The CAB model of pain-related activity avoidance: description and implications for research and practice

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The CAB Model of Pain-related Activity Avoidance: Description and Implications for Research and Practice in Physical Therapy

ABSTRACT
Background and Purpose: Pain-related activity avoidance is a phenomenon that causes substantial annual patient morbidity. Therefore, it has been the subject of many recent studies related to physical therapist practice. The purposes of this review are: (1) to provide a rationale for considering cognition and affect in physical therapist practice, and (2) to propose the CAB Model for patient education in physical therapist management of pain-related activity avoidance.

Method: Narrative review.
Findings: CAB is an acronym that emphasizes Cognition and Affect in designing patient education programs that facilitate change in avoidant behavior. Clinical Relevance: This review synthesizes literature that suggests pain-related cognitions and affect may be important targets for patient education by physical therapists, because they may serve as progenitors of pain-related activity avoidance. This narrative review provides a model for physical therapists to use in considering these features of clinical presentation and to guide future research.

Key Words: pain, cognition, emotion, behavior, physical therapy

INTRODUCTION
Pain is among the most common concerns that lead people to seek physical therapy. It is defined as a somatosensory modality that provides the perception of an unpleasant sensory experience associated with actual or potential tissue damage. While most individuals share a common stimulus-specific anatomy and physiological processing that provides for the information-gathering function of pain, a vast body of clinical and scientific evidence indicates there are substantial differences in how patients respond to pain. Many of these differences relate to the affective and cognitive-evaluative functions of pain. The affective function of pain provides emotional unpleasantness to pain sensations. This causes people to avoid additional pain and the tissue damage that pain represents. The cognitive-evaluative function of pain may result in maladaptive behavioral responses to pain, such as a disabling avoidance of work, family, and recreational activities. One such behavior includes activity avoidance, which is associated with a spiraling cycle of decline in pain and function.

The Guide to Physical Therapist Practice and recent literature suggest that physical therapists' ability to effectively address their patients' maladaptive behavioral responses to pain, such as activity avoidance, partly depends on their ability to provide adequate patient education to promote behavior change. Effective patient education by physical therapists appears to depend on the use of effective brief psychoeducational strategies that can address the cognitive and affective processes that motivate pain-related activity avoidance. However, the literature to date that characterizes effective brief psychoeducational strategies in the physical therapy setting is in a nascent stage of development. The purposes of this narrative review are 3-fold. First, we will present the rationale for physical therapist intervention at the level of cognition and affect for purposes of optimal patient education in patients with pain-related activity avoidance. Second, we will describe the CAB Model of theoretical relationships between Cognition and Affect in determining motivation for Behavior based on supporting evidence, and discuss the model's relevance to clinical practice and future research related to pain-related activity avoidance.

Cognition and Affect are Important Targets for Management of Pain-Related Activity Avoidance by Physical Therapists
The clinical importance of the affective and cognitive components or pain has made them the subject of numerous studies. In general, psychological factors more strongly predict outcomes for patients with low back pain than demographic characteristics, physical factors, and pain intensity. Lethem et al and Slade et al and their colleagues were among the first to describe a potential mechanism relating psychological factors with clinical outcomes related to low back pain in the general population. In their Fear-Avoidance Model, all patients were considered to be at least somewhat fearful of pain because of the typical affective function of pain. Lethem and Slade hypothesized that some patients seek to avoid pains by reducing or avoiding functional behaviors that may provoke pain, while other patients confront pain. The authors described pain confrontation as a strategy that promotes recovery by progressively reducing levels of fear through repeated self-exposure to pain-provoking activities. Avoidance of pain was thought to reinforce additional activity avoidance over time. In turn, pain and activity avoidance was thought to result in deconditioning that reduces the overall capacity for pain-free functional activities.

