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CHAPTER 4

Graded activity, gradual exposure in vivo, and cognitive treatment of illness perceptions: a comparative analysis of three cognitive behavioral treatments for chronic low back pain

Petra C. Siemonsma, Kirsten W. Maas, Ant T. Lettinga

*Physical Therapy* (in revision 2011)
ABSTRACT

Background: New treatments come to the fore, but we have little knowledge of how their contents relate to those of their predecessors. This lack of information hampers clinicians in making informed choices in their clinical work and impedes researchers in making choices in their scientific work.

Objective: The aim of this study was to demonstrate how specification of treatment theory can improve choices of treatment and can contribute to a better understanding of research findings in cognitive-behavioral pain rehabilitation.

Methods: Comparative analysis of the content and theoretical underpinnings of three cognitive-behavioral treatments for rehabilitation of patients with chronic low back pain disability was used to compare and contrast their definitions of (1) functional problems, (2) patient characteristics, (3) critical features, (4) causal chain, and (5) expected changes in the patient’s status and in their environment. Key publications of the primary designers and publicists were the primary analytical material.

Results: Graded Activity was the most behavioral of the three treatments, because it attempts to change pain behavior by means of operant conditioning techniques in a time-contingent approach. Cognitive Treatment of Illness Perceptions was the most cognitive treatment, because it tries to change maladaptive illness perceptions by means of mental experiments, including Socratic dialogues. Gradual Exposure in Vivo was positioned in between the two ends of the behavioral-cognitive spectrum, as it attempts to change fear of pain by exposing patients to cognitive-behavioral experiments.

Conclusions: Therapists are urged to use the information from this study for making rational treatment choices and to inform patient about these choices. The analyses suggest that a fair comparative trial on the treatments is complicated because they have both overlapping and unique components.
INTRODUCTION
Multidisciplinary treatment teams play an important role in the physical rehabilitation of chronic low back pain (CLBP). Physical therapists are well recognized members of these teams. Several types of ‘cognitive-behavioral’ treatment are available for the rehabilitation of patients with CLBP disability (Morley, 2004; Moseley, 2004), and physical therapists make use of a wide variety of these treatments (Nicholas & George, 2011). Rehabilitation of chronic low back pain makes use of a diffuse mix of a number of these treatments. Very little research has focused on disentangling the differences and similarities between the treatments. New treatments come to the fore, but we have little knowledge of how their contents relate to those of their predecessors. This lack of information hampers clinicians in making informed choices in their clinical work (Morley, 2004). More often than not, therapists do not know how to inform their patients about the (dis)advantages of a particular type of treatment in relation to another type. It also impedes researchers in making choices in their scientific work, for instance in the choice of selection criteria and outcome measures for comparative trials that reflect the rationale of the treatments under study (Lettinga, Reynders et al., 2002; Leeuw, Goossens et al., 2007).

More and more researchers in the field of physical rehabilitation have therefore stressed the need for conceptualization and specification of rehabilitation treatment (Fuhrer, 2003; Whyte & Hart, 2003; Whyte, 2006; Keith, 1997; Lettinga, Twillert van et al., 2006). They argue that detailed specification of rehabilitation treatment, together with a conceptual scheme that orders such components into an accepted set of measures, would be of great benefit (Keith & Lipsey, 1993). This will result in the identification of the critical features of the treatment, the patients, and their environment that comprise the causal sequences that connect treatment and outcome (Fuhrer, 2003; Lipsey, 1990; Keith et al., 1993). More in depth-understanding of the different ways in which treatments address problems, set goals and explain therapeutic changes may thus help to improve both science and practice in chronic pain rehabilitation.

We matched words with deeds and specified how the content and theoretical underpinnings of the recently developed ‘Cognitive Treatment of Illness Perceptions’ (CTIP) (Siemonsma, Schroder et al., 2008) for patients with chronic low back pain disability relate to those of two of its predecessors: ‘Graded Activity’ (GA) (Fordyce, Fowler et al., 1968; Sanders, 2002; Fordyce, 1976) and ‘Gradual Exposure in Vivo’ (GEiV) (Vlaeyen, Kole-Snijders et al., 1995; Vlaeyen, Jong de et al., 2002b; Vlaeyen & Crombez, 1999). Both GA and GEiV were effective in improving the physical activity level of patients with chronic low back pain
disability (Leeuw, Goossens et al., 2008; Smeets, Vlaeyen et al., 2008; Nicholas, Wilson et al., 1991; George, Zeppieri et al., 2008). The effectiveness of CTIP has recently been demonstrated in a clinical trial (Siemonsma, Stuive et al., 2009; Siemonsma, Stuive et al., 2011b). The aim of this paper is to demonstrate how the specification of ‘treatment theory’ can facilitate the choice of clinical treatment in cognitive-behavioral pain rehabilitation, contribute to a better understanding of research findings, and inform research design decisions.

