gent outcomes in terms of illness, disability and suffering. The major benefit of the biopsychosocial
32 model concerns its flexibility in allowing a broad variety of factors to influence and
33 determine each individual pain experience. On the other hand, the biopsychosocial model is
34 conceived as a theoretical conceptualization only and does not possess explanatory power for the
35 way in which biological, psychological, and social processes exert their influence on chronic pain.
36 Under the biopsychosocial umbrella, several specific explanatory models have been developed
37 that aim to clarify the role of specific factors in pain. Explanatory models on fear of pain are
38 rooted in one of the most robust explanatory models in psychology, namely conditioning theory.
39 Fear conditioning theories possess the power to explain why fears can exist and become chronic,
40 even when the source of threat is not apparent.

41 14.2 Fear and avoidance

42 Fear and avoidance are central concepts to contemporary views on pain development and
43 treatment.

44 *Fear* is generally conceived as a basic or pure emotion that represents a present-oriented
45 state, an emotional reaction that is directed at an identifiable, concrete stimulus (Izard 1992;





1 Rachmann 2004). From an evolutionary perspective, fear serves to protect the individual from
2 immediate threat. However, because fears can be both rational and irrational, fear responses can
3 occur for either accurately or inaccurately perceived dangers. It is important to note at this point
4 that fear cannot be equated to anxiety, although both terms are often used interchangeably.
5 In contrast to fear, anxiety is a future-oriented state that is more diffuse, unfocussed, and less
6 controllable than fear.

7 What pain patients are afraid of and what is thus seen as the object of fear in pain has been
8 divided into three areas; fear of pain sensations (i.e. the pain itself), fear of pain-causing activities
9 and fear of movement and (re)injury (Vlaeyen and Linton 2000). Other authors have emphasized
10 that also more general aspects, such as threats to life-goals and identity, might be objects of fear
11 in pain patients (Morley and Eccleston 2004). Fear of pain encompasses cognitive, physiologic, as
12 well as motor processes. Studies have demonstrated correlations between fear of pain and meas-
13 ures of anxiety, cognitive errors, depression, and disability (McCracken et al. 1992, 1996). CLBP
14 patients may fear not only pain, but also activities that are expected to cause pain. In this case, fear
15 is hypothesized to generalize to other situations that are closely linked to the feared stimulus.
16 A specific fear is fear of movement and physical activity that is (wrongfully) assumed to cause (re)
17 injury. Kori et al. (1990) introduced the term 'kinesiophobia' (kinesis=movement) for the condi-
18 tion in which a patient has 'an excessive, irrational, and debilitating fear of physical movement
19 and activity resulting from a feeling of vulnerability to painful injury or re-injury'.

20 *Avoidance* refers to the performance (or withdrawal) of a behaviour so that an undesirable
21 experience or situation is delayed or put off. Although in the case of chronic pain it is not possible
22 to avoid the pain itself, activities that might increase pain or cause (re)injury can be avoided.
23 Therefore, the suboptimal performance of activities is often taken as an index of avoidance behav-
24 iour in pain patients.

25 14.2.1 Fear-avoidance learning

26 Relying on both *classical* and *operant* conditioning principles, the two-factor theory by Mowrer
27 (1947) has been an influential theory in explaining fear-avoidance acquisition. According to this
28 theory, classical conditioning accounts for the acquisition of fear responses to aversive stimuli
29 through learning of associations between stimuli. Neutral stimuli that are associated with uncon-
30 ditioned aversive stimuli (US) develop fearful qualities and become conditioned fear stimuli
31 (CS). The likelihood of fear development is increased by exposure to high-intensity pain and/or
32 fear situations, and by frequent repetitions of the association between the new conditioned
33 stimulus and the pain/fear. Once objects or situations have acquired fear provoking qualities, they
34 develop motivating properties and elicit conditioned (defensive) responses, including escape,
35 avoidance, and safety seeking behaviours. For example, using a differential classical conditioning
36 paradigm with visual cues as CS and electric shock as the US, Bradley et al. found that individuals
37 responded with greater defensive reactivity in the context of threat cues (CS+) as compared to
38 safe cues (CS-) who were never associate with the US (Bradley et al. 2008). The operant condi-
39 tioning component of the two factor theory describes how defensive responses (e.g. avoidance)
40 become persistent through learning of associations between behaviour and its consequences. The
41 reduction of fear that is invoked by these responses serves as their negative reinforcement.
42 Although Mowrer's two-factor theory has been very influential in the fear-avoidance literature, it
43 is troubled by a number of shortcomings. For example, it can not explain the persistence of avoid-
44 ance behaviour when the aversive stimulus has been withdrawn for a repeated number of times.
45 Following conditioning principles, the absence of repeated unpleasant experiences should lead to
46 the extinction of acquired avoidance behaviour. Furthermore, the basic premise of the theory that
47 *all* fears are acquired by classical conditioning cannot be sustained, since several instances are





1 known in which persons develop fears for stimuli they have never encountered before (e.g. fear
2 of snakes).

3 Fordyce et al. (1982) described how pain behaviour might result from avoidance learning. In
4 the case of pain, a patient may no longer perform certain activities because he or she anticipates
5 that these activities will increase pain and suffering. In the acute phase, avoidance behaviours
6 such as resting, limping, or the use of supportive equipment are effective in reducing suffering
7 from nociception. Later on, these protective pain and illness behaviours may persist in anticipa-
8 tion of pain, instead as of a response to it. Long-lasting avoidance of motor activities may lead to
9 detrimental consequences, both physically (loss of mobility, muscle strength, and fitness, possibly
10 resulting in the 'disuse syndrome') (Bortz 1984), and psychologically (loss of self-esteem, depres-
11 sion, and somatic preoccupation).

12 Although classical and operant learning principles are important mechanisms in the develop-
13 ment of fear and avoidance behaviour, it seems likely that besides learning principles, other proc-
14 esses are important in fear-avoidance acquisition as well. Favouring a cognitive theory of avoidance
15 learning, Philips (1987) takes the view that avoidance is influenced by the *expectancy* that further
16 exposure to certain stimuli will promote pain and suffering. This expectancy is assumed to be
17 based on previous aversive experiences in the same or similar situations. Since the avoidance
18 behaviour displayed by pain patients and by patients with phobias shows large similarities, Philips
19 suggested that, 'chronic pain and chronic fear—both aversive experiences which result in avoid-
20 ance behaviour—may share important characteristics' (Philips 1987, p. 277). Several studies have
21 focussed on the relationship between fear/anxiety and chronic pain, of which the object of fear
22 has been fear of pain (Lethem et al., 1983), fear of work-related activities (Waddell 1987), and fear
23 of movement that is assumed to cause (re)injury (Vlaeyen et al. 1995a, 1995b).

24 Usually, extinction of fear takes place when exposure to the feared stimulus does not lead to
25 the adverse consequences anymore. In the area of pain, Philips was one of the first to argue
26 for the systematic application of graded exposure to produce disconfirmations between expected
27 and the actually experienced pain and harm (Philips 1987) Experimental support for this novel
28 idea was provided by Crombez et al. (1996) in a sample of CLBP patients who were requested
29 to perform four exercises (two with each leg) at maximal force. During each exercise, baseline
30 pain and expected pain before the performance of the movement were recorded as well as
31 the experienced pain during the movement. As predicted, the CLBP patients initially overpre-
32 dicted pain, but after repeated exposure to the movements the overprediction was readily
33 corrected. These findings were replicated with other movements, including bending forward
34 and straight leg raising (Crombez et al. 2002b; Goubert et al. 2002). However, the later data
35 also showed that these disconfirmations were context dependent. Indeed, when patients were
36 exposed to a different movement, again overpredictions were made as if no exposure to a previ-
37 ous movement had taken place. This restriction of generalization was particularly true for those
38 patients who catastrophically (mis)interpreted the pain. Exposure to the physical activities did
39 not result in a fundamental change in the belief that certain movements are harmful or painful,
40 but rather that the movements involved in the exposure sessions are less harmful or painful than
41 anticipated.

42 14.2.2 Fear-avoidance model of pain

43 With the introduction of a 'fear-avoidance model of exaggerated pain perception' in 1983, Lethem
44 and colleagues reserved a critical role for fear of pain and avoidance behaviour in the explanation
45 of perpetuating pain complaints in the absence of organic pathology (Lethem et al. 1983). In this
46 model, 'confrontation' and 'avoidance' are postulated as two extreme responses to the fear of pain.



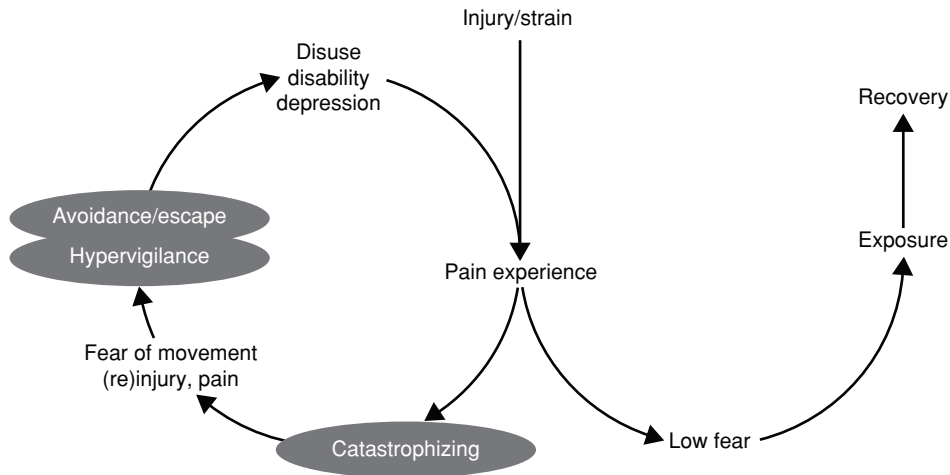


Fig. 14.1 Fear avoidance model of chronic pain. This figure has been reproduced with permission of the International Association for the Study of Pain® (IASP®). The figure may not be reproduced for any other purpose without permission.

1 While confrontation will lead to the reduction of fear over time, avoidance leads to the maintenance or exacerbation of fear, possible developing into a phobic-like state. The avoidance results in the reduction of both social and physical activities, which in turn can lead to a number of physical and psychological consequences augmenting the disability.

2
3
4
5 After the introduction of the fear-avoidance model by Lethem and the emphasis on the role of cognitions in avoidance by Philips, various cognitive-behavioural models of chronic pain have been proposed. These models are commonly referred to as contemporary fear-avoidance models, in which pain disability is conceived as the result of a vicious process that is determined by the interaction between cognitions and behaviour (Asmundson et al. 1999; Vlaeyen et al. 1995b; Waddell et al. 1993). Subtle differences aside, contemporary fear-avoidance models all share the same basic tenets, which can be easily understood from the integrated model that is illustrated in Figure 14.1. Upon the initial perception of pain, individuals assign a certain meaning and purpose to the painful experience that is based upon current expectations regarding the pain and prior learning history. Although the majority of individuals will evaluate the pain experience as undesirable and unpleasant at this stage, most persons will not perceive it as an extreme threat or an insurmountable catastrophe. These individuals will proactively and gradually *confront* their pain, and resume their daily activities, promoting health behaviours and early recovery. However, for a minority of individuals, the painful experiences, which are intensified during movement, will elicit catastrophizing cognitions. These catastrophic cognitions can then lead to pain-related fear (fear of pain, fear of movement, fear of (re)injury), which in its turn initiates the *avoidance* of potential painful activities and hypervigilance for potential signals of additional pain and bodily harm. As such, a vicious and self-perpetuating spiral is activated with avoidance of more and more (daily) activities, leading to functional disability and possibly also to social isolation and depression. In addition, physical deconditioning and depression may fuel the fear-avoidance cycle by increasing pain intensity and increasing the fearful appraisal of and selective attention to pain. In addition to the avoidance of fearful activities, pain disability may also persist because of the immediate consequences to which it leads, such as diminished pain, increased attention from others, and the avoidance of social conflicts or responsibility.