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deconditioning then would result in a spiraling cycle of decline in patient function. Subsequent conceptual work by this group suggested these predictions may generalize well to patients with persistent pain, regardless of pathology. Much research exists to date that documents these so-called fear avoidance beliefs’ association with disability and temporal characteristics.  

While construct validity of the Fear-Avoidance Model remains an open question, it is evident that pain-related activity avoidance is an important issue in physical therapist practice. A nascent literature in the field of physical therapy suggests the importance of exercise and educational interventions provided by physical therapists to ameliorate disablement in patients with pain-related activity avoidance. George and colleagues reported on the physical therapy management of a 42-year-old male with low back pain and elevated fear avoidance beliefs. Along with using a treatment-based classification approach and graded exercise, ongoing patient education was provided to the patient in an attempt to improve the patient’s specific understanding of his health condition, provide a pain self-management plan, and build a collaborative approach to treatment. The approach used in this case study included an unspecified amount of treatment time spent with individualized instruction, which was supplemented with a pamphlet. Subsequently, in a study of subjects with LBP and elevated activity avoidance beliefs, Godges et al. demonstrated that a pragmatic approach to physical therapy combined with patient education guided by review of a pamphlet reduced significantly the number of days to return to work. A component of individualized education was provided by the treating physical therapist which centered on 3 primary questions that were asked of each subject in the education group of this study. These included whether the subject had learned new information from their review of the pamphlet, had questions regarding material presented in the pamphlet, and whether the pamphlet provided them with information that would be helpful to manage their back pain. These examples from the physical therapy literature provide preliminary support for the importance of educational interventions and brief counseling strategies provided by physical therapists in addressing disablement in patients with pain-related activity avoidance. Despite the compelling nature of these studies, no studies have identified the specific components of optimal patient education programs for this patient population.

Successful patient education programs facilitate clinically meaningful changes in patients’ and clients’ behavior. Motivation to perform behaviors, including functional and self-management activities, is associated with patients’ thoughts, beliefs, attitudes, and emotions. Therefore, these cognitive attributes may be important treatment considerations in optimal patient education by physical therapists for patients with pain-related activity avoidance. Correspondingly, studies indicate cognitive-behavior therapy associated with exercise-based treatments positively affects disablement in patients with pain-related activity avoidance. Identification of cognitive and affective factors associated with functioning and disablement appears important to determine the characteristics of effective patient education programs in patients with pain-related activity avoidance. In this manner, cognitive and affective components of behavior change form an important route of intervention for physical therapists to promote successful outcomes in this patient population. Implementation of formal cognitive-behavior therapy programs is within the scope of practice for physical therapists, although it may be outside the usual training and time constraints for many physical therapists at this time. However, this should not prevent the formation of guidelines physical therapists may use to consider cognitive and affective components of pain-related activity avoidance in order to improve the quality of patient education in this population. This will provide a cadre of clinicians who are capable of providing effective patient education programs, an approach that has been promoted in the literature.  

The CAB Model  

The development of the CAB Model has been based on the widely accepted observation that individuals’ Cognitions and Affect predicate their motivation to complete a Behavior. One’s self-assessments of the efficacy to perform a behavior and the behavior’s potential outcome appear to be the primary thoughts and beliefs that predict behavior enactment by patients. According to the CAB Model (Figure 1), patients with pain-related activity avoidance are predicted to demonstrate low efficacy and/or outcomes expectations that lead to excessive pain-avoiding behavior in the short-term and subsequently leading to activity-avoiding behavior over time. Also according to the CAB Model, activity-related cognition is hypothesized to be influenced by emotional state through cognitive filtering. Therefore, emotional states serve as a potential amplifying factor to existing pain- and activity-avoidant cognitions, because anxiety and depression appear to cause additional negative appraisal of efficacy and outcomes expectations through the processes of catastrophizing and learned helplessness.  