METHODS

Our comparative analysis draws on insights developed in the field of theory-driven program evaluation, in which the specification of treatment theory plays a central role (Fuhrer, 2003; Whyte et al., 2003; Keith et al., 1993; Lettinga et al., 2006; Lipsey, 1990; Keith, 1997; Whyte, 2007). Fuhrer (Fuhrer, 2003) distinguished five domains for treatment specifications as promising cornerstones in the theoretical infrastructure of rehabilitation science: (1) the functional problems on which the intervention is intended to achieve change, (2) patient characteristics that make them candidates for the intervention, (3) critical features of the intervention that are responsible for the intended outcomes, (4) elements and contingencies in the causal chain connecting provision of the intervention with likely outcomes, (5) expected changes in the patient’s status and in their environment that constitutes those outcomes, in both the short term and in the long term. We used these five domains to guide our comparative analytical work, and they will subsequently be specified in the following paragraphs.

The primary analytical material for this content analysis consisted of articles, books, and chapters of books written by the primary designers of the treatments and the main publicists. We used the original texts and textbooks to specify the theories underlying the treatments. For GA, the Fordyce publications formed the starting point, together with recently published outcome studies (Fordyce et al., 1968; Sanders, 2002; Fordyce, 1976; Smeets et al., 2008; George et al., 2008). Important sources of information about GEiV were found in the publications of Vlaeyen et al., as well as in recent publications of trials involving GEiV (Vlaeyen et al., 1995; Vlaeyen et al., 2002b; Vlaeyen et al., 1999; Leeuw et al., 2008; Vlaeyen, Jong de et al., 2002a). For CTIP, we found quite extensive literature on Leventhal’s Self-Regulation Model (SRM) and it’s application (Siemonsma et al., 2008; Leventhal, Brissette et al., 2003; Leventhal, Nerenz et al., 1984; Leventhal, Benyamini et al., 1997; Scharf Donovan & Ward, 2001; Ward, Heidrich et al., 2007). A summary of the results of our comparative analysis is presented in Figure 1. Adaptations of the original treatments were not included in
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**Figure 1** Overview of differences and similarities between three treatments for chronic low back pain
the analytical material, because this would make the analyses too complex. However this analysis forms a good starting point for relating and positioning later adaptations to the original treatments.

RESULTS
Specification of the functional problem
Our first research question was: “What is the functional problem for which the treatments attempt to achieve change?” All three treatments are developed to help people deal with the disabling consequences of chronic (back) pain that restrict daily activities and social participation. This chronic pain is referred to as non-specific, because no physiological cause can be determined that fully explains the back problem (Kent & Keating, 2004; Haldeman, 1990; Nachemson, 1992). Therefore, the treatments do not focus on physical damage and the resulting pain, or on biomedical solutions to the problem. Instead they focus on the decreased physical activity of patients who suffer from long-lasting back pain, and on the psychosocial factors that explain the persistence of the low back pain. They are thus all intended to increase the physical activity level, despite the pain.

Best candidates to join the interventions
Our second research question was: “Which patient characteristics make them best candidates to participate in the intervention?” Despite the fact that all three treatments focus on the same functional problem, not all patients with chronic low back pain may be suitable candidates for each type of treatment. So, which treatment may work best for whom, and on the basis of which considerations?

Pain behavior and environmental consequences in GA
In GA chronic pain and decreased physical activity are considered to result from a process of reinforcement that has led to a persistent state of certain behavior. According to Fordyce (Fordyce, 1976), the designer of GA, the decreased activities are a behavioral condition in which patients avoid certain activities because of aversive consequences (p. 63/64) (Fordyce, 1976). Fordyce states that pain is a symptom and chronic pain is a syndrome. When there is physical damage the general reaction, or symptom, to this damage will be pain. However, when the pain sustains, with or without any underlying physical cause, it can become chronic and pain behavior may develop. This pain behavior is defined as the expression or display of pain itself (p.1) (Fordyce, 1976). Pain behaviors range from autonomic reactions (such as flushing or alterations in pulse), visible and
audible signals, verbal reports or requests, to functional limitation and restricted movement (p.109) (Fordyce, 1976).