6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28



1 14.2.3 Empirical support for the main components of the 2 fear-avoidance model

3 The fear avoidance model has offered a fruitful framework within which the development and
4 maintenance of persisting pain complaints can be understood. Empirical support for the model
5 has been found within the area of CLBP, osteoarthritis, neck pain, and chronic headache (e.g.
6 Fritz et al. 2001; Leeuw et al. 2007a; Vlaeyen and Linton 2000; Waddell et al. 1993). This para-
7 graph reviews experimental evidence for the main components of the fear-avoidance model.

8 Pain catastrophizing

9 Pain catastrophizing is conceived as a cognitive construct that represents the tendency to make
10 exaggerated negative or threatening interpretations of pain (Sullivan et al. 1995). Pain catastro-
11 phizing has often been found closely related to fear of pain. In addition, a few studies have reported
12 about the predictive value of pain catastrophizing for pain-related fear (Leeuw et al. 2007c;
13 Vlaeyen et al. 1995b; 2004b). Elevated levels of pain-catastrophizing have been consistently found
14 related to pain disability in chronic pain samples, acute pain samples, and pain-free volunteers
15 (Peters et al. 2005; Severeijns et al. 2005; Sullivan et al. 2005; Turner et al. 2004). Furthermore,
16 persons who tend to catastrophize about pain are found to show more hypervigilance for pain-
17 related information, less tolerance for pain, and to report increased pain intensity levels when
18 experiencing pain (Crombez et al. 2002a; Haythornthwaite et al. 2003; Peters et al. 2005; Sullivan
19 et al. 2005; Turner et al. 2002). In prospective studies, pain catastrophizing has been found pre-
20 dictive of elevated pain intensity levels during a painful procedure or after an operation (Edwards
21 et al. 2004; Sullivan et al. 1995; Vlaeyen et al. 2004b). For more detailed information on pain
22 catastrophizing see also Chapter 13.

23 Pain-related fear

24 The importance of pain-related fear has been demonstrated in chronic and acute pain samples as
25 well as in healthy volunteers possessing elevated levels of pain-related fear (Crombez et al. 1999;
26 Leeuw et al. 2007a; Swinkels-Meewisse et al. 2006; Vlaeyen and Linton 2000). As such, LBP
27 patients who are high in pain-related fear perform less well on behavioural (physical) perform-
28 ance tasks, like a walking test or a lifting task (Al Obaidi et al. 2003; Vlaeyen et al. 1995a; Vlaeyen
29 and Linton 2000; Vowles and Gross 2003). Fear of movement/(re)injury showed to be a stronger
30 predictor for detrimental performance on physical tasks than biomedical symptoms or severity
31 and duration of the pain experience (Vlaeyen and Linton 2000). Furthermore, pain-related fears
32 about work have been found related to disability of daily living and work lost in the past year,
33 more so than to biomedical variables such as the anatomic pattern, the time pattern, or the sever-
34 ity of pain (Fritz et al. 2001; Waddell et al. 1993). In pain-free individuals, elevated levels of pain-
35 related fear have been found associated with increased pain intensity ratings for experimentally
36 induced pain (George et al. 2006; Roelofs et al. 2004b; Hirsh et al. 2008). In a number of prospec-
37 tive studies, pain-related fear proved to be a powerful predictors of disability 6 months or 1 year
38 after acute pain onset (Klenerman et al. 1995; Swinkels-Meewisse et al. 2006; Turner et al. 2006;
39 Vlaeyen et al. 1995b)

40 Avoidance behaviour

41 In chronic pain research, avoidance behaviour is commonly derived from the suboptimal
42 performance of activities. Several studies have demonstrated that pain patients perform less well
43 on behavioural performance tasks like lifting or walking tasks (Vlaeyen and Linton 2000). In
44 addition, Crombez and colleagues (1999) showed that pain-related fear was associated with



1 escape/avoidance of physical activities, resulting in poor behavioural performance. More recently,
2 a number of studies have provided support for the relation between pain-related fear and avoid-
3 ance. Al Obaidi and colleagues (2003) demonstrated that pain-related fear was associated with
4 decreased speed in preferred and fast walking. In addition, Geisser and colleagues (2000) and
5 Vowles and Gross (2003) showed diminished performance on physical tasks in high pain-fearful
6 individuals. Supporting the tenets of the fear-avoidance model, there is thus compelling evidence
7 that pain-related fear underlies avoidance behaviours in chronic pain. Nevertheless, it should
8 be noted that a number of studies failed to demonstrate a relationship between fear and avoidance
9 (George et al. 2006; Huis in 't Veld et al. 2007, Michael and Burns 2004). For example, Reneman
10 and colleagues found a weak to no relation at all between pain-related fear and performance of
11 functional activities in a sample of CLBP patients (Reneman et al. 2003; Reneman et al. 2007). In
12 addition, some studies showed conflicting results, in that pain-related fear was associated with
13 task persistence rather than avoidance. Pain-related fear may elicit different behaviours depend-
14 ing on current goal context, and vice versa, outwardly similar behaviours may be driven by differ-
15 ent motivational strategies. Such an affective-motivational perspective will probably initiate a
16 next generation of studies addressing new questions including the following: (1) Can higher order
17 goals inhibit the primary goal to protect the integrity of the body by hypervigilance, escape, and
18 avoidance behaviour?; (2) What is the effect of life goal interference and goal conflict on pain-
19 related fear? (see e.g. Karsdorp et al. 2010; Van Damme et al. 2008; Vlaeyen and Morley 2004).

20 Hypervigilance and attention

21 Hypervigilance for pain is defined as the excessive orientation towards pain and pain-related
22 stimuli in both the external and the internal environment. Using Stroop paradigms and dot-
23 probe tasks, a number of studies have provided evidence that pain fearful individuals do show
24 attentional bias towards pain-related information or bodily sensations (Asmundson and
25 Hadjistavropoulos 2007; Keogh et al. 2001; Roelofs et al. 2002, 2003). Furthermore, a series of
26 studies have shown that pain demands attention and disrupts ongoing activities (Crombez et al.
27 1998a, 2002a; Eccleston and Crombez 1999). This disruptive effect of pain on attention has been
28 demonstrated in pain patients as well as in healthy controls, and is dependent upon the novelty,
29 unpredictability, and intensity of pain (Crombez et al. 1998a). Furthermore, a series of studies
30 showed that pain-fearful patients attend more to pain-threatening signals, are less able to ignore
31 pain-related information, and perform worse on cognitive demanding tasks in comparison to
32 non-fearful patients (Crombez et al. 1998b, 2002a; de Gier et al. 2003; Eccleston et al. 1997; Peters
33 et al. 2002). Supporting the idea that pain vigilance is dependent on pain-related fear, Deghani
34 and colleagues (2004) reported a study in which reductions in pain-related fear account for
35 diminished attentional bias for pain after treatment. In addition, experimental laboratory studies
36 have repeatedly demonstrated the association between elevated levels of pain catastrophizing and
37 deteriorated cognitive task performance under conditions of pain (Crombez et al. 2002a; Van
38 Damme et al. 2002; Vancleef and Peters 2006). Recent evidence has shown that the interruptive
39 effect of pain on attention results from the difficulty to *disengage* attention from pain-related
40 information, rather than from an attentional shift towards pain (Asmundson et al. 2005; Roelofs
41 et al. 2005; Van Damme et al. 2002). This attentional disengagement has been proposed to be
42 enhanced by the anticipation of pain (Van Damme et al. 2004).

43 Depression

44 Although depressed mood is one of the presumed consequences of longstanding avoidance of
45 daily activities, a small number of studies have actually examined depression in relation to pain-
46 related fear. Grotle et al. (2004) found only modest associations between pain-related fear and a



1 measure of distress, both in acute and CLBP patients. Sullivan et al. (2008) examined the effects
2 of a pain rehabilitation program aimed at work resumption on changes in levels of pain and
3 depression. This study revealed that changes in depression were mainly predicted by the level of
4 chronicity, and that this relationship was mediated by pain reduction, and not by changes in
5 pain catastrophizing or fear of movement/re-injury. There is a need for more systematic studies
6 examining the association between pain-related fear and depression.

7 **Disuse**

8 Frequent and enduring avoidance of daily activities may also result in gradual deterioration of a
9 person's muscular system and fitness. The term 'disuse syndrome' refers to the physiological and
10 psychological effects of a reduced level of physical activity in daily life (Bousema et al. 2007;
11 Verbunt et al. 2003). Although often referred to in the literature, the disuse syndrome still is ill-
12 defined (Wittink et al. 2000). Generally, two different aspects are distinguished: physical decon-
13 ditioning, which can either be expressed in weakened muscle strength or reduced aerobic fitness,
14 and disordered muscle coordination during physical activity (also called 'guarded movements').
15 Generally, the physical fitness levels of CLBP patients are found to be either lower or equal to that
16 of healthy subjects (Verbunt et al. 2003). Only one current study succeeded in demonstrating that
17 CLBP patients have lower aerobic fitness than matched healthy counterparts, while this could not
18 be explained by pain-related fear or other relevant variables (Smeets et al. 2006). Evidence for
19 disordered muscle coordination was found by (Geisser et al. 2004), who showed that among
20 CLBP patients pain-related fear was not only associated with reduced lumbar flexion and greater
21 EMG in full flexion, but also to abnormalities in the muscle activity during flexion from the
22 standing position. These changes in musculoskeletal functioning and flexion may be important
23 for the understanding of how pain may interfere with daily life functioning. In sum, it still is
24 unclear what the effects of pain-related fear are on physical functioning, both in terms of reduced
25 aerobic fitness as disordered muscle coordination (see also Chapter 12).

26 14.2.4 **Vulnerabilities for fear of pain**

27 The foregoing paragraphs offer support for the importance of pain-related fear and associated
28 avoidance behaviour in chronic pain. However, an interesting issue that presents itself concerns
29 the aetiology of pain-related fear. Complementing fear-learning theories as described in earlier
30 paragraphs, several factors have been proposed to constitute vulnerability for pain-related fear.
31 As such, research has indicated that fear of pain is closely related to a number of negative emo-
32 tional constructs, like negative affectivity, trait anxiety, anxiety sensitivity, and injury/illness sen-
33 sitivity (Keogh and Asmundson 2004; for more information see Chapter 12). Elevated levels of
34 anxiety sensitivity and injury illness sensitivity have been frequently found related to maladaptive
35 responses to pain in terms of reduced tolerance for pain, increased pain intensity levels, attention
36 bias for pain etc (Stewart and Asmundson 2006; Vancleef and Peters 2006; Vancleef et al. 2006).
37 In addition, trait anxiety and negative affectivity have been found related to increased pain inten-
38 sity, increased discomfort and disability by the pain, hypervigilance for internal bodily sensations,
39 and less adequate coping with and perceived control over pain (Keogh and Asmundson 2004;
40 Stegen et al. 2001). One way to conceptualize the various constructs in relation to each other is by
41 representing them in a hierarchical tree structure (Keogh and Asmundson 2004; Vancleef et al.
42 2006; Vancleef et al. 2009). In this hierarchical tree, fear of pain is conceived as the most *specific*
43 construct that resides at the lowest level of the tree. Fear of pain is subordinated to anxiety sensi-
44 tivity and injury illness sensitivity that in their turn subordinate to trait anxiety. One level above
45 trait anxiety, negative affectivity represents the most *general* and stable negative emotional
46 construct at the top of the tree. A hierarchical structure offers an elucidating framework for the





1 conceptualization of pain-relevant negative emotional constructs. As such, content overlap
2 between the constructs is accounted for by interrelations between constructs, while each indi-
3 vidual construct possesses unique explanatory value for pain as well. According to the tree struc-
4 ture, pain-related fear will exert the most direct influence on pain, while influences of other like
5 anxiety sensitivity for example are understood to run through the specific fears that are found
6 at the lower positioned levels. It is important to note that the hierarchical structure serves a
7 mere theoretical conceptualization to date that serves to aid our understanding of the relative
8 contribution of various negative emotional constructs to pain. Nevertheless, it seems obvious that
9 general and stable anxiety related constructs entail vulnerability for pain-related fear and pain
10 catastrophizing. Therefore, it is important that diagnostic and treatment approaches to pain keep
11 these other pain anxiety constructs into account in understanding and treating individual pain
12 problems.