Efficacy Thoughts and Outcome Beliefs Predict Motivation for Activity Performance Despite Pain  

Many investigators have applied theories from the field of cognitive psychology in an attempt to explain pain-related activity avoidance. Early experimental work in animal models by Miller and Dollard suggested that new behavior may be learned by imitation in the presence of sufficient motivation. They also suggested the development of new behavior through imitation is shaped by the rewards received for imitating the new behavior. This work is historically important because it is among the first studies to describe the influence of social interaction on developing new behavior. However, this hypothesis did not explain adequately the potential role of internal motivation for acquiring a new behavior through imitation. Bandura advanced this early work by proposing a model for learning new behavior that acknowledges reciprocal causation among external factors related to the environment and internal factors related to the individual. This contrasted with the behaviorist’s view of the time, which recognized the effect of the environment to shape the development of new behaviors externally as preeminently important. Bandura’s Social Cognitive Theory suggests learning is a self-directed and goal-oriented activity that is guided by the motivation of the individual, and learning may or may not change behavior. According to early conceptual work with Social Cognitive Theory, patients’ expectations about the activities they might perform, in the presence of adequate incentives and ability, were hypothesized to be important determinants of whether these activities will be performed. Expectations are not considered to condition an automatic response, in which favorable expectations always result in performance of an activity. Rather, individuals’ expectations are thought to help shape patients’ functional behavior by way of motivation to complete functional activities. In this context, patients’ expecta-
performance of a behavior. Bandura\textsuperscript{35} broadly

to determine motivation for the performance of an
activity.\textsuperscript{[42x53]} In patients with pain-related activity avoidance (B), the behavioral
outcome of pain causes increased maladaptive cognitive processes (negative efficacy and
outcome expectations). Affective processes (anxiety and depression) further influence
negative cognitions by way of catastrophizing and learned helplessness. As behaviors di­
minish over time, negative cognitive and affective processing becomes the primary source
of information regarding potential behavior outcome, rather than direct experience with
the behavior itself. This leads to a spiraling cycle of decline in patient function.

Figure 1. The CAB Model of hypothetical relationships among cognition, affect, and beha­
avior in pain-related activity avoidance. Patient cognitions (efficacy and outcome expecta­
tions) combined with emotional state are hypothesized to predict the performance of an
activity (A). Cognition and affect reciprocally inform each other, as well as interpretation
of activity outcome. In patients with pain-related activity avoidance (B), the behavioral
outcome of pain causes increased maladaptive cognitive processes (negative efficacy and
outcome expectations). Affective processes (anxiety and depression) further influence
negative cognitions by way of catastrophizing and learned helplessness. As behaviors di­
minish over time, negative cognitive and affective processing becomes the primary source
of information regarding potential behavior outcome, rather than direct experience with
the behavior itself. This leads to a spiraling cycle of decline in patient function.

According to Social Cognitive Theory,\textsuperscript{2} two
sets of expectations influence a patient's mo­
tivation for the performance of a behavior, including outcome expectations. Outcome
expectations are defined as a patient's cost to benefit analysis of a task that results in a
result in a certain outcome.\textsuperscript{32,34} The major
implication for physical therapist practice of patients' outcome expectations is that a
behavior may be avoided by a patient if the behavior is considered too costly in terms
of anticipated benefit relative to a more minor perceived gain. Patients' avoidance beha­
viors are thought to be reinforced by their outcome expectation of pain reduction
through avoiding activities that potentially provoke pain, whether or not the patient
actually is successful to reduce their pain in this manner.\textsuperscript{36} Cipher and Fernandez\textsuperscript{27}
also identified that positive outcome expecta­
tions regarding a pain-generating coldpressor task significantly predicted whether subjects would volunteer for the experimental
treatment, while negative expectations predicted avoidance.