Fordyce explains pain behavior with the help of the operant conditioning theory. The learning model of operant conditioning asserts that all overt behaviors are significantly influenced by their consequences and by the context in which they occur. In the operant conditioning theory it is asserted that positive reinforcement and positive consequences result in an increase in that overt behavior, and that negative reinforcement and negative consequences lead to a decrease in that behavior. The reinforcement of operant pain behavior can be clearly illustrated with the example of “not lifting heavy loads”: a person offering help (positive reinforcement of not lifting), the patient feeling less tired at the end of the day (positive consequence of not lifting), the patient not experiencing possible pain (avoidance of the negative consequence ‘pain’), and comments such as “don’t lift that, you might strain your back” (negative reinforcement of “lifting heavy loads”). The underlying rationale of GA is that attention from others and other gains give pain behavior a function and the result is that the pain comes under control of environmental consequences. The best candidates for GA therefore display pain behavior that is reinforced by environmental consequences.

Fear of pain and catastrophizing thoughts in GEiV

In GEiV chronic low back pain and a decrease in the physical activity level is associated with fear of pain (Vlaeyen et al., 1995; Vlaeyen et al., 2002b; Vlaeyen et al., 1999; Vlaeyen et al., 2002a). According to the designers of GEiV, pain-related fear is thought to be more disabling than the pain itself. It is argued that negative appraisals of pain and its consequences can lead to a decrease in physical activity. Moreover, fear itself can be characterized by escape and avoidance, both of which lead to the immediate consequence of a lower physical activity level (Vlaeyen et al., 2002b). Vlaeyen et al. (1995) (Vlaeyen et al., 1995) found a strong relationship between pain-related fear and catastrophizing thoughts, i.e. exaggerating a negative orientation toward noxious stimuli (Giardino, Turner et al., 2003). Pain catastrophizing is therefore suggested to be a precursor of pain-related fear.

The pain that is expected, or feared, when performing certain activities is explained in GEiV with the help of the classical conditioning theory: people may learn to associate successive events of physical activity with exacerbation of pain (p.17) (Leeuw, 2008). In addition, avoidance may lead to the maintenance or exacerbation of fear, possibly resulting in a phobic state (Vlaeyen et al., 1999).
According to Lethem et al. (Lethem, Slade et al., 1983) one can react to a pain stimulus by confronting the consequences of this stimulus, or by avoiding the expected stimulus because of fear. Walking up the stairs while expecting pain is an example of confronting the stimulus, whereas taking the elevator because of fear of the expected pain is referred to as avoidance behavior. Inspired by the Lethem et al. model (Lethem et al., 1983), the designers of GEiV developed a fear-avoidance model that is illustrated as a vicious circle (Vlaeyen & Linton, 2000). It is argued that if patients interpret the pain as threatening, and catastrophizing thoughts are present, pain-related fear evolves. This pain-related fear may lead to avoidance behavior, hyper vigilance (paying more attention to possible signals of a threat) and to a lower level of activity, often accompanied by depression. This implies that patients who show avoidance of activity in combination with fear of pain and catastrophizing thoughts are hypothesized as the best candidates for GEiV.

**Maladaptive illness perceptions and rational problem-solvers in CTIP**

In CTIP the decreased physical activity level is not explained in terms of pain behavior or pain-related fear, as in GA and GEiV. Instead, it is considered as a problem in the illness perceptions. Therewith, the focus is on the patient’s personal model of the illness, which represents a personal opinion about the problem or disorder. This personal model, or common-sense model, is influenced by social communication and cultural knowledge, by external social environment, and by current experience with the illness (Leventhal et al., 2003). A patient’s common-sense model can be incorrect, incomplete or include unhelpful thoughts about the back problem and about physical activity, such as: “When my back aches badly I should stay in bed”. These thoughts are called maladaptive illness perceptions. Leventhal et al. (Leventhal et al., 1984; Leventhal et al., 1997) distinguished five dimensions of illness representations: identity, cause, time-line, consequences and control/cure. In CTIP it is assumed that maladaptive illness perceptions may lead to maladaptive behavior, i.e. decreased physical activity (Siemonsma et al., 2008).

Leventhal’s SRM (Leventhal et al., 1984) appears to be the most important theoretical underpinning of CTIP. In the SRM it is assumed that the ways in which people think about health threats are important in determining how they feel and what they do in reaction to events. In SRM diagrams, thinking and feeling are demonstrated as two parallel processes. The illness perceptions are part of the process of what people think, whereas the other process focuses on what people feel, and is therefore important for emotional adjustment. CTIP
focuses on the cognitive path, rather than on the emotional path. In CTIP, patients are thought to learn and behave in rational ways. This implies that they must have the skills to critically reflect on their own common-sense model of their back pain problem and relate new information to the model. So, the best candidates for CTIP are assumed to be patients with a rational problem-solving style, and whose activity limitations are mainly explained by maladaptive illness perceptions about the low back pain.