13 14.3 Assessment of pain-related fear

14 Patients with fear of pain are at risk for developing persistent back pain and disability, which
15 implies a need to make a thorough assessment of pain-related fear and avoidance. As pain-related
16 fear involves cognitions, emotions, overt behaviour and physiological responses, several methods
17 are needed to fully understand patients' reactions to pain. This section provides an overview of
18 assessment tools that are frequently used in current research and clinical practice to assess pain-
19 related fear. As such, both clinicians and researchers rely heavily on interviews and self-report
20 measures to assess fear. Several widely used validated questionnaires are also useful tools in
21 the assessment of fear. Furthermore, another tool based on pictures of every day movements
22 is helpful in determining fear and above all the avoidance of movements. In order to get a
23 more complete picture and to be able to grasp different components of the object of pain-related
24 fear, self-report measures are often combined with observational or physiological measures.
25 A multimodal assessment presumably helps us to reach a better understanding of patients' fear
26 of pain.

27 14.3.1 Self-report measures

28 The most common way to assess pain-related fear is through self-report measures which cover
29 different aspects of fear. Most of these focus on cognitive and affective responsivity that may
30 indicate fear. A challenge in developing self-report measures has been isolating the emotional
31 response as opposed to measuring 'beliefs'. Indeed, many of the instruments available appear to
32 tap into beliefs that the patient holds rather than things that actually provoke fear. Similarly, some
33 instruments may measure affect but may be more oriented towards 'worry' rather than to actual
34 fear. Although this may seem to some to be a mute point, the differences may be significant espe-
35 cially if the proposed treatment (see the section on exposure *in vivo*) focuses on fear. At present,
36 a large number of self-report measures are available for the assessment of pain-related fear. The
37 choice for one measure over the other mainly depends on the object of fear (e.g. fear of pain, fear
38 of movement, fear of re-injury), and the fear specific concerns (e.g. cognitive concerns, physical
39 concerns, emotional concerns) one aims to measure. Furthermore, whereas some measures are
40 more generally applicable for assessing fear in both healthy and pain populations, others are more
41 appropriate for assessment in specific pain patient groups only (e.g. cervical pain, back pain).
42 Some of the most commonly used self-report measures of pain-related fear in the current assess-
43 ment and treatment of pain-related fear are listed below. However, this list is not conclusive, and
44 other measures, including modified versions of the questionnaires described below are eligible for
45 use in pain research and clinical practice as well.





1 It should be noted that self-report instruments are subject to a number of drawbacks that have
2 to be kept in mind when interpreting results of these measures. As such, respondents might not
3 always report their genuine thoughts and feelings, because of social desirability, response bias, or
4 simply because they are unable to access and grasp their real concerns. Furthermore, no one-to-
5 one relationship between the measure and the latent construct it represents can be assumed.
6 Nevertheless, keeping these drawbacks in mind, psychometric evaluated self-report measures are
7 easy to administer, at low-cost, but still offer valuable information to researchers and clinicians.

8 Fear of pain

9 The *Pain and Impairment Relationship Scale (PAIRS)* was an early attempt to capture chronic pain
10 patients' beliefs and attitudes towards pain and ability to function despite pain (Riley et al. 1988).
11 It consists of 15 statements about pain and activity (e.g. 'I can't go about my normal life activities
12 when I am in pain', 'An increase in pain is an indication that I should stop what I am doing
13 until the pain decreases') which are rated on a seven-point scale (0=completely disagree;
14 6=completely agree). The scale has been found to have good psychometric properties (DeGood
15 and Shutty 1992) and may be used to assess beliefs about pain and activity. As this scale was a
16 relatively early attempt to assess pain-related fear, it is not clear what processes it in fact captures.
17 Indeed, it appears to assess a wide range of attitudes and beliefs concerning living with persistent
18 pain that go beyond fear of pain.

19 The *Pain Anxiety Symptoms Scale (PASS)* was developed to measure general anxiety and fear in
20 people with chronic pain (McCracken et al. 1992). The original scale consisted of 40 items
21 intended to assess four aspects of pain-related anxiety: (1) fearful appraisal of pain (e.g. 'When
22 I feel pain I am afraid something terrible will happen'); (2) cognitive anxiety (e.g. 'During painful
23 episodes it is difficult for me to think of anything besides the pain'); (3) physiological anxiety (e.g.
24 'Pain seems to cause my heart to pound or race'); (4) escape and avoidance behaviour (e.g.
25 'I avoid important activities when I hurt'). Responders how often they have these thoughts or
26 sensations on a six-point scale (0=never; 5=always). Later, a shortened version of the scale was
27 developed and validated (PASS-20) (McCracken and Dhingra 2002). The short form version has
28 20 items and has been found to be a good reflection of the original PASS (Roelofs et al. 2004a).
29 One of the advantages with this measure is that it includes bodily indicators of fear through ques-
30 tions about physiological arousal. However, as these reactions might appear as a direct conse-
31 quence of pain, it is difficult to determine whether it actually captures indicators of fear.
32 Furthermore, as bodily reactions are difficult to assess through self-report measures, physiologi-
33 cal measures might be preferable if available. In addition, the questions in the PASS presume
34 that the individual has an earlier or present experience of pain problems. This makes the PASS
35 inappropriate for use with people who are not clinical pain patients.

36 The *Fear of Pain Questionnaire-III (FPQ-III)* (McNeil and Rainwater 1998) was developed to
37 assess fear associated with both acute and chronic pain in healthy individuals. People are asked to
38 rate their fear of pain in 30 situations, which are divided into: (1) severe pain (e.g. 'Breaking your
39 leg'), (2) minor pain (e.g. 'Having a muscle cramp') and (3) medical pain (e.g. "Having a tooth
40 pulled"). Answers are given on a five-point scale (1=no fear at all; 5=extreme fear). Recently, a
41 shortened version of the scale has been developed (FPQ-SF) (Asmundson et al. 2008). The authors
42 suggest that the FPQ-SF is a more psychometrically sound alternative to the original scale. One
43 advantage of the FPQ is that it is possible to use it both with pain and non-pain populations as the
44 questions do not imply any earlier clinical experience of pain. However, the non-clinical focus
45 of the scale might make it less relevant to use for clinical purposes as some of the items
46 describe events that are far from clinical situations (e.g. having sand or dust blowing into your
47 eyes; gulping a hot drink before it has cooled).



1 Fear of pain-causing activities

2 The Fear-Avoidance Beliefs Questionnaire (FABQ) (Waddell et al. 1993) is used to assess
3 pain patients' beliefs about possible harm from work and physical activities. It has 16 items which
4 are divided into two subscales; (1) fear-avoidance beliefs about physical activity (e.g. 'Physical
5 activity might harm my back') and (2) fear-avoidance beliefs about work ('My work aggravated
6 my pain'). Answers are given on a seven-point scale (0=completely disagree; 6=completely
7 agree). The scale has been found to have good psychometric properties in patients with both acute
8 and long-term pain (Swinkels-Meewisse et al. 2003; Waddell et al. 1993), and may be used to
9 identify beliefs that are related to pain-related disability and work loss. One of the disadvantages
10 with this questionnaire might be, contrary to what the name of the scale indicates that it assesses
11 *beliefs* rather than fear per se. It might be possible that people hold such beliefs without being
12 particularly fearful, which is important to take into account when using this scale in a clinical
13 context.

14 Fear of movement and (re)injury

15 The Tampa Scale for Kinesiophobia (TSK) (Kori et al. 1990) has been developed to assess patients'
16 fear of (re)injury due to movement, and consists of 17 items (e.g. 'Pain always means I have
17 injured my body' and 'If I try to overcome it, my pain would increase').

18 Later, a shorter version of the TSK has been developed and validated, containing only 13 items
19 as it excludes the four items that are reverse scored. This version has greater internal consistency
20 and is composed of two lower-order factors ('Activity Avoidance' and 'Somatic Focus') that also
21 load on a single higher-order factor (Geisser et al. 2000). A number of studies have corroborated
22 the two-factor structure of TSK, which also appeared invariant across pain diagnoses and Dutch,
23 Swedish, and Canadian samples (Goubert et al. 2004b; Roelofs et al. 2007). One concern that has
24 been highlighted about the TSK is that some items have troublesome wording (Pool et al. 2009).
25 More specifically, some questions seem to be difficult to understand because they employ words
26 such as 'dangerous' and 'injury' that may have different meanings for different patients. Some
27 items also use negations which may be difficult for some patients to understand. These reflections
28 might be important to take into consideration when using the TSK with patients.

29 Perceived harmfulness of movements: the PHODA

30 When fear of movement is assessed in a clinical context, the Photograph Series of Daily Activities
31 (PHODA) (Kugler et al. 1999) is a pictorial assessment tool which consists of 98 photographs of
32 various daily-life activities (e.g. walking, lifting, bending, etc.). Patients are asked to rate how
33 harmful they think each activity would be to their back by placing the photographs on a ther-
34 mometer which ranges from 0 (=not at all harmful) to 100 (=extremely harmful). Although the
35 PHODA mainly is used as a self-report measure, it also provides the clinician with an opportunity
36 to observe and discuss the patient's fear when confronted with different activities. The PHODA is
37 commonly used in the assessment phase of exposure *in vivo*, a treatment for pain-related fear that
38 is described later in this chapter. Recently, an electronic and shortened version of the PHODA
39 (PHODA-SeV) was developed and validated (Leeuw et al. 2007b). It showed excellent psycho-
40 metric properties, which implies that it is a proper alternative to the original version. One limita-
41 tion that has been raised is that the PHODA seems to be more appropriate for highly fearful pain
42 patients and less applicable for those with low or mediate levels of fear (Trost et al. 2009).
43 Nevertheless, because the PHODA consists of photographs of real activities, it may be a clinically
44 useful tool for revealing the patients' beliefs and concerns about specific movements. This is an
45 important basis for the exposure treatment and one which may be quite difficult without tools
46 such as the PHODA.



1 An alternative measure to assess fear of movement is the Pictorial Fear of Activity Scale-Cervical
 2 (PFAcTS-C) (Turk et al. 2008). This instrument was recently developed to assess fear of move-
 3 ment that is specifically related to neck pain. The PFAcTS-C differs from the PHODA in its
 4 specific focus on neck pain and the varying degree of mechanical load that is incorporated in the
 5 photographs. The instrument consists of 77 photographs of movements with varying biome-
 6 chanical stress. Respondents are asked, for each photograph, to rate on a scale from 0 (=no fear at
 7 all) to 10 (=extremely fearful) how worried or fearful they would be to perform the activity as
 8 shown in the picture. A first validation study in a group of neck pain patients indicated that the
 9 PFAcTS-C is a promising tool for assessing fear of movement in patients with cervical pain (Turk
 10 et al. 2008). However, since this tool is still rather new, more research is needed to examine its
 11 applicability.