Efficacy expectations are the second set of
expectations predicted by Social Cognitive
Theory to determine motivation for the per­
formance of a behavior. Bandura\textsuperscript{35} broadly
describes efficacy expectations as an individu­
al's task- and situation-specific estimate of
personal mastery. Bandura\textsuperscript{35} also surmised
individuals would avoid environments and
activities that seemed to exceed one's own
estimate for coping. Therefore, self-efficacy
influences an individual's choice of environ­
ment and activities. In addition, self-efficacy
is positively associated with the magnitude
and persistence of coping behaviors once they are initiated.\textsuperscript{38-40} These ideas appear to
explain the significant association between
self-efficacy and pain-related activity avoid­
ance, in that patients with low self-efficacy
more frequently tended toward increased
pain-related activity avoidance\textsuperscript{32,41-43}
and poorer functional outcomes.\textsuperscript{44} Woby
and colleagues\textsuperscript{45} found that patients with
persistent low back pain who demonstrated
high self-efficacy beliefs also showed significa­
tantly better clinical outcomes regardless of
the strength of other beliefs about pain and
function than individuals with low self­
efficacy beliefs. Self-efficacy expectations re­
garding work also significantly predict the
likelihood of returning to work in injured
workers.\textsuperscript{46} This suggests self-efficacy may
mediate the relationship between pain-relat­
ed activity avoidance and clinical outcomes
in patients with persistent low back pain.

An analysis of the behavior change liter­
ature in body weight management and
smoking cessation supports the notion that
self-efficacy is modifiable, and that high self­
efficacy is important to successful health be­
havior change in patients. Participants in a
smoking cessation behavior therapy group
aimed at increasing social support and emp­
owerment were 6 times more likely to case smoking than a control group.\textsuperscript{47} Teixe­
ira and colleagues\textsuperscript{48-49} determined high
exercise self-efficacy was among important
pretreatment predictors of response to a
weight management program in overweight
and obese women. High exercise and ear­
ing self-efficacy was a significant predictor
of favorable response to an 8-week behav­
ior therapy program in a similar sample.\textsuperscript{50}
However, despite the apparent importance
of high self-efficacy to facilitate short-term
behavior change, the effect of the program
to strengthen self-efficacy beliefs was tran­
sient because this trend was not significantly
present at 6-month follow-up. These results
suggest that high self-efficacy combined with
the ability to implement clinician instruc­
tions accurately and consistent home exer­
cise program compliance may have positive
impacts on short-term patient compliance
and short-term clinical outcomes in patients
with pain-related activity avoidance, but
those intermediate-term effects are variable.

Emotional States Guide Thoughts and
Beliefs about Activity Performance De­
spite Pain

Investigators have examined the role of
affect as potential correlates and progeni­
tors of pain-related activity avoidance. De­
pressed affect is recognized as a significant
predictor of increased disability.\textsuperscript{51,52}
improvement with multidisciplinary rehabili­
tation programs,\textsuperscript{53,54} and increased health
care utilization in patients with pain.\textsuperscript{55,56}
Likewise, anxiety and sensitivity to anxiety
have been the focus of many studies in pa­
tients both with and without pain. Studies
have identified these factors as a similarly
significant predictors of a tendency toward
potential pain-related activity avoidance in
children and adolescents,\textsuperscript{57,41} as well as pain
frequency,\textsuperscript{62} low pain coping,\textsuperscript{63} increased
disability,\textsuperscript{55,56,64} and increased health care
utilization in adults.\textsuperscript{55} Patients with idiopathic
or nonspecific pain were more likely than
patients with specific or organic pain to
tolerate positively for a major psychologi­
cal disorder in one sample\textsuperscript{65} and other stud­
ies have identified a significantly greater
prevalence of nonpain fear and avoidance
in patients with nonspecific pain.\textsuperscript{65,66} How­
ever, it is important to note that most stud­
ies to date looking into the role of affect did
not report the prevalence of patients who
were diagnosed with a major psychologi-
cal disorder related to anxiety or depression
despite liberal use of the psycho-diagnostic
labels ‘anxiety’ and ‘depression.’ A recent
systematic review also documented inco-
sistent evidence for the predictive ability of
measures of anxiety and depression on work
outcome. Nevertheless, from the current
available evidence to date, affective features
of anxiety and depression are important
considerations for the clinical management
of pain-related activity avoidance by physi-
cal therapists.