**Critical features of the treatments**

Our third research question was: “What are the critical features of the treatments that are responsible for the intended outcomes?” For instance, what exactly are the differences between the adjectives ‘graded’ and ‘gradual’ in GA and GEIV, and are they critical? And because such adjectives are not used in CTIP, what might then be the critical features of this specific treatment?

**Quotas and time-contingent approach in GA**

In GA it is assumed that a higher physical activity level should be achieved gradually, rather than suddenly. GA makes use of small steps over a predefined period of time, in which the patients progressively learn to increase their activity level, despite the pain. The physical activity level that patients are expected to gradually achieve in GA are fixed *quotas* of activities, which are based on the patient’s current activity level, the ultimate goals of the treatment, and the time available for the treatment. The patients are expected to do no more and no less than the set quota.

Important in GA is to start the treatment at a level below the patient’s current physical activity level. This ensures that the patient will perform well, and enables the therapist to encourage and praise the patient for achieving the set quota. In terms of the operant conditioning theory, positive reinforcement is applied to the “well” behavior of patients, while at the same time ‘pain behavior’ is ignored. Telling the patients that they did well, patting the patients on the back, and showing them graphs of how they gradually increased their activity level, are examples of how therapists can positively reinforce their good behavior. Such positive reinforcement should be given immediately after an activity, because operants are influenced by the consequences that immediately follow the behavior. So, the treatment quotas are determined before the start of the treatment, and the activities must be carried out within predetermined time-periods. Therefore GA has been also been described as a ‘time-contingent’ approach. The quotas and related time-contingent approach can thus be
Hierarchies and physical experimentation in GEiV

The adjective ‘graded’ is not applied to GEiV, ‘gradual’ is the word used to describe the way in which the treatment is structured. ‘Gradual’ refers to the stepwise progression through an individual’s hierarchy of pain-related fear stimuli. Pain-related fear stimuli are identified in GEiV with a series of photographs of daily activities for which the patient must try to imagine performing the same movement. The photographs are placed on a fear thermometer, according to the extent to which the patients feel worried that the presented movement is harmful to their back (Kugler, Wijn et al., 1999). The fear thermometer ranges from 0 (less frightening) to 100 (extremely frightening). The activities are thus hierarchically ordered according to the extent to which they elicit fear of pain, and not to the experienced pain itself.

Inspired by the (kinesio)phobia theory, behavioral experiments are used in GEiV to gradually extinguish fear-provoking stimuli in a safe and controlled setting, starting with less frightening activities and building up to more frightening activities when the previous fears have faded away (Foa & Kozak, 1986). The idea is that the classical conditioning, by which patients have learned that physical activity is followed by pain, can be de-conditioned in this way. However, whereas patients with ‘real’ phobias (e.g. for spiders) are generally aware that their fear is exaggerated and irrational, patients with kinesiophobia due to pain are often not aware of their catastrophizing thoughts (Kori, Miller et al., 1990). Therefore, a cognitive element is incorporated in the behavioral experiments. The patient’s hypotheses about the consequences of the fear-provoking activities must first be explained, after which they can be disconfirmed with the help of an in vivo experiment. Thus, instead of assessing the physical activity level on the basis of predefined quotas, such as in GA, in GEiV the fear-provoking activities are stepwise experienced in vivo (behavioral experiments) by the patient with the help of a personal fear hierarchy. The critical features of GEiV can thus be specified as hierarchies of pain-related fear and related physical experimentation.

Maps and Socratic dialogues in CTIP

The adjectives ‘graded’ or ‘gradual’ are not used to typify CTIP. Patients with chronic low back pain who receive CTIP are not exposed in a ‘graded’ or ‘gradual’
Chapter 4

way to certain activity levels. Instead, they are encouraged to critically reflect upon the common-sense model of their problem: chronic low back pain and decreased activities. The therapist investigates how, why and what patients think of their back problem, and how it effects their physical activities. Information is thus drawn from the patients themselves, rather than provided by the therapist. In this way a map of illness perceptions can be drawn, based on the five dimensions described in the SRM. So, instead of pre-determined quotas or a thermometer with fear-provoking activities (hierarchy), the first step in CTIP is to map the illness perceptions of the chronic back pain and its interference with physical activity.