12 14.3.2 Interview

13 Apart from questionnaires, every assessment of pain-related fear also involves a rigorous inter-
 14 view. The semi-structured interview is an important tool for collecting additional information
 15 about the patient's cognitions, emotions and overt behaviour (e.g. avoidance) in relation to pain.
 16 The clinician also may get a better picture of the role fear and avoidance may have played in the
 17 aetiology and maintenance of the pain and disability problem. However, as the interview provides
 18 a purely subjective picture of the pain problem, it should be complemented by other assessment
 19 tools. Some of the areas that are covered in the interview are listed in Table 14.1

20 14.3.3 Self-assessment

21 Self-assessment is a useful supplement to the interview. Self-assessment is one of the most com-
 22 monly used methods in psychological research and practice (Sigmon and LaMattina 2006). In
 23 self-assessment, the patients systematically observe and record their own behaviour. In pain

Table 14.1 Interview in assessment of pain-related fear

Description of the pain	Where do you have pain? What does the pain feel like? How intense is the pain? (0–10) When does it hurt more? When does it hurt less?
Learning history	When did the pain start? How did it develop? What do you think has made your pain problem worse?
Cognitions	What do you think causes your pain? When you do something that provokes the pain, what goes through your mind? What do you think it will lead to in the future? What is the worst thing that could happen?
Emotions	What emotions do you have in relation to the pain? Are there any activities that you are afraid of doing?
Activities/movements vs. avoidance	What are you able to do despite the pain? What activities do you avoid because of the pain? How active are you in daily life?
Coping vs. safety behaviours	What do you do to stand the pain? What do you do when the pain gets worse? What do you do to be able to perform activities that are difficult because of pain?



1 patients, diaries are used to keep record of situations that provoke fear and avoidance. Often, the
2 patients also use the diary to register their daily activities, which may be an indirect measure of
3 fear and avoidance. In the last years, research about the use of electronic diaries in pain assess-
4 ment has increased (e.g. Jamison et al. 2001; Peters et al. 2000). Maybe this will become more
5 common in clinical practice in the future. At the moment, however, paper-and-pencil diaries are
6 still the most widely used tools in self-assessment of pain-related fear.

7 14.3.4 **Observational measures**

8 Even though it is well known that patients express fear of pain both verbally and non-verbally,
9 there are few standardized tools to assess overt behaviour. Fear of pain has been associated with a
10 number of overt behaviours, such as diminished physical performance and escape/avoidance
11 behaviour (Leeuw et al. 2007a). In a clinical situation, clinicians may instinctively observe how
12 the patient reacts to pain and movement, and use this information in the further assessment.
13 Notwithstanding, a thorough observational assessment is seldom accomplished. There are obser-
14 vational measures which aim to assess pain behaviour (e.g. Weiner et al. 1996). However, these are
15 not developed to capture fear. In verbal assessment of fear, we do not rely solely on one question
16 or on what the patients tell us at first glance, but complement this with standardized question-
17 naires. A comparable scrupulous assessment of overt behaviour would help us to reach a better
18 understanding of patients' pain-related fear.

19 Assessment of other overt behaviours may also help to reach a better understanding of pain-
20 related fear. Facial expression has been suggested to be a potential target for assessment (McNeil
21 and Vowles 2004). However, there is still a lack of appropriate assessment tools for facial expres-
22 sion as a non-verbal manifestation of pain-related fear.

23 14.3.5 **Physiological measures**

24 In the last decades, researchers have paid increasing attention to psychophysiological recordings
25 as an assessment tool for pain-related fear and anxiety. In particular, Flor and her colleagues have
26 contributed to the growing knowledge about how psychophysiological measures may be used in
27 the area of pain (Flor et al. 2001), including as indicators of fear. Muscle tension, skin conduct-
28 ance, and heart rate are some of the targets for psychophysiological assessments in pain patients
29 (Andrasik and Flor 2008). Also the startle reflex, an involuntary eye blink movement, has been
30 used in experiments as an indicator of fear (e.g. Carleton et al. 2006; Naliboff et al. 2008). In
31 clinical settings, however, it is still uncommon to include physiological measures when assessing
32 fear. A challenge for the future is the development of sound psychophysiological measures that
33 may be used in the clinical assessment of pain-related fear.

34 14.3.6 **Additional measures**

35 In addition to explicit and physiological measures of fear of pain, researchers have relied on
36 *indirect* cognitive measures of indicators of fear and anxiety related to pain. In these measures,
37 variables of interest (beliefs, attitudes, cognitive biases) are inferred from behavioural responses
38 (e.g. reaction times, reading times) within a specific context. Characteristic to these measures is
39 the fact that they assess cognitive processes, beliefs, and attitudes without the awareness or control
40 of the participant. Experimental research often uses automatized cognitive processing tasks like
41 the modified Stroop task and the dot probe paradigm to assess attention bias for pain. In the mod-
42 ified Stroop task, categories of sensory or affective pain words and neutral words are presented in
43 different colours. Responders are asked to name the colour of each word and response times are
44 compared. Typically, it takes longer to name the colour when the information is threatening; in





1 this case when pain words are presented. In the dot probe paradigm, one neutral word and one
2 pain-related word are presented simultaneously on a screen. Next, one of the words is replaced by
3 a dot. Response times for when the dot replaces neutral and pain-related words are compared. In
4 pain patients and pain-fearful individuals, reaction time is expected to be shorter when the dot
5 replaces pain words, due to attentional biases. Both the modified Stroop task and the dot probe
6 paradigm are tests of attentional bias which may presumably indicate fear. There are mixed
7 results, however, concerning whether these tests are reliable indicators of fear (e.g. Asmundson
8 et al. 2005; Pincus and Morley 2001; Roelofs et al. 2002).

9 Furthermore, a few studies have relied on *implicit association measures* to assess the attitudes
10 and beliefs that pain-fearful individuals possess regarding pain and disability. These studies dem-
11 onstrated that CLBP patient who are high in pain-related fear possess stronger associations
12 between pain and threat than low-fearful patients do. Furthermore, Goubert et al. (2003) reported
13 about a general implicit negative attitude towards back-stressing pictures in healthy individuals,
14 using an affective priming task. Recently, Leeuw and colleagues (2007d) used two association
15 tasks, the implicit association task and the go-no-go association task, to measure implicit fear of
16 movement(re) injury in a group of CLBP patients and pain-free controls. Results did not indicate
17 implicit fear of movement(re)injury in both groups, nor did the authors observe differences in
18 the implicit attitudes between the patient and the control group. Nevertheless, the authors argued
19 that psychometric and methodological difficulties of the paradigms might explain the lack of
20 findings. In general implicit measures are promising techniques that might be able to reveal
21 those aspects of pain-related fear that are inaccessible to explicit measures like self-report and
22 interviews.

23 14.4 Treating pain-related fear

24 Exposure *in vivo* is a novel treatment approach which has been developed to target fear of pain. As
25 seen earlier in this chapter, fear and avoidance may be essential factors that maintain pain and
26 dysfunction in some patients. It has been stated that 'Fear of pain and what we do about it may be
27 more disabling than pain itself' (Waddell et al. 1993, p. 164). Based on this, graded exposure
28 *in vivo* recently was developed as a cognitive-behavioural treatment for patients with back pain
29 and high levels of pain-related fear (Vlaeyen et al. 2004a). Today, it is the only standardized and
30 evidence-based treatment which exclusively focuses on reducing pain-related fear and avoidance.

31 Because exposure *in vivo* is the 'treatment of choice' for patients suffering from excessive fears,
32 e.g. phobias (Barlow 2000), it would also seem to be ideal for patients with pain-related fear.
33 Accordingly, exposure *in vivo* for pain-related fear relies on the same principles as exposure
34 therapy for phobia. In fact, Kori et al. (1990) went so far as to call fear-related pain a phobia,
35 introducing the term 'kinesiophobia' as a description of 'an excessive, irrational, and debilitating
36 fear of physical movement and activity resulting from a feeling of vulnerability to painful injury
37 or reinjury'. Avoidance of the feared stimuli, which here refers to movements, maintains and
38 exaggerates the fear. During exposure, phobic patients confront the feared stimuli until habitua-
39 tion, i.e. until the fear decreases and finally dissipates. The same principles may be transferred to
40 pain patients. During exposure for pain-related fear, the patient is gradually exposed to move-
41 ments following the hierarchy until extinction of defensive fear responses occur. Besides the effect
42 of extinction there may also be benefits in terms of cognitions. As the fear and avoidance model
43 underscores, performing a feared movement may be associated with catastrophic expectations
44 which, during exposure *in vivo*, are challenged and disconfirmed (Vlaeyen et al. 2008). The main
45 goal in exposure *in vivo* is hence that the patient confronts what (s)he is afraid of as a way to
46 become less fearful. Recent evidence shows that learned associations between certain movements



1 and pain are not abolished during exposure, but that inhibitory learning occurs. This means that
 2 the initial associations remain stored in memory, but that the individual has learned to inhibit the
 3 conditioned (defence) responses. Moreover, the inhibitory learning appears to be context depend-
 4 ent, thereby limiting generalization of extinction to other contexts (Craske et al. 2008; Crombez
 5 et al. 2002b).

6 14.4.1 Main components of exposure

7 Assessment

8 The first step in graded exposure *in vivo* is to perform a thorough assessment of pain-related fear
 9 and avoidance. As assessment has been discussed earlier in this chapter, let us simply review this
 10 briefly here. A proper assessment is a prerequisite for the treatment as it serves to identify target
 11 movements for the exposure. The intention is to get a complete picture of how the patient's fear
 12 and avoidance maintain the pain problem. The PHODA (Leeuw et al. 2007b), an instrument with
 13 pictures of daily activities that patients rate for fear, is an especially important tool in the assess-
 14 ment. Thus, the PHODA provides information as to *which* movements the patient is fearful of
 15 and also *how* afraid they are of each movement. This information is employed to develop a hier-
 16 archy of feared movements. The PHODA may also be used to reveal catastrophic (mis)interpreta-
 17 tions and irrational beliefs that patients have about movements and pain. At the end of assessment,
 18 the therapist should have a clear idea of what movements the patient avoids and what beliefs and
 19 catastrophic thoughts are linked to these movements; this will be the focus of the treatment.

20 Defining goals

21 During the assessment phase, the patient and the therapist agree on a limited number of specific
 22 treatment goals. Goal setting serves a number of important functions. First, the goals serve as a
 23 clear statement of the aim of exposure. A primary aim in cognitive behavioural treatments for
 24 pain is to restore functional ability, and not simply to get rid of the pain. Therefore, goals should
 25 focus on activities and not on pain reduction. Second, when the patient has been involved in
 26 developing goals they view as quite valuable; they become more engaged in the treatment and
 27 naturally take a more active role in the treatment. Third, goals help to structure the treatment. By
 28 establishing goals the patient and the therapist share a picture of what they are striving towards.
 29 The goals also make it easier to establish a hierarchy which involves movements that are impor-
 30 tant for the patient to restore. Typically, a hierarchy includes daily activities that the patient
 31 desires to resume or develop such as hobbies, family life, or work. Fourth, goals are also used as
 32 an evaluation tool. With clear goals, both the patient and the therapist may evaluate treatment
 33 progress and see whether the exposure has succeeded or not. Typical example of treatment goals
 34 are shown in Table 14.2.