The inconsistent influence of affect on
outcome in patients with pain-related ac-
activity avoidance suggests a mechanism in-
volving an indirect effect that may not be
observable across studies. One potential
explanation of the relationship between
outcome and affect involves cognitive bias.
Cognitive bias refers to the tendency to
make errors in judgment that are based on
thoughts and beliefs, particularly those that
guide attention. Attentional bias is the ten-
dency to take into account certain stimuli
over others. This is thought to be a largely
adaptive response to assist individuals in
making rapid decisions regarding the most
important stimuli upon which to take ac-
tion. Baumeister and colleagues suggested in
their recent review that a great many
psychological studies have documented the
trend that attention toward negative or po-
tentially dangerous stimuli typically takes
priority over attention to positive stimuli.
In fact, the observation that negative stimuli
outrank positive stimuli in attentional bias is
so common that it has been suggested as
one of the more pervasive findings in the
psychological literature. Attention toward
negative stimuli also may be modulated by
affect. In patients with pain-related activ-
ity avoidance and negative affect (ie, anxiety
or depression), attentional bias toward nega-
tive stimuli may shape and reinforce existing
avoidance behaviors. Therefore, physical
therapists’ consideration of affective char-
acteristics may be an important component
of optimal educational interventions in this
population.

Perhaps the use of affective states as a
cognitive filter partially explains the phe-
nomenon of pain catastrophizing, which
appears to be associated with pain-related
activity avoidance. Catastrophizing is a
cognitive process in which an individual
dwells on the most negative possible result
of a behavior. Catastrophizing has been
characterized as a series of automatic “What
if?” questions that patients with anxiety
disorders appear to ask themselves. The
responses to these questions generated by
the individual seem to “betray a rapid-fire
sense of impending incompetence,” rather
than using data that supports one’s
own efficacy. Patients who engage in pain
catastrophizing thoughts and beliefs may
use their perceived incompetence as a cog-
nitive filter that biases them toward attend-
ing to additional feedback from the envi-
ronment that supports their view of incom-
potence. This cycle is clinically significant,
because pain catastrophizing appears to be
important in predicting disability and
and pain intensity in patients with various
forms of persistent pain. The cyclic nature of pain catastrophizing sug-
gests it may be viewed as a cognitive habit
that improves with rehearsal. Each time
the most negative possible outcome of a
behavior is expected, information appears
to be selectively perceived to support this
notion. This cycle would more effectively
reinforce pain-related activity avoidance
over time. Pain catastrophizing further
buttresses the importance of cognition and
affect valuable considerations for physical
therapists in designing optimal patient care
management plans.

Cognitive filtering according to de-
pressed mood also may be partly responsible
for pain-related behavior avoidance through
learned helplessness. Seligman first de-
scribed learned helplessness based on human
and animal research, in which an individual
perceives injurious stimuli as inevitable and
uncontrollable. These perceptions have
been hypothesized to reduce the capacity
for meaningful response to potentially tra-
umatic stimuli; to limit the ability to learn al-
ternate coping and escape strategies, and to
promote emotional distress. The nature of
individuals’ causal explanations for nega-
tive stimuli and events have been associated
with learned helplessness. Specifically,
attributions that patients direct to causes
that are within the individual (internal), do
not change over time (stable), and many dif-
f erent situations (generalizable) seem to pre-
dict learned helplessness in depression.
While the role of learned helplessness in
pain-related activity avoidance has been
less studied to date, it has been associated
with disability in patients with persistent
pain. Of therapeutic importance, studies
have documented that learned helplessness
is reversible and preventable in response to
specific exposure to appropriate escape and
coping strategies. The reversibility of
learned helplessness in response to these
interventions may partly explain the effec-
tiveness of exposure-based therapeutic
programs for patients with pain-related ac-
tivity avoidance. However, the role for
specific patient education by physical
therapists to address patients’ escape strate-
gies, coping skills, and attributional style
may be the subject of important future
studies.