The next step in the treatment is to create doubt about the illness perceptions that are maladaptive, by challenging them in a Socratic dialogue style (Nelson, 1994). The therapist’s role is to ask questions that lead the patients to discover that some of their beliefs are illogical, maladaptive or unhelpful. The patients are then encouraged to formulate alternative illness perceptions for their chronic low back problems, and to test the alternative illness perceptions in daily practice. So, CTIP encourages chronic low back pain patients, by means of mental experiments, to adjust or broaden their common-sense model of their illness by logical thinking and critical reflection. CTIP thus focuses on mental experimentation and practical examination of various explanations of the chronic pain, rather than on increasing physical activity in a graded or gradual way. Patients receiving CTIP have to rely on their own rationality, rather than on a pre-determined quota’s of activity or on behavioral experiments such as in GA and GEiV. Critical features of CTIP are thus illness perceptions maps and Socratic dialogue style.

Connected principles and practices
Our fourth research question was: “What are the elements and contingencies in the causal chain, connecting provision of the intervention with likely outcomes?” In other words, how are the principles and practices in the treatments connected to one another?

Operant conditioning principles and practices in GA
The desired outcome of GA in the longer term - an increased physical activity level despite the pain - is derived from the chronic and non-specific character of the pain. The focus of GA is on the psychosocial conditions that explain the persistence of the pain, and not on the biomedical cause of the pain. Patients are told that pain does not necessarily mean that there is damage, and that there is
therefore no need to stop being physically active when experiencing pain. GA tries to achieve therapeutic change by focusing on environmental contingencies that sustain the pain behavior. The stepwise increase of physical activities according to pre-determined quotas provides therapists with the opportunity to reinforce well behavior, and to ignore pain behavior. Well behavior in chronic low back pain patients is encouraged by giving them positive reinforcement, and reinforcement of pain behavior is avoided by ignoring this behavior. So, the connecting principle in GA is the operant conditioning theory, i.e. operant conditioning principles delineate both the nature of the chronic back pain problem and the solution to this problem.

**Classic conditioning, phobia and cognitive principles and practices in GEiV**

Although the desired outcome of GEiV in the longer term is also an increase in physical activity, despite the pain, GEiV does explain the chronic pain in terms of pain-related fear. The onset and maintenance of pain-related fear is explained with the help of classical conditioning principles; chronic low back pain patients learn that there are associations between successive events during physical activity and exacerbation of the pain, which results in avoidance behavior. The fear-avoidance model specifies pain-related fear in terms of a vicious circle illustrates to patients the association between physical activity and noxious stimuli, which leads to catastrophizing thoughts, hyper vigilance, avoidance of physical activity, etc., in a downward spiral, possibly resulting in a state comparable with phobia. It is explained to the patient that these thoughts are maladaptive, and can be disconfirmed in vivo, thus by means of physical experimentation. GEiV attempts to break the vicious circle by exposing patients in a gradual way from less frightening activities to more frightening activities in their personal fear hierarchy, thereby attempting to disconfirm their catastrophizing thoughts or kinesiophobia. Thus, a combination of classic conditioning, phobia, and cognitive principles and practices demarcate the nature as well the solution of the problem in GEiV.

**Self-regulation and conceptual change principles and practices in CTIP**

CTIP shares the desired outcome in the longer term with GA and GEiV, i.e. an increase of the physical activity level, despite the pain. In CTIP a cognitive change is assumed to lead to a change in behavior, and therefore the focus of the treatment is on changing the patient’s personal common-sense model: first by exploring the patient’s thoughts about the disorder and drawing a map of illness
perceptions, followed by creating doubt and exploring alternative explanations, and finally by applying the alternative perceptions in daily life.

CTIP does not just aim at creating doubt; rather its aim is to arrive at a permanent change in cognition. It is assumed in Socratic-dialogues style that a discovery made by the patient has the most lasting impact (Nelson, 1994; Seeskin, 1987). Therefore this style of dialogue was selected as the method for discussion: the therapist asks questions that lead patients to discover that some of their beliefs are illogical, maladaptive or unhelpful. However, a barrier that is recognized in the application of CTIP is the tenacity of perceptions in general. Patients can be told about alternative illness perceptions, but behavioral change is unlikely to occur if the patient’s current perceptions are incompatible with the alternative perceptions (Donovan & Ward, 2001; Ward et al., 2007). For this reason, CTIP is based upon the three conditions for cognitive change, as formulated by Strike and Posner (Strike & Posner, 1992). In their theory of conceptual change it is hypothesized that change is likely to occur if: (1) the patient is dissatisfied with an existing conception, (2) an intelligible and plausible alternative is offered, and (3) the alternative conception will be beneficial to the patient. These principles explain why creating doubt about the existing maladaptive illness perceptions (the second phase of treatment in CTIP) is seen as a vital step in the treatment.

