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

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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.[1,2] 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.[3] 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 serves for learning and behavioral adaptation. Disorders involving the affective and cognitive-evaluative functions 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 pains and function.[4-6]

The *Guide to Physical Therapist Practice*[7] and recent literature[8,9] 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.[10-13] Lethem et al[4] and Slade et al[5] 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[4] and Slade[5] 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. The avoidance of activity and associated

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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.[14] Much research exists to date that documents these so-called fear avoidance beliefs' association with disability and temporal characteristics.[6,15-17]

While construct validity of the Fear-Avoidance Model remains an open question,[12,18-20] it is evident that pain-related activity avoidance is an important issue in physical therapist practice.[21-26] 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[8] 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[9] 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.[27] 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.[28] 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,[7] 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.[29,30]

The CAB Model

The development of the CAB Model has been based on the widely accepted observation that individuals' **C**ognitions and **A**ffect predicate their motivation to complete a **B**ehavior. 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[31] 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[32-34] 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 the individual. This contrasted with the behaviorists' 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[33] 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.[32,35] 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.[32-35] In this context, patients' expecta-

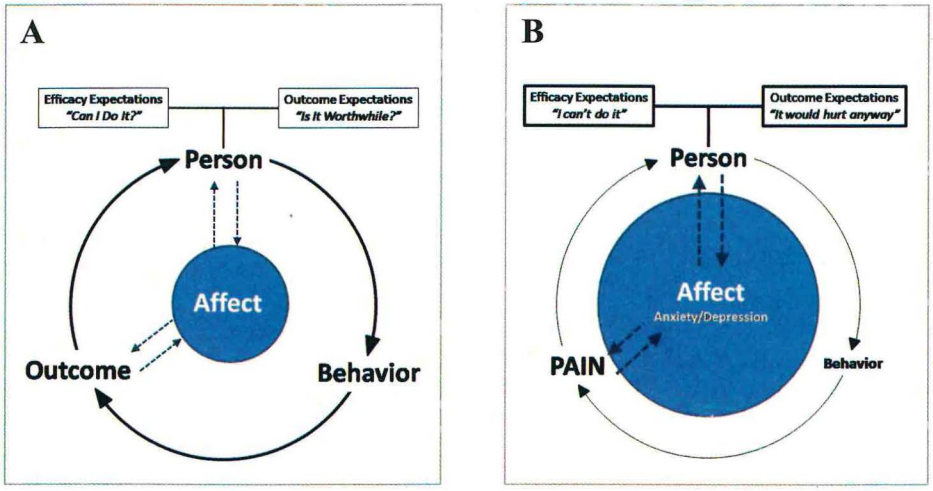

Figure 1. The CAB Model of hypothetical relationships among cognition, affect, and behavior in pain-related activity avoidance. Patient cognitions (efficacy and outcome expectations) combined with emotional state are hypothesized to predict the performance of an activity (A). Cognition and affect reciprocally 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 diminish 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.

tions affect the degree and duration of pain coping necessary to perform health-related and functional behaviors (Figure 1).

According to Social Cognitive Theory, 2 sets of expectations influence a patient's motivation for the performance of a behavior, including outcome expectations. Outcome expectations are defined as a patient's cost to benefit analysis that a certain behavior will result in a certain outcome.[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 pain relative to a more minor perceived gain. Patients' avoidance behaviors 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.[36] Cipher and Fernandez[37] also identified that positive outcome expectations regarding a pain-generating cold pressor 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 performance of a behavior. Bandura[35] broadly describes efficacy expectations as an individual's task- and situation-specific estimate of personal mastery. Bandura[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 environment and activities. In addition, self-efficacy is positively associated with the magnitude and persistence of coping behaviors once they are initiated.[38-40] These ideas appear to explain the significant association between self-efficacy and pain-related activity avoidance, in that patients with low self-efficacy more frequently tended toward increased pain-related activity avoidance beliefs[12,41-43] and poorer functional outcomes.[44] Woby and colleagues[45] found that patients with persistent low back pain who demonstrated high self efficacy beliefs also showed significantly better clinical outcomes regardless of the strength of other beliefs about pain and function than individuals with low self-efficacy beliefs. Self-efficacy expectations regarding work also significantly predict the likelihood of returning to work in injured workers.[46] This suggests self-efficacy may mediate the relationship between pain-related activity avoidance and clinical outcomes in patients with persistent low back pain.