Table 14.2 Typical examples of treatment goals

Goal	Description
Play with my kids	Play actively with my kids 30 minutes in the garden twice a week, including lifting them, bending over etc.
Play soccer	Play soccer with my old team 1 hour once a week
Increase my work time	Increase my work time from 25% to 75% at my ordinary work place, including performing all duties.
Do the weekly shopping	Do the weekly shopping by myself, including carrying the bags to the car

**Table 14.3** An example of a graded fear-hierarchy of pain-related fear stimuli

Goal: To play with my kids in the garden 30 minutes, twice a week		
Movement/activity	Pretreatment PHODA score	Post-treatment PHODA score
Running while carrying a child on my shoulders	100	20
Riding off a pavement with a bicycle	90	15
Lifting a child from the floor	80	0
Bending forward to pick up tools from the floor	70	0
Jumping up and down	50	0
Walking up and down the stairs	30	0

1 Establishing hierarchies

2 Once treatment goals are identified, the therapist and the patient need to establish a fear hierar-
 3 chy. The hierarchy consists of movements that provoke pain-related fear starting with those
 4 inducing only a little fear to those trigger a maximum of fear. It normally will include 5–10 steps
 5 or movements. An example of a graded fear-hierarchy is shown in Table 14.3. Exposure begins
 6 with a movement that provokes only a small amount of fear. When habituation occurs and the
 7 patient is able to perform the movement without provoking fear, then the next movement in the
 8 hierarchy is tackled. This procedure continues until the patient is able to perform all of the move-
 9 ments in the hierarchy, including the goal activity, without provoking very much fear. In this way,
 10 function is restored and the clear goals of the treatment are achieved.

11 Education

12 Education is an important part of the treatment. The purpose of the psychoeducation is to pro-
 13 vide a clear rational and to engage the patient. Before being exposed to any fear-provoking stim-
 14 ulti, the patient should understand how and why exposure should reduce fear, and how this will
 15 bring the patient closer to his or her goals. The therapist explains the fear-avoidance model, using
 16 the patient's own history and wording as much as possible. If the patient does not use the word
 17 'fear', other words may be more suitable. An essential message in the education is that fear and
 18 avoidance are natural and normal responses to acute pain, but that they paradoxically maintain
 19 fear and pain in the long term. Another point is that long-term back, neck or shoulder pain typi-
 20 cally signals that muscles are working too hard to protect the back (resulting in muscle pain)
 21 rather than from damage to the spine. There is some evidence that psychoeducation in itself may
 22 have some effect in reducing pain-related fear and disability (Burton et al. 1999; de Jong et al.
 23 2005b; Moore et al. 2000). The psychoeducation aims to enhance the patient's understanding
 24 of how the exposure treatment will help them to deal with their fears and achieve their goals
 25 concerning function.

26 Graded exposure

27 The keystone in exposure is, of course, when the patient actually exposes himself to previously
 28 avoided stimuli according to the fear hierarchy. The patient starts at lower level of the hierarchy,
 29 with a movement that provokes relatively less intense fear. First, the therapist serves as a role
 30 model and demonstrates the movement. Then, the patient performs the movement, with verbal
 31 support from the therapist. The general principles for exposure are followed: the patient is exposed
 32 to the feared stimuli for a prolonged time, until fear and anxiety decreases significantly. In expo-
 33 sure for pain-related fear, the patient consequently performs the movement several times.



1 The therapist encourages the patient to do the exposure without using safety behaviours, i.e.
 2 subtle strategies that patients use to ‘protect’ themselves (guarded walking, relaxation, seeking
 3 social support, etc.). Safety behaviours are subtle avoidance behaviours which may hinder the
 4 effect of exposure (Tang et al. 2007; Vlaeyen et al. 2004a). In between exposure sessions, the
 5 patient is told to continue the exposure at home by performing homework assignments. Besides
 6 reducing fear and re-establishing physical function, this helps the patient to generalize the effects
 7 and enhance self-efficacy. All treatment sessions follow the same structure, each time at a higher
 8 level in the hierarchy, to systematically decrease the patient’s pain-related fear.

9 Behavioural experiments

10 The graded exposure *in vivo* might be combined with behavioural experiments (Bennett-Levy
 11 et al. 2004; Vlaeyen et al. 2004a). Behavioural experiments have been developed from cognitive
 12 theory, to create a collaborative empiricism. The purpose is to challenge irrational beliefs and
 13 catastrophic (mis)interpretations about pain and movement. In a behavioural experiment, the
 14 patient first formulates the belief and rates its credibility. Then, an alternative belief is formulated
 15 and the patient rates its credibility. Next, the patient performs the movement and describes
 16 what happens. Finally, the outcome is compared to the expectation and conclusions are drawn.
 17 Table 14.4 displays an example of a behavioural experiment in a patient with pain-related fear.
 18 The main goal with behavioural experiments is to challenge and adjust irrational beliefs but may
 19 also be used as a way to encourage patients to view the exposure as an experiment in which new
 20 behaviours are tested.

21 14.4.2 Evidence for exposure *in vivo*

22 Exposure *in vivo* is a promising treatment approach for patients with pain-related fear. Two
 23 recent reviews concluded that exposure *in vivo* is currently the treatment of choice for such
 24 patients (; Bailey et al. 2010; Lohnberg 2007). The first research about the effect of exposure was
 25 a series of studies using a replicated single-case experimental design. These showed that graded
 26 exposure *in vivo* was effective in reducing pain-related fear, avoidance behaviour, and to some
 27 extent also pain intensity in patients with back pain (Boersma et al. 2004; Linton et al. 2002;
 28 Vlaeyen et al. 2001). Later, the same type of design was used to evaluate the effect in other groups
 29 of patients. These studies demonstrate the same basic results in patients with complex regional
 30 pain syndrome (de Jong et al. 2005a) and in patients with neck pain after a motor vehicle accident
 31 (de Jong et al. 2008). Further evidence was then provided in randomized control trials (RCTs).
 32 RCTs are generally seen as the most powerful way of demonstrating that an intervention is effec-
 33 tive (Kazdin 2003). Recently, three RCTs have been published, evaluating the effect of exposure

Table 14.4 An example of a behavioural experiment in a patient with pain-related fear

Belief/thought	Rating of credibility before the experiment	Rating of credibility after the experiment
Belief/catastrophic thought: ‘If I jump from the chair, I will get excruciating pain (10 on a scale 0–10)’	85%	20%
Alternative belief: ‘If I jump from the chair, my pain will only increase slightly (2 on a scale 0–10)’	15%	80%
What happened: The pain increased slightly (from 2 to 3 on a scale 0–10)		
Conclusion: The original thought was an overestimation of the harmfulness of the movement. The alternative belief is more realistic.		



1 in patients with long-term back pain (Leeuw et al. 2008; Linton et al. 2008; Woods and Asmundson
2 2008). Although the results are not as striking as in the single-subject studies, exposure was found
3 to result in moderate to large effects for reducing pain-related fear, catastrophic thoughts, disabil-
4 ity and pain. However, when compared to graded activity, a commonly used treatment in pain
5 rehabilitation, the results were more modest (Leeuw et al. 2008; Woods and Asmundson 2008).
6 The exposure groups showed larger improvements on measures of pain-related fear and anxiety,
7 beliefs, and catastrophizing, but on measures of disability and pain both treatments appeared to
8 be about equally effective. Overall, these studies show that exposure may be an important treat-
9 ment, but that it cannot yet be recommended as a 'stand alone' treatment. As the authors of one
10 of the studies suggest (Woods and Asmundson 2008), it is important to explore the use of expo-
11 sure in applied multidisciplinary treatment settings. Given that patients with high levels of pain-
12 related fear become noticeably less fearful and anxious through exposure, it has potential to be a
13 successful addition to ordinary treatment packages for fearful patients suffering from long-term
14 pain. Likewise, new advances in delivering exposure treatments may also improve its utility.

15 14.5 Future directions

16 This chapter shows that the literature on fear-avoidance has strong roots in the learning-
17 conditioning theory. The classical conditioning account of fear development predicts that neutral
18 stimuli can develop fearful qualities and become conditioned fear stimuli (CS) when they are
19 associated with unconditioned aversive stimuli (US). Following this theory, the *nature* of the CS
20 and the US determines the kind of fear. Future research should focus more on the nature of both
21 types of stimuli in fear development. On a continuum from 'outside' to 'inside' the body—an
22 exteroceptive-interoceptive continuum—three types of sensorial receptors can be distinguished.
23 *Exteroceptors* are situated closely to the bodily surface and are sensitive to mechanical and electro-
24 mechanical energetic fields surrounding the organism. *Proprioceptors* are sensitive to the orienta-
25 tion and the action of parts of the body in space. *Interoceptors* are located in the cavities of the
26 body and form the basis for the neural representation of the viscera and the vascular system.
27 Traditionally, human fear conditioning studies have used paradigms in which affectively neutral,
28 exteroceptive stimuli (CSs, e.g. a picture or a tone) become predictors for an aversive physical
29 event (e.g. pain). Pain research has focused more on proprioceptive stimuli (i.e. kinesiophobia).
30 Certain movements may have acquired the features of a CS as they have been associated with a US
31 (more pain), and create fear of movement. Strangely enough, there is much less information in
32 the pain literature on interoceptive fear conditioning. Interoceptive cues (e.g. muscle spasms,
33 mild pain, dizziness . . .) can also become CSs and this might be a particular form of fear condi-
34 tioning differentiates the fear of 'pain' construct from the fear of 'movement' construct (De Peuter
35 et al. 2010). The fear of pain construct might be more relevant in physical complaints where the
36 musculoskeletal system is less involved. Besides the theoretical importance of examining this idea
37 more into detail, findings may also lead to different therapeutic interventions. For example, inte-
38 roceptive exposure has been reported as an effective treatment in patients with panic disorder,
39 assumed to be mediated by interoceptive fear conditioning (Walker and Furer 2008). At this
40 point, it is important to note that the term 'fear-avoidance' as introduced by Lethem et al. in 1983
41 might need reconsideration given the fact that it points only to one defensive mechanism: avoid-
42 ance. It might be more appropriate to adopt the general term 'pain-related fear', which could be
43 defined as the fear that originated in associations where pain is the US. Depending on the CS, this
44 general term can then be subdivided in fear of movement (proprioceptive fear), fear of pain (inte-
45 roceptive fear), fear of sounds (exteroceptive fear, for example in headaches), etc . . . or more
46 diffuse pain anxiety.



1 A second direction for further research on fear-avoidance stems from commonly observed and
2 complex situations in which the individual cannot identify discrete cues that signal or predict the
3 US. In that case the context in which the US occurs becomes the US, and theorists have intro-
4 duced the term 'contextual' fear for this form of fear, which has a lot of resemblances with gener-
5 alized anxiety disorder (Vansteenwegen et al. 2008). Some authors prefer the term 'anxiety' above
6 fear. In the case of contextual fear with pain as the US, one could speak of 'pain anxiety'. The
7 characteristics of pain anxiety are that the defensive responses last longer as contextual stimuli
8 usually are temporally quite stable.

9 In sum, since the early writings in the 1980s we have made considerable progress in the
10 understanding and management of pain-related fear and anxiety, and we look forward to further
11 exploration and fine tuning of these processes in the near future.

12 Acknowledgements

13 The contribution of Johan W. S. Vlaeyen was supported by the NWO Social Sciences Research
14 Council of the Netherlands, Grant No. 453-04-003, and by an Odysseus Grant of the Research
15 Foundation Flanders, Belgium (FWO).