The Strike and Posner theory of conceptual change, together with the SRM in general, and the common-sense model in particular, are thus the connecting principles for CTIP. They link the critical features of CTIP (maps and Socratic dialogues) with the short-term outcome in terms of a range of plausible alternative illness perceptions of the back pain and of physical activity, and the long-term outcome in terms of an increased physical activity level despite the pain.

Outcomes
Our fifth and last research question was: “What are the expected changes in the patient’s status and in their environment that constitutes those outcomes, in both the short term and in the long term?” Since this question has been addressed in detail in the previous paragraphs, we will focus here on potentially relevant measures that reflect intended therapeutic change and long term outcome for all three treatments.
Reducing pain behavior in GA
An expected change in patient status and environment in GA relates to the pain behavior of low back pain patients. Pain behavior is multifaceted: it has many appearances. These appearances include guarding, rubbing, words, sounds, facial expression and avoidance. All these aspects of pain behavior should be considered in a measurement of outcome in GA. In addition, pain behavior is reinforced by environmental contingencies, and this implies that not only the behavior of the patient, but also the responses from the environment need to be changed and measured. Several observation scales are available to rate patients’ overt pain behaviors, and provide a valid and reliable way of assessing pain behavior (Keefe & Smith, 2002). A fairly recent example is the in vivo real-time pain behavior assessment (Prkachin, Hughes et al., 2002) that can be used in combination with a physical examination for low back pain patients. Also an observational protocol was developed to directly observe patient pain reactions and spousal responses to that behavior (Romano, Turner et al., 1997). But problems exist such as validity of applying such measures during treatment and the time, money or equipment needed to conduct the observational measures (Keefe et al., 2002). These might be reasons why the focus of measurement is usually on the expected long-term outcome of GA: i.e. the increase in physical activity, despite the pain. The Roland Morris Disability Questionnaire (RDQ) (Roland & Fairbank, 2000) is such a frequently used outcome measure, listing 24 problems with activities of daily life, for example ‘I walk more slowly than usual because of my back’. Patients are asked to answer ‘yes’ or ‘no’. An alternative is the Quebec Back Pain Disability Scale (QBPDS) (Davidson & Keating, 2002; Kopec, 1997; Schoppink, Tulder van et al., 1996) containing a list of 20 activities for which patients are asked to rate the degree of difficulty in performing them (ranging from ‘no difficulty at all’ to ‘unable to perform’), for example “how difficult is it for you to walk several kilometers?”.

Fear reduction in GEIV
The expected therapeutic change in GEIV is a reduction in catastrophizing thoughts and pain-related fear that lead to avoidance of physical inactivity. Catastrophizing thoughts can be assessed with the Pain Catastrophizing Scale (PCS) (Sullivan, Bishop et al., 1995; Damme van, Crombez et al., 2002), and the Tampa Scale of Kinesiophobia (TSK) (Vlaeyen et al., 1995; Roelofs, Sluiter et al., 2007) is used as a diagnostic tool to assess pain-related fear or fear of movement/(re)injury (Leeuw et al., 2008). However, the TSK does not provide information about which specific activities are feared or avoided by a patient.
(Leeuw et al., 2007), and is therefore not considered to be an appropriate measurement for treatment effectiveness. The effectiveness of GEiV, for instance, may initially be observed in those activities that are subjected to treatment. The Photograph Series of Daily Activities (PHODA)(Kugler et al., 1999) was developed to identify and rank specific activities, and as such can help in identifying those activities that are suitable for treatment. For the evaluation of GEiV a short version of the PHODA was developed and tested (Leeuw et al., 2007). Subsequently, when the effects may have generalized to other activities, a general improvement in the physical activities is anticipated, and this can be measured using RDQ or QBPDS. However, the RDQ or the QBPDS may under-estimate the effects of GEiV by measuring activities that are not relevant for the treatment or for the patient.

**Alternative perceptions in CTIP**

CTIP suffers from the problem that an adequate measure to objectify therapeutic change is not really available. Indeed, the Illness Perception Questionnaire (IPQ-r) (Moss-Morris, Weinman et al., 2002; Weinman, Petrie et al., 1996) can be used to describe general illness perceptions, and like the TSK and pain behavior assessments, the measure was developed as a diagnostic tool. IPQ-r is suited to map illness perceptions, and to detect changes in illness perceptions in a quantitative way (Weinman et al., 1996). It was however not designed to detect qualitative change in maladaptive perceptions of chronic low back pain disability, which is, in part, the explicit short-term goal of CTIP.