Implications of the ‘CAB’ Model for
physical therapist management of pain-
related activity avoidance

Predictions based on the CAB Model
have several implications for research and
practice related to optimal physical ther-
pist management of pain-related activity
avoidance. Patient education to address
pain-related cognition in combination with
movement-related interventions appears op-
timal for patients without significant affect-
ive overlay, because efficacy and outcome
expectations serve as strong predictors of
motivation to perform behaviors (Figure 2).
Findings from several studies suggest quota-
based exercise programs that facilitate pain
confrontation alone may promote improve-
ments in short-term patient outcomes. How-
ever they may run the unintended risk of
reinforcing avoidant behaviors in the
long term through reinforcing the existing
cognitive and affective patterns they are
meant to address. This may account for
inconclusive findings in clinical trials re-
garding the clinical effectiveness of graded
exposure approaches in the context of mul-
tidisciplinary pain management for this pa-
tient population. Second, patients with
substantial cognitive and affective compo-
ents also may require specific intervention
to address these issues. Movement-related
interventions may be limited in their abil-
ity to address effectively these components
if they are clinically significant. Therefore,
guidelines for referral to licensed mental
health providers by physical therapists must
be created to ensure appropriate interdisci-
plinary care is provided to patients with
needs requiring attention beyond the scope
of physical therapist practice.

Intervention at the level of cognition by
way of patient education for patients with
pain-related activity avoidance necessitates
physical therapists measure efficacy and
outcomes expectations. Since self-efficacy
beliefs are known to be specific to a task or
situation, their generalization across health
conditions and movement dysfunctions that
differ in pain-related avoidance behaviors remains unclear. Assessment of self-efficacy is in early stage of development in the rehabilitation literature, so few health condition- and stage-specific scales currently exist.\textsuperscript{100-103} Existing questionnaires that were designed to measure pain-related fear, such as the Fear Avoidance Beliefs Questionnaire\textsuperscript{104} and Tampa Scale for Kinesiophobia,\textsuperscript{105} actually also may be useful measures of outcomes expectations and attributions. The measurement and optimal interventions at the levels of efficacy and outcome expectations appear to be important topics for future research in physical therapy.

The CAB Model also suggests a need for examination and evaluation of patients' emotional states in order for physical therapists to design optimal patient education programs to address pain-related activity avoidance. The global role of affect as a cognitive filter may be measured by the Pain Catastrophizing Scale.\textsuperscript{106} Several standardized instruments already exist to assess the extent of specific affective states in cognitive filtering on the basis of affect, including the State-Trait Anxiety Inventory\textsuperscript{107} and Beck Depression Inventory.\textsuperscript{108} Clinically significant anxiety and depression according to these questionnaires constitute a need for referral to a licensed mental health provider. Subclinical depression and anxiety features may require differential patient education interventions to address pain catastrophizing and learned helplessness, respectively. Evidence of potential adverse pain-related affect also may be gathered by way of the McGill Pain Questionnaire,\textsuperscript{109,110} although it may be less specific to determining the emotional state that is most responsible for potential cognitive filtering. Additional research should establish best practices related to physical therapists' measurement and intervention at the level of patients' affect for purposes of considering emotional states in patient education programs and establishing the need for referral to licensed mental health professionals.

**CONCLUSION**

This review proposed the CAB model for patient education in physical therapist management of pain-related activity avoidance, based on current scientific evidence and emerging literature that suggests an important role for individualized patient education provided by physical therapists in this population. 'CAB' is an acronym that emphasizes the need to consider Cognition and Affect in designing patient education programs that facilitate change in avoidant Behavior. Future studies should examine the construct validity of this model, as well as its optimal application to physical therapist practice.

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