16 References

- 17 Al Obaidi, S. M., Al Zoabi, B., Al Shuwaie, N., Al Zaabie, N. and Nelson, R. M. (2003) The influence of
18 pain and pain-related fear and disability beliefs on walking velocity in chronic low back pain.
19 *International Journal of Rehabilitation Research*, **26**, 101-8.
- 20 Andrasik, F. and Flor, H. (2008) Biofeedback, in H. Breivik, W. Campbell and M.K. Nicholas (ed.) *Clinical*
21 *Pain Management: Practice and procedures*. London: Hodder & Stoughton.
- 22 Asmundson, G. J. and Hadjistavropoulos, H. D. (2007) Is high fear of pain associated with attentional bias
23 for pain-related or general threat? A categorical reanalysis. *Journal of Pain*, **8**, 11-18.
- 24 Asmundson, G. J. G., Bovell, C. V., Carleton, N. R. and McWilliams, L. A. (2008) The Fear of Pain
25 Questionnaire - Short Form (FPQ-SF): Factorial validity and psychometric properties. *Pain*, **134**, 51-58.
- 26 Asmundson, G. J. G., Carleton, N. R. and Ekong, J. (2005) Dot-probe evaluation of selective attentional
27 processing of pain cues in patients with chronic headaches. *Pain*, **114**, 250-6.
- 28 Asmundson, G. J. G., Norton, P. J. and Norton, G. R. (1999) Beyond pain: The role of fear and avoidance
29 in chronicity. *Clinical Psychology Review*, **19**, 97-119.
- 30 Bailey, K. M., Carleton, R. N., Vlaeyen, J. W., Asmundson, G. J. (2010) Treatments addressing pain-related
31 fear and anxiety in patients with chronic musculoskeletal pain: A preliminary review. *Cognitive*
32 *Behaviour Therapy*, **39**(1), 46-63.
- 33 Barlow, D. H. (2000) Unravelling the mysteries of anxiety and its disorders from the perspective of emotion
34 theory. *American Psychologist*, **55**, 1247-63.
- 35 Bennett-Levy, J., Butler, G., Fennell, M., Hackmann, A., Mueller, M. and Westbrook, D. (2004) *Oxford*
36 *Guide to Behavioral Experiments in Cognitive Psychology*, Oxford: Oxford University Press.
- 37 Boersma, K., Linton, S. J., Overmeer, T., Jansson, M., Vlaeyen, J. W. S. and de Jong, J. (2004) Lowering
38 fear-avoidance and enhancing function through exposure in vivo. A multiple baseline study across six
39 patients with back pain. *Pain*, **108**, 8-16.
- 40 Bortz, W. M. (1984) The disuse syndrome. *The Western Journal of Medicine*, **141**, 691-4.
- 41 Bousema, E. J., Verbunt, J. A., Seelen, H. A., Vlaeyen, J. W. and Knottnerus, J. A. (2007) Disuse and
42 physical deconditioning in the first year after the onset of back pain. *Pain*, **130**, 279-86.
- 43 Bradley, M., Silakowski, T. and Lang, P. J. (2008) Fear of pain and defensive activation. *Pain*, **137**, 156-63.
- 44 Burton, A. K., Waddell, G., Tillotson, K. M. and Summerton, N. (1999) Information and advice to patients
45 with back pain can have a positive effect. A randomized controlled trial of a novel educational booklet
46 in primary care. *Spine*, **24**, 2484-91.





- 1 Carleton, N. R., Asmundson, G. J. G., Collimore, K. C. and Ellwanger, J. (2006) Strategic and automatic
2 threat processing in chronic musculoskeletal pain: a startle probe investigation. *Cognitive Behaviour*
3 *Therapy*, **35**, 236–47.
- 4 Craske, M. G., Kircanski, K., Zelikowsky, M., Mystkowski, J., Chowdhury, N. and Baker, A. (2008)
5 Optimizing inhibitory learning during exposure therapy. *Behaviour Research and Therapy*, **46**, 5–27.
- 6 Crombez, G., Eccleston, C., Baeyens, F. and Eelen, P. (1998a) Attentional disruption is enhanced by the
7 threat of pain. *Behaviour Research and Therapy*, **36**, 195–204.
- 8 Crombez, G., Eccleston, C., van den Broeck, A., van Houdenhove, B. and Goubert, L. (2002a) The effects
9 of catastrophic thinking about pain on attentional interference by pain: No mediation of negative
10 affectivity in healthy volunteers and in patients with low back pain. *Pain Research and Management*,
11 **7**, 31–9.
- 12 Crombez, G., Eccleston, C., Vlaeyen, J. W. S., Vansteenwegen, D., Lysens, R. and Eelen, P. (2002b)
13 Exposure to physical movements in low back pain patients: Restricted effects of generalization. *Health*
14 *Psychology*, **21**, 573–78.
- 15 Crombez, G., Vervaeke, L., Baeyens, F., Lysens, R. and Eelen, P. (1996) Do pain expectancies cause pain in
16 chronic low back patients? A clinical investigation. *Behaviour Research and Therapy*, **34**, 919–25.
- 17 Crombez, G., Vervaeke, L., Lysens, R., Baeyens, F. and Eelen, P. (1998b) Avoidance and confrontation of
18 painful, back-straining movements in chronic back pain patients. *Behavior Modification*, **22**, 62–77.
- 19 Crombez, G., Vlaeyen, J. W. S., Heuts, P. H. T. G. and Lysens, R. (1999) Pain-related fear is more disabling
20 than pain itself: evidence on the role of pain-related fear in chronic back pain disability. *Pain*, **80**,
21 329–39.
- 22 de Gier, M., Peters, M. L. and Vlaeyen, J. W. (2003) Fear of pain, physical performance, and attentional
23 processes in patients with fibromyalgia. *Pain*, **104**, 121–30.
- 24 de Jong, J. R., Vangronsveld, K., Peters, M. L., et al. (2008) Reduction of pain-related fear and disability in
25 post-traumatic neck pain: a replicated single-case experimental study of exposure in vivo. *Journal of*
26 *Pain*, **9**, 1123–34.
- 27 de Jong, J. R., Vlaeyen, J. W. S., Onghena, P., Cuypers, C., den Hollander, M. and Ruijgrok, J. (2005a)
28 Reduction of pain-related fear in complex regional pain syndrome type 1: the application of graded
29 exposure in vivo. *Pain*, **116**, 264–75.
- 30 de Jong, J. R., Vlaeyen, J. W. S., Onghena, P., Goossens, M. E. J. B., Geilen, M. and Mulder, H. (2005b)
31 Fear of Movement/(Re)injury in Chronic Low Back Pain: Education or Exposure In Vivo as Mediator
32 to Fear Reduction? *Clinical Journal of Pain*, **21**, 9–17.
- 33 De Peuter, S., Van Diest, I., Vansteenwegen, D., Van den Bergh, O., Vlaeyen, J. W. S. Pain-related fear and
34 chronic pain: Interoceptive fear conditioning as a novel approach. *European Journal of Pain*
35 (submitted manuscript: accepted pending revision).
- 36 DeGood, D. E. and Shutt, M. S. (1992) Assessment of pain beliefs, coping and self-efficacy, in D. C. Turk
37 and D.C. Melzack (ed.) *Handbook of pain assessment*. New York: Guilford.
- 38 Dehghani, M., Sharpe, L. and Nicholas, M. K. (2004) Modification of attentional biases in chronic pain
39 patients: a preliminary study. *European Journal of Pain*, **8**, 585–94.
- 40 Eccleston, C. and Crombez, G. (1999) Pain demands attention: A cognitive-affective model of the
41 interruptive function of pain. *Psychological Bulletin*, **125**, 356–66.
- 42 Eccleston, C., Crombez, G., Aldrich, S. and Stannard, C. (1997) Attention and somatic awareness in
43 chronic pain. *Pain*, **72**, 209–15.
- 44 Edwards, R. R., Haythornthwaite, J. A., Sullivan, M. J. and Fillingim, R. B. (2004) Catastrophizing as a
45 mediator of sex differences in pain: differential effects for daily pain versus laboratory-induced pain.
46 *Pain*, **111**, 335–41.
- 47 Flor, H., Miltner, W. and Birbaumer, N. (2001) Psychophysiological recording methods. In
48 D. C. T. Melzack (Ed.) *Handbook of Pain Assessment*. New York: Guilford.
- 49 Fordyce, W. E. (1976) *Behavioural methods for chronic pain and illness*, St. Louis, Mosby.



- 1 Fordyce, W. E., Shelton, J. L. and Dundore, D. E. (1982) The modification of avoidance learning in pain
2 behaviors. *Journal of Behavioral Medicine*, **5**, 405–14.
- 3 Fritz, J. M., George, S. Z. and Delitto, A. (2001) The role of fear-avoidance beliefs in acute low back pain:
4 relationships with current and future disability and work status. *Pain*, **94**, 7–15.
- 5 Geisser, M., Haig, A., Wallbom, A. and Wiggert, E. (2004) Pain-related fear, lumbar flexion, and dynamic
6 EMG among persons with chronic musculoskeletal low back pain. *Clinical Journal of Pain* **20**, 61–9.
- 7 Geisser, M. E., Haig, A. J. and Theisen, M. E. (2000) Activity avoidance and function in persons with
8 chronic back pain. *Journal of Occupational Rehabilitation*, **10**, 215–27.
- 9 George, S. Z., Dannecker, E. A. and Robinson, M. E. (2006) Fear of pain, not pain catastrophizing, predicts
10 acute pain intensity, but neither factor predicts tolerance or blood pressure reactivity: An experimental
11 investigation in pain-free individuals, **10**, 457–65.
- 12 Giummarra, M. J., Gibson, S. J., Georgiou Karistianis, N. and Bradshaw, J. L. (2007) Central mechanisms
13 in phantom limb perception: the past, present and future. *Brain Research Reviews*, **54**, 219–32.
- 14 Goubert, L., Crombez, G. and De Bourdeaudhuij, I. (2004a) Low back pain, disability and back pain myths
15 in a community sample: prevalence and interrelationships. *European Journal of Pain*, **8**, 385–94.
- 16 Goubert, L., Crombez, G., Hermans, D. and Vanderstraeten, G. (2003) Implicit attitude towards pictures
17 of back-stressing activities in pain-free subjects and patients with low back pain. *European Journal of*
18 *Pain*, **7**, 33–42.
- 19 Goubert, L., Crombez, G., Van Damme, S., Vlaeyen, J. W. S., Bijttebier, P. and Roelofs, J. (2004b)
20 Confirmatory factor analysis of the Tampa Scale for Kinesiophobia: invariant two-factor model across
21 low back pain patients and fibromyalgia patients. *Clinical Journal of Pain*, **20**, 103–10.
- 22 Goubert, L., Francken, G., Crombez, G., Vansteenwegen, D. and Lysens, R. (2002) Exposure to physical
23 movement in chronic back pain patients: No evidence for generalization across different movements.
24 *Behaviour Research and Therapy*, **40**, 415–29.
- 25 Grotle, M., Vollestad, N. K., Veierod, M. B. and Brox, J. I. (2004) Fear-avoidance beliefs and distress in
26 relation to disability in acute and chronic low back pain. *Pain*, **112**, 343–52.
- 27 Haythornthwaite, J. A., Clark, M. R., Pappagallo, M. and Raja, S. N. (2003) Pain coping strategies play a
28 role in the persistence of pain in post-herpetic neuralgia. *Pain*, **106**, 453–60.
- 29 Hirsh, A. T., George, S. Z., Bialosky, J. E. and Robinson, M. E. (2008) Fear of pain, pain catastrophizing,
30 and acute pain perception: relative prediction and timing of assessment. *Journal of Pain*, **9**, 806–12.
- 31 Huis in 't Veld, R. M. H. A., Vollenbroek-Hutten, M. M. R., Groothuis-Oudshoorn, K. C. G. M. and
32 Hermens H. J. (2007) The role of the fear-avoidance model in female workers with neck-shoulder
33 pain related to computer work. *Clinical Journal of Pain*, **23**, 28–34.
- 34 Izard, C. E. (1992) Basic emotions, relations among emotions, and emotion-cognition relations.
35 *Psychological Review*, **99**, 561–5.
- 36 Jamison, R. N., Raymond, S. A., Levine, J. G., Slawsby, E. A., Nedeljkovic, S. S. and Katz, N. P. (2001)
37 Electronic diaries for monitoring chronic pain: 1-year validation study. *Pain*, **91**, 277–85.
- 38 Jensen, M. P., Brant-Zawadzki, M., Obuchowski, N., Modic, M., Malkasian, D. and Ross, J. (1994)
39 Magnetic resonance imaging of the lumbar spine in people without back pain. *New England Journal of*
40 *Medicine*, **331**, 69–73.
- 41 Karsdorp, P. A., Nijst, S. E., Goossens, M. E. and Vlaeyen, J. W. S. (2009) The role of current mood and
42 stop rules on physical task performance: An experimental investigation in patients with work-related
43 upper extremity pain. *European Journal of Pain*, **14**(4), 434–40.
- 44 Kazdin, A. E. (2003) *Research design in clinical psychology*. Boston, MA: Allyn & Bacon.
- 45 Keogh, E. and Asmundson, G. J. G. (2004) Negative affectivity, catastrophizing, and anxiety sensitivity. In
46 G. J. G. Asmundson, J. W. S. Vlaeyen and G. Crombez, G. (ed.) *Understanding and treating fear of pain*.
47 New York: Oxford University Press.
- 48 Keogh, E., Ellery, D., Hunt, C. and Hannett, I. (2001) Selective attentional bias for pain-related stimuli
49 amongst pain fearful individuals. *Pain*, **91**, 91–100.