The long-term outcome of CTIP is an increase in those activities that are most relevant for the individual patient. The Patient Specific Functioning List (PSFL) (Beurskens, Vet de et al., 1999; Pengel, Refshauge et al., 2004) is therefore considered to be an appropriate measurement instrument. The PSFL was designed to first select three activities that are the most relevant for the patient and that are subsequently formulated in patient-relevant terms. So whereas appropriate short-term outcome measures for CTIP are difficult to find, the long-term outcome of increasing patient-specific physical activities, despite the pain, can be measured with the PSFL. Measurement of general improvement in CTIP will suffer from the same problem as in GA and GEiV: RDQ and QBPDS may under-estimate the effectiveness of CTIP by measuring activities that are not relevant for the treatment or for the patient.
DISCUSSION
This comparative content analysis inevitably has its limitations. For instance, we did not rely on empirical material collected in interviews with practitioners or on observations of the treatment. We focused only on literature in which the designers described their method of treatment, which is obviously not necessarily what actually happens in clinical practice. We also did not study all the written material, but we hope to have illustrated so far that unraveling and mapping the relationships between recently developed treatments and their predecessors is beneficial for the development and specification of chronic low back pain rehabilitation.

The framework we have used may be a starting point for further comparison with other treatments and can serve as a basis for discussion. We urge clinicians to discuss the aims, ingredients and ideal patients for the treatments that they have available, and to make rational choices about what to apply to whom. In their discussions the rationales of treatments should be discussed: do the rationales fit if the treatments are mixed? This in contrast to intuitively mixing treatments or adding one treatment to another. Also we urge them to consider the timing and interaction of treatments: treatments might be like pills in this respect that more is not always better and some combination are better than others.

We considered GA as the most behavioral of the three treatments, because it attempts to change the pain behavior by means of operant conditioning techniques in a time-contingent approach. CTIP appeared to be the most cognitive intervention, because it tries to change maladaptive illness perceptions by means of mental experiments, including Socratic dialogues. GEiV is positioned in between the two poles of the behavioral-cognitive spectrum, because it attempts to change fear of pain and catastrophizing thoughts by exposing patients to behavioral experiments. Let us now do what we promised to do: i.e. discuss the benefits of this comparative analysis for both clinical research and clinical practice in chronic low back pain rehabilitation.

Implications for clinical research
So what does more in-depth understanding of the different ways in which the three treatments relate to one another contribute to the interpretation of research findings in chronic low back pain rehabilitation? Firstly, this comparative analysis helped to explain why both GA and GEiV appeared to be effective in increasing the physical activity level of patients, despite the pain (Leeuw et al., 2008; Smeets et al., 2008). Both GA and GEiV make use of some type of exposure in their treatment: i.e. by stepwise exposing patients to physical activities. GA
makes use of predefined activity quotas and a time-contingent approach, while GEiV exposes patients by means of behavioral experiments to a hierarchy of activities based on their fear of pain. Nevertheless, exposure to physical activity appears to be an essential aspect of both treatments, especially in comparison to CTIP. CTIP primarily exposes patients to mental experimentation by means of Socratic dialogues, and then encourages them to experiment with alternative illness perceptions in daily life, but not necessarily in a stepwise manner. That GA and GEiV share an essential treatment component - stepwise exposure to physical activity - may, among other things, explain the shortage of differential effects on physical limitations. See for example the comparative trial of GEiV and GA by Leeuw et al. (Leeuw et al., 2008).

Furthermore, this comparative analysis helps to explain why GEiV was more successful in reducing fear of pain than GA in Leeuw’s comparative trial. The study included patients suffering from chronic pain who had fear of pain (e.g. patients with a score of 33 or more on the TSK). In fact, this selection criteria matched more closely with the treatable conditions of GEiV (fear of pain) than with those of GA (pain behavior), which can lead to the unjustified conclusion that GA has no specific gains to offer to patients other than reducing physical limitations. Anyone wishing to discover the full effects of GA should therefore opt for additional selection criteria that closely match with GA. A similar argument yields for the selection of measuring devices with which to compare treatments. For instance, selecting pain behavior observations as a measurement instrument in a comparative trial, would give GA an advantage over GEiV and CTIP, because the latter two do not explicitly aim in their treatment at changing pain behavior. In turn the PHODA might give best opportunities to GEiV, and the IPQ-r will put CTIP in the best position. This comparative analysis may thus help to explain that although selection criteria and reliable measuring devices may be neutral to the user, they are not necessarily neutral with regard to what they set out to compare (Lettinga et al., 2002).