- 1 Klenerman, L., Slade, P. D., Stanley, I. M., et al. (1995) The prediction of chronicity in patients with an
2 acute attack of low back pain in a general practice setting. *Spine*, **20**, 478–84.
- 3 Kori, S. H., Miller, R. and Todd, D. (1990) Kinesiophobia: a new view of chronic pain behavior. *Pain*
4 *Management*, Jan/Feb, 35–43.
- 5 Kugler, K., Wijn, J., Geilen, M., de Jong, J. and Vlaeyen, J. W. S. (1999) *The photograph series of daily*
6 *activities (PHODA). CD-rom version 1.0.*, Heerlen, The Netherlands: Institute for Rehabilitation
7 Research and School for Physiotherapy.
- 8 Leeuw, M., Goossens, M. E., Linton, S. J., Crombez, G., Boersma, K. and Vlaeyen, J. W. (2007a) The
9 fear-avoidance model of musculoskeletal pain: current state of scientific evidence. *Journal of Behavioral*
10 *Medicine*, **30**, 77–94.
- 11 Leeuw, M., Goossens, M. E. J. B., van Breukelen, G. J. P., Boersma, K. and Vlaeyen, J. W. S. (2007b)
12 Measuring perceived harmfulness of physical activities in patients with chronic low back pain: The
13 photograph series of daily activities – Short electronic version. *Journal of Pain*, **8**, 840–49.
- 14 Leeuw, M., Goossens, M. E. J. B., van Breukelen, G. J. P., et al. (2008) Exposure in vivo versus operant
15 graded activity in chronic low back pain patients: Results of a randomized controlled trial. *Pain*,
16 **138**, 192–207.
- 17 Leeuw, M., Houben, R. M., Severeijns, R., Picavet, H. S., Schouten, E. G. and Vlaeyen, J. W. (2007c)
18 Pain-related fear in low back pain: a prospective study in the general population. *European Journal of*
19 *Pain*, **11**, 256–66.
- 20 Leeuw, M., Peters, M. L., Wiers, R. W. and Vlaeyen, J. W. (2007d) Measuring Fear of Movement/(Re)
21 injury in Chronic Low Back Pain Using Implicit Measures. *Cognitive Behaviour Therapy*, **36**, 52–64.
- 22 Lethem, J., Slade, P. D., Troup, J. D. and Bentley, G. (1983) Outline of a Fear-Avoidance Model of
23 exaggerated pain perception—I. *Behaviour Research and Therapy*, **21**, 401–8.
- 24 Linton, S. J. (1998) The socioeconomic impact of chronic back pain: is anyone benefiting? *Pain*, **75**, 163–68.
- 25 Linton, S. J., Boersma, K., Jansson, M., Overmeer, T., Lindblom, K. and Vlaeyen, J. W. S. (2008)
26 A randomized controlled trial of exposure in vivo for patients with spinal pain reporting fear of
27 work-related activities. *European Journal of Pain*, **12**, 722–30.
- 28 Linton, S. J., Overmeer, T., Janson, M., Vlaeyen, J. W. S. and de Jong, J. R. (2002) Graded in-vivo exposure
29 treatment for fear-avoidant pain patients with functional disability: A case study. *Cognitive Behaviour*
30 *Therapy*, **31**, 49–58.
- 31 Lohnberg, J. (2007) A Review of Outcome Studies on Cognitive-Behavioral Therapy for Reducing
32 Fear-Avoidance Beliefs Among Individuals With Chronic Pain. *Journal of Clinical Psychology in*
33 *Medical Settings*, **14**, 113–22.
- 34 McCracken, L. M. and Dhingra, L. (2002) A short version of the Pain Anxiety Symptoms Scale
35 (PASS–20): Preliminary development and validity. *Pain Research and Management*, **7**, 45–50.
- 36 McCracken, L. M., Gross, R. T., Aikens, J. and Carnrike, C. L. M., Jr. (1996) The assessment of anxiety
37 and fear in persons with chronic pain: A comparison of instruments. *Behaviour Research and Therapy*,
38 **34**, 927–33.
- 39 McCracken, L. M., Zayfert, C. and Gross, R. T. (1992) The pain anxiety symptoms scale: development and
40 validation of a scale to measure fear of pain. *Pain*, **50**, 67–73.
- 41 McNeil, D. W. and Rainwater, A. J. (1998) Development of the Fear of Pain Questionnaire—III. *Journal of*
42 *Behavioral Medicine*, **21**, 389–410.
- 43 McNeil, D. W. and Vowles, K. E. (2004) Assessment of fear and anxiety associated with pain:
44 Conceptualization, methods, and measures, in G. J. G. Asmundson, J. W. S. Vlaeyen, and G. Crombez
45 (ed) *Understanding and treating fear of pain*. New York: Oxford University Press.
- 46 Michael, E. S. and Bruns, J. W. (2004). Catastrophizing and pain sensitivity among chronic pain patients:
47 moderating effects of sensory and affect focus. *Annals of Behavioral Medicine*, **27**, 185–94.
- 48 Moore, J. E., Von Korff, M., Cherkin, D., Saunders, K. and Lorig, K. (2000) A randomized trial of
49 cognitive-behavioral program for enhancing back pain self care in a primary care setting. *Pain*,
50 **88**, 145–53.



- 1 Morley, S. and Eccleston, C. (2004) The object of fear in pain, in G. J. G. Asmundson, J. W. S. Vlaeyen, and
 2 G. Crombez (ed.) *Understanding and treating fear of pain*. New York: Oxford University Press.
- 3 Mowrer, O. H. (1947) On the dual nature of learning: a reinterpretation of 'conditioning' an
 4 'problem-solving'. *Harvard Educational Review*, **17**, 102–50.
- 5 Nachemson, A. L., Waddell, G. and Norlund, A. L. (2000) Epidemiology of neck and low back pain, in
 6 A. L. Nachemson and E. Johnsson (ed.) *Neck and back pain: the scientific evidence of causes, diagnosis,
 7 and treatment*. Philadelphia, PA: Lippincott, Williams, and Wilkins.
- 8 Naliboff, B. D., Waters, A. M., Labus, J. S., et al. (2008) Increased acoustic startle responses in ibs patients
 9 during abdominal and nonabdominal threat. *Psychosomatic Medicine*, **70**, 920–27.
- 10 Peters, M. L., Sorbi, M. J., Kruijsse, D. A., Kerssens, J. J., Veerhak, P. F. M. and Bensing, J. M. (2000)
 11 Electronic diary assessment of pain, disability and psychological adaptation in patients differing in
 12 duration of pain. *Pain*, **84**, 181–92.
- 13 Peters, M. L., Vlaeyen, J. W. and Weber, W. E. (2005) The joint contribution of physical pathology,
 14 pain-related fear and catastrophizing to chronic back pain disability. *Pain*, **113**, 45–50.
- 15 Peters, M. L., Vlaeyen, J. W. S. and Kunnen, A. M. W. (2002) Is pain-related fear a predictor of somatosensory
 16 hypervigilance in chronic low back pain patients? *Behaviour Research and Therapy*, **40**, 85–103.
- 17 Philips, H. C. (1987) Avoidance behaviour and its role in sustaining chronic pain. *Behaviour Research and
 18 Therapy*, **25**, 273–9.
- 19 Phillips, C., Main, C. J., Buck, R., Aylward, M., Wynne-Jones, G. and Farr, A. (2008) Prioritising pain in
 20 policy making: The need for a whole systems perspective. *Health Policy*, **88**, 166–75.
- 21 Picavet, H. S. and Schouten, J. S. (2003) Musculoskeletal pain in the Netherlands: prevalences,
 22 consequences and risk groups, the DMC(3)-study. *Pain*, **102**, 167–78.
- 23 Pincus, T. and Morley, S. (2001) Cognitive-processing bias in chronic pain: A review and integration.
 24 *Psychological Bulletin*, **127**, 599–617.
- 25 Pool, J. J. M., Hiralal, S., Ostelo, R. W. J. G., et al. (2009). The applicability of the Tampa Scale of
 26 Kinesiophobia for patients with sub-acute neck pain. *Quality and Quantity*, **43**, 773–80.
- 27 Rachmann, S. (2004) *Anxiety*. Hove: Psychological Press.
- 28 Reneman, M. F., Jorritsma, W., Dijkstra, S. J. and Dijkstra, P. U. (2003) Relationship between
 29 kinesiophobia and performance in a functional capacity evaluation. *Journal of Occupational
 30 Rehabilitation*, **13**, 277–85.
- 31 Reneman, M. F., Schiphorst Preuper, H. R., Kleen, M., Geertzen, J. H. B. and Dijkstra, P. U. (2007) Are
 32 pain intensity and pain related fear related to functional capacity evaluation performances of patients
 33 with chronic low back pain? *Journal of Occupational Rehabilitation*, **17**, 247–58.
- 34 Riley, J. F., Ahern, D. K. and Follnik, M. J. (1988) Chronic Pain and Functional Impairment: Assessing
 35 Beliefs About Their Relationship. *Archives of Physical Medicine and Rehabilitation*, **69**, 579–82.
- 36 Roelofs, J., McCracken, L. M., Peters, M. L., Crombez, G., van Breukelen, G. and Vlaeyen, J. W. S. (2004a)
 37 Psychometric evaluation of the Pain Anxiety Symptoms Scale (PASS) in chronic pain patients. *Journal
 38 of Behavioral Medicine*, **27**, 167–83.
- 39 Roelofs, J., Peters, M. L., Fassaert, T. and Vlaeyen, J. W. (2005) The role of fear of movement and injury in
 40 selective attentional processing in patients with chronic low back pain: a dot-probe evaluation. *Journal
 41 of Pain*, **6**, 294–300.
- 42 Roelofs, J., Peters, M. L., van der Zijden, M. and Vlaeyen, J. W. (2004b) Does fear of pain moderate the
 43 effects of sensory focusing and distraction on cold pressor pain in pain-free individuals? *Journal of
 44 Pain*, **5**, 250–6.
- 45 Roelofs, J., Peters, M. L. and Vlaeyen, J. W. S. (2003) The modified Stroop paradigm as a measure of
 46 selective attention towards pain-related information in patients with chronic low back pain.
 47 *Psychological Reports*, **92**, 707–15.
- 48 Roelofs, J., Peters, M. L., Zeegers, M. P. A. and Vlaeyen, J. W. S. (2002) The modified stroop paradigm
 49 as a measure of selective attention towards pain-related stimuli among chronic pain patients: a
 50 meta-analysis. *European Journal of Pain*, **6**, 273–81.



- 1 Roelofs, J., Sluiter, J. K., Frings-Dresen, M. H. W., et al. (2007) Fear of movement and (re)injury in chronic
2 musculoskeletal pain: Evidence for an invariant two-factor model of the Tampa Scale for
3 Kinesiophobia across pain diagnoses and Dutch, Swedish, and Canadian samples. *Pain*, **131**, 181–90.
- 4 Schmidt, C. O., Raspe, H., Pfingsten, M., et al. (2007) Back pain in the German adult population:
5 Prevalence, severity, and sociodemographic correlates in a multiregional survey. *Spine*, **32**, 2005–11.
- 6 Severeijns, R., van den Hout, M. A. and Vlaeyen, J. W. S. (2005) The causal status of pain catastrophizing:
7 An experimental test with healthy participants. *European Journal of Pain*, **9**, 257–65.
- 8 Sigmon, S. T. and LaMattina, S. M. (2006) Self-assessment, in M.Hersen (ed.) *Clinician's Handbook of*
9 *Adult Behavioral Assessment*. Oxford: Academic Press.
- 10 Smeets, R. J. E. M., Wittink, H., Hidding, A. and Knottnerus, J. A. (2006) Do patients with chronic low
11 back pain have a lower level of aerobic fitness than healthy controls? : Are pain, disability, fear of
12 injury, working status, or level of leisure time activity associated with the difference in aerobic fitness
13 level? *Spine*, **31**, 90–8.
- 14 Stegen, K., Van Diest, I., Van de Woestijne, K. P. and Van den Bergh, O. (2001) Do persons with negative
15 affect have an attentional bias to bodily sensations? *Cognition and Emotion*, **15**, 813–29.
- 16 Stewart, S. H. and Asmundson, G. J. G. (2006) Anxiety sensitivity and its impact on pain experiences and
17 conditions: a state of the art. *Cognitive Behaviour Therapy*, **35**, 185–8.
- 18 Sullivan, M. J., Adams, H. and Sullivan, M. E. (2004) Communicative dimensions of pain catastrophizing:
19 social cueing effects on pain behaviour and coping. *Pain*, **107**, 220–6.
- 20 Sullivan, M. J., Adams, H., Tripp, D. A. and Stanish, W. (2008) Stage of chronicity and treatment response
21 in patients with musculoskeletal injuries and concurrent symptoms of depression. *Pain*, **135**, 151–9.
- 22 Sullivan, M. J. L., Bishop, S. R. and Pivik, J. (1995) The Pain Catastrophizing Scale: Development and
23 validation. *Psychological Assessment*, **7**, 524–32.
- 24 Sullivan, M. J. L., Lynch, M. E. and Clark, A. J. (2005) Dimensions of catastrophic thinking associated with
25 pain experience and disability in patients with neuropathic pain conditions. *Pain*, **113**, 310–15.
- 26 Swinkels-Meewisse, E. J. C. M., Swinkels, R. A. H. M., Verbeek, A. L. M., Vlaeyen, J. W. S. and
27 Oostendorp, R. A. B. (2003) Psychometric properties of the Tampa Scale for kinesiophobia and the
28 fear-avoidance beliefs questionnaire in acute low back pain. *Manual Therapy*, **8**, 29–36.
- 29 Swinkels-Meewisse, I. E., Roelofs, J., Schouten, E. G., Verbeek, A. L., Oostendorp, R. A. and Vlaeyen, J. W.
30 (2006) Fear of movement/(re)injury predicting chronic disabling low back pain: a prospective
31 inception cohort study. *Spine*, **31**, 658–64.
- 32 Tang, N. K., Salkovskis, P. M., Poplavskaya, E., Wright, K. J., Hanna, M. and Hester, J. (2007) Increased
33 use of safety-seeking behaviors in chronic back pain patients with high health anxiety. *Behaviour*
34 *Research and Therapy*, **45**, 2821–35.
- 35 Trost, Z., France, C. R. and Thomas, J. S. (2009) Examination of the photograph series of daily activities
36 (PHODA) scale in chronic low back pain patients with high and low kinesiophobia. *Pain*, **141**, 276–82.
- 37 Turk, D. C. and Flor, H. (1999) Chronic pain: A biobehavioral perspective. *Psychosocial factors in pain:*
38 *Critical perspectives*. New York: Guilford Press.
- 39 Turk, D. C. and Gatchel, R. J. (2002) *Psychological approaches to pain management: A practitioner's*
40 *handbook*. New York: Guilford.
- 41 Turk, D. C., Robinson, J. P., Sherman, J. J., Burwinkle, T. and Swanson, K. (2008) Assessing fear in
42 patients with cervical pain: development and validation of the Pictorial Fear of Activity Scale-Cervical
43 (PFACTS-C). *Pain*, **139**, 55–62.
- 44 Turner, J. A., Franklin, G., Fulton-Kehoe, D., et al. (2006) Worker recovery expectations and
45 fear-avoidance predict work disability in a population-based workers' compensation back pain sample.
46 *Spine*, **31** 682–9.
- 47 Turner, J. A., Jensen, M. P., Warmes, C. A. and Cardenas, D. D. (2002) Catastrophizing is associated with
48 pain intensity, psychological distress, and pain-related disability among individuals with chronic pain
49 after spinal cord injury. *Pain*, **98**, 127–34.



- 1 Turner, J. A., Mancl, L. and Aaron, L. A. (2004) Pain-related catastrophizing: a daily process study. *Pain*,
2 110, 103–11.
- 3 Van Damme, S., Crombez, G. and Eccleston, C. (2002) Retarded disengagement from pain cues: the effects
4 of pain catastrophizing and pain expectancy. *Pain*, 100, 111–18.
- 5 Van Damme, S., Crombez, G., Eccleston, C. and Roelofs, J. (2004) The role of hypervigilance in the
6 experience of pain, in G. J. G. Asmundson, J. W. S. Vlaeyen, and G. Crombez (ed.) *Understanding and*
7 *treating fear of pain*. New York: Oxford University Press.
- 8 Van Damme, S., Crombez, G. and Eccleston, C. (2008) Coping with pain: A motivational perspective. *Pain*,
9 139, 1–4.
- 10 Vancleef, L. M. G. and Peters, M. L. (2006) The interruptive effect of pain on attention. *Journal of Pain*,
11 7, 21–2.
- 12 Vancleef, L. M. G., Peters, M. L., Roelofs, J. and Asmundson, G. J. G. (2006) Do fundamental fears
13 differentially contribute to pain-related fear and pain catastrophizing? An evaluation of the sensitivity
14 index. *European Journal of Pain*, 10, 527–36.
- 15 Vancleef, L. M. G., Vlaeyen, J. W. and Peters, M. L. (2009) Dimensional and Componential Structure of a
16 Hierarchical Organisation of Pain-related Anxiety Constructs. *Psychological Assessment*, 23, 340–51.
- 17 Vansteenwegen, D., Iberico, C., Vervliet, B., Marescau, V. and Hermans, D. (2008) Contextual fear
18 induced by unpredictability in a human fear conditioning preparation is related to the chronic
19 expectation of a threatening US. *Biological Psychology*, 77, 39–46.
- 20 Verbunt, J., Seelen, H., Vlaeyen, J., et al. (2003) Disuse and deconditioning in chronic low back pain:
21 Concepts and hypotheses on contributing mechanisms. *European Journal of Pain*, 7, 9–21.
- 22 Verhaak, P. F., Kerssens, J. J., Dekker, J., Sorbi, M. J. and Bensing, J. M. (1998) Prevalence of chronic
23 benign pain disorder among adults: a review of the literature. *Pain*, 77, 231–6.
- 24 Vlaeyen, J. W., De Jong, J., Leeuw, M. and Crombez, G. (2004a) Fear reduction in chronic pain: graded
25 exposure in vivo with behavioural experiments, in G. J. G. Asmundson, J. W. S. Vlaeyen, and
26 G. Crombez (ed.) *Understanding and treating fear of pain*. New York: Oxford University Press.
- 27 Vlaeyen, J. W., Kole-Snijders, A. M. J., Boeren, A. M. and Van Eek, H. (1995a) Fear of movement/(re)
28 injury in chronic low back pain and its relation to behavioral performance. *Pain*, 62, 363–72.
- 29 Vlaeyen, J. W., Timmermans, C., Rodriguez, L. M., et al. (2004b) Catastrophic thinking about pain
30 increases discomfort during internal atrial cardioversion. *Journal of Psychosomatic Research*,
31 56, 139–44.
- 32 Vlaeyen, J. W. S., de Jong, J., Heuts, P. H. T. G. and Crombez, G. (2008) Graded exposure in vivo for
33 pain-related fear, in H. Breivik, W. Campbell and M. K. Nicholas (ed.) *Clinical Pain Management:*
34 *Practice and procedures*. 2nd edn. London, Hodder & Stoughton.
- 35 Vlaeyen, J. W. S., de Jong, J. R., Geilen, M., Heuts, P. and van Breukelen, G. (2001) Graded exposure
36 in vivo in the treatment of pain-related fear: a replicated single-case experimental design in four
37 patients with low back pain. *Behaviour Research and Therapy*, 39, 151–66.
- 38 Vlaeyen, J. W. S., Kole-Snijders, A. M. J., Rotteveel, A. M., Ruesink, R. et al. (1995b) The role of fear of
39 movement/(re)injury in pain disability. *Journal of Occupational Rehabilitation*, 5, 235–52.
- 40 Vlaeyen, J. W. S. and Linton, S. J. (2000) Fear-avoidance and its consequences in chronic musculoskeletal
41 pain: A state of the art. *Pain*, 85, 317–32.
- 42 Vlaeyen, J. W. and Morley, S. (2004). Active despite pain: The putative role of stop-rules and current
43 mood. *Pain*, 110, 512–16.
- 44 Vowles, K. E. and Gross, R. T. (2003) Work-related beliefs about injury and physical capability for work in
45 individuals with chronic pain. *Pain*, 101, 291–8.
- 46 Waddell, G. (2004) The biopsychosocial model, in G. Waddell (ed.) *The back pain revolution*. Edinburgh:
47 Churchill Livingstone.
- 48 Waddell, G. (1987) Volvo award in clinical sciences. A new clinical model for the treatment of low back
49 pain. *Spine*, 12, 632–44.



- 1 Waddell, G. (2004) The epidemiology of back pain, in G. Waddell (ed.) *The back pain revolution*.
2 Edinburgh: Churchill Livingstone.
- 3 Waddell, G., Newton, M., Henderson, I., et al. (1993) A Fear-Avoidance Beliefs Questionnaire (FABQ) and
4 the role of fear-avoidance beliefs in chronic low back pain and disability. *Pain*, **52**, 157–68.
- 5 Walker, B. F. (2000) The prevalence of low back pain: a systematic review of the literature from 1966 to
6 1998. *Journal of Spinal Disorders*, **13**, 205–17.
- 7 Walker, B. F., Muller, R. and Grant, W. D. (2004) Low back pain in Australian adults. Prevalence and
8 associated disability. *Journal of Manipulative Physiology and Therapy*, **27**, 238–44.
- 9 Walker, J. R. and Furer, P. (2008) Interoceptive exposure in the treatment of health anxiety and
10 hypochondriasis. *Journal of Cognitive Psychotherapy*, **22**, 366–78.
- 11 Weiner, D., Pieper, C., McConnell, E., Martinez, S. and Keefe, F. (1996) Pain measurement in elders with
12 chronic low back pain: traditional and alternative approaches. *Pain*, **67**, 461–7.
- 13 Wittink, H., Hoskins Michel, T. H., Wagner, A., Sukiennik, A. and Rogers, W. (2000) Deconditioning in
14 patients with chronic low back pain: fact or fiction? *Spine*, **25**, 2221–8.
- 15 Woods, M. P. and Asmundson, G. J. G. (2008) Evaluating the efficacy of graded in vivo exposure for the
16 treatment of fear in patients with chronic back pain: A randomized controlled trial. *Pain*, **136**, 271–80.