Last but not least, this comparative analysis inspired research to determine whether or not CTIP works best for patients with a rational-problem solving style (Siemonsma, Stuive et al., 2011a). We have designed and carried out an exploratory trial with the best measuring devices that were available, the results showed CTIP to be more effective in increasing physical activities that a waiting list control group, and to be more effective in patients who are rationale problem solvers (score 44 points or more on the SPSI) (Siemonsma et al., 2011a; Hout van den, Vlaeyen et al., 2002; Maydeu-Olivares & D’Zurilla, 1996; Dreer, Berry et al., 2009). These research findings suggest that not all patients with
chronic low back pain are best served with physical exposure, because a specific sub-group of chronic low back pain patients — patients with maladaptive cognitions about their illness and a rational problem solving style — can benefit from mental exposure. Such a theory-informed explanatory trial thus contributes to improving rehabilitation practice, which is indeed a more appropriate thing to do than just try proving whether it is (cost) effective, or not.

Implications for clinical practice
How does more detailed knowledge of the differences and similarities between GA, GEiV and CTIP benefit clinical practice? Although there is no strong evidence base for the superior value of any of these three treatments in terms of increasing patients’ activity levels, therapists now have a theoretical knowledge basis with which they can justify their choice for a certain type of cognitive behavioral treatment. That is to say, one may speculate that patients with clear pain behavior that seems under the control of environmental contingencies may benefit more from GA. Patients in which fear of pain is a marked feature, and who have catastrophizing thoughts, may be best candidates for GEiV. Then again, patients who hold maladaptive illness perceptions and who have a rational problem-solving approach may benefit most from CTIP.

With this knowledge at their disposal, therapists can also explain the range of treatment choices to their patients. The advantages and limitations of the three treatments for chronic back pain in relation to one another can now be discussed in more detail, giving patients a more informed choice. Therapists can now take into consideration the degree to which the patient has the skills that are required for successful participation in one of the treatments. Is the patient able and willing to follow a structured exercise regimen (GA), is the patient able and willing to confront his/her fears (GEiV), or is the patient able and willing to discuss his/her thoughts about the illness and physical activity in detail with the therapist (CTIP)? How problems, goals and lives of individual patients relate to those analyzed here, is indeed an interesting subject for further inquiry.

In turn, with the results of this comparative analysis therapists may also gain more insight into which techniques they themselves are already skilled in, and for which they need more training. It should also be noticed that each treatment requires a specific method of communication or therapist-patient interaction. In GA, for instance, the therapist has to be skilled in providing feedback with help of operant conditioning techniques, including the appropriate selection of patient-specific reinforcements. In addition, GA demands that communication from the therapist is restricted, in the sense that the patient’s
communications concerning the pain must be ignored as much as possible; the therapist therefore has to be skilled in diverting the discussion to other topics. In GEiV, on the other hand, therapists are expected to be experts in formulating catastrophizing hypothesis for their patients that can be tested in vivo. This implies that they have to be creative in designing behavioral experiments that disconfirm the catastrophizing thoughts. And finally, therapists that wish to apply CTIP have to be experts in Socratic dialogues, which require quite a paradoxical method of communication. Under the pretence of wanting to know more about the patient’s thoughts - thereby pretending not to want to change the patient’s behavior - the therapist nevertheless continuously has to bring the patient’s common sense model of chronic back pain and its consequences into discussion.

These various different skills are vital for the optimal provision of each of the three treatments, and should therefore be an important element in the training of therapists. However, one may want to consider whether therapists should be expected to be able to provide all three types of treatment, or whether it is best for them to be a master in only one treatment.

Conclusion

Rehabilitation theorists have advocated the importance of theory development in informing selection criteria, in choosing potentially relevant outcome measures, and in the optimal choice of control group (Fuhrer, 2003; Whyte, 2006). In this paper we matched deeds with words by specifying and contrasting the content and theoretical underpinnings of three cognitive behavioral treatments. This helped us to deliberate on the question which cognitive-behavioral treatment is most desirable for what subgroup of patients with chronic low back pain disability, including the likely outcome measures and selection criteria with which their effectiveness might be best objectified. Problems such as comparing treatments on ill-conceived selection criteria and outcome measures were exemplified. Therewith we demonstrated how specification of treatment theory can contribute to a better understanding of research findings and design as well as contributed to the informed choices of treatment. Therapists are urged to use the knowledge from the comparative analyses for making rational treatment choices and to inform patient about these choices.

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