An analysis of the behavior change literature 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 behavior change in patients. Participants in a smoking cessation behavior therapy group aimed at increasing social support and empowerment were 6 times more likely to case smoking than a control group.[47] Teixeira and colleagues[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 eating self-efficacy was a significant predictor of favorable response to an 8-week behavior therapy program in a similar sample.[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 transient 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 instructions accurately and consistent home exercise 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 Despite Pain

Investigators have examined the role of affect as potential correlates and progenitors of pain-related activity avoidance. Depressed affect is recognized as a significant predictor of increased disability,[51,52] improvement with multidisciplinary rehabilitation programs,[53,54] and increased health care utilization in patients with pain.[55,56] Likewise, anxiety and sensitivity to anxiety have been the focus of many studies in patients 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,[57-61] as well as pain frequency,[62] low pain coping,[63] increased disability,[52,54,64] and increased health care utilization[55] in adults. Patients with idiopathic or nonspecific pain were more likely than patients with specific or organic pain to screen positively for a major psychological disorder in one sample[65] and other studies have identified a significantly greater prevalence of nonpain fear and avoidance in patients with nonspecific pain.[66,67] However, 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 psychological disorder related to anxiety or depression despite liberal use of the psycho-diagnostic labels 'anxiety' and 'depression.' A recent systematic review also documented inconsistent evidence for the predictive ability of measures of anxiety and depression on work outcome.[46] 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 physical therapists.

The inconsistent influence of affect on outcome in patients with pain-related activity avoidance suggests a mechanism involving 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 tendency 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 action. Baumeister and colleagues[68] suggested in their recent review that a great many psychological studies have documented the trend that attention toward negative or potentially 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.[68] Attention toward negative stimuli also may be modulated by affect.[69] In patients with pain-related activity avoidance and negative affect (ie, anxiety or depression), attentional bias toward negative stimuli may shape and reinforce existing avoidance behaviors. Therefore, physical therapists' consideration of affective characteristics 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 phenomenon 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.[70,71] Catastrophizing has been characterized as a series of automatic "What if?" questions that patients with anxiety disorders appear to ask themselves.[72] The responses to these questions generated by the individual seem to "betray a rapid-fire sense of impending incompetence,[73(p96)] 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 cognitive filter that biases them toward attending to additional feedback from the environment that supports their view of incompetence. This cycle is clinically significant, because pain catastrophizing appears to be important in predicting disability[60,61,74-79] and pain intensity[61,74,76,77,80-82] in patients with various forms of persistent pain. The cyclic nature of pain catastrophizing suggests 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 depressed mood also may be partly responsible for pain-related behavior avoidance through learned helplessness. Seligman[83] first described 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 traumatic stimuli, to limit the ability to learn alternate coping and escape strategies, and to promote emotional distress.[83-85] The nature of individuals' causal explanations for negative stimuli and events have been associated with learned helplessness.[86,87] Specifically, attributions that patients direct to causes that are within the individual (internal), do not change over time (stable), and many different situations (generalizable) seem to predict learned helplessness in depression.[86,87] 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.[88] Of therapeutic importance, studies have documented that learned helplessness is reversible and preventable in response to specific exposure to appropriate escape and coping strategies.[89-93] The reversibility of learned helplessness in response to these interventions may partly explain the effectiveness of exposure-based therapeutic programs for patients with pain-related activity avoidance.[8,9,36,94,95] However, the role for specific patient education by physical therapists to address patients' escape strategies, 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 therapist management of pain-related activity avoidance. Patient education to address pain-related cognition in combination with movement-related interventions appears optimal for patients without significant affective 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 improvements in short-term patient outcomes.[94,96-98] However 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 regarding the clinical effectiveness of graded exposure approaches in the context of multidisciplinary pain management for this patient population.[99] Second, patients with substantial cognitive and affective components also may require specific intervention to address these issues. Movement-related interventions may be limited in their ability 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 interdisciplinary 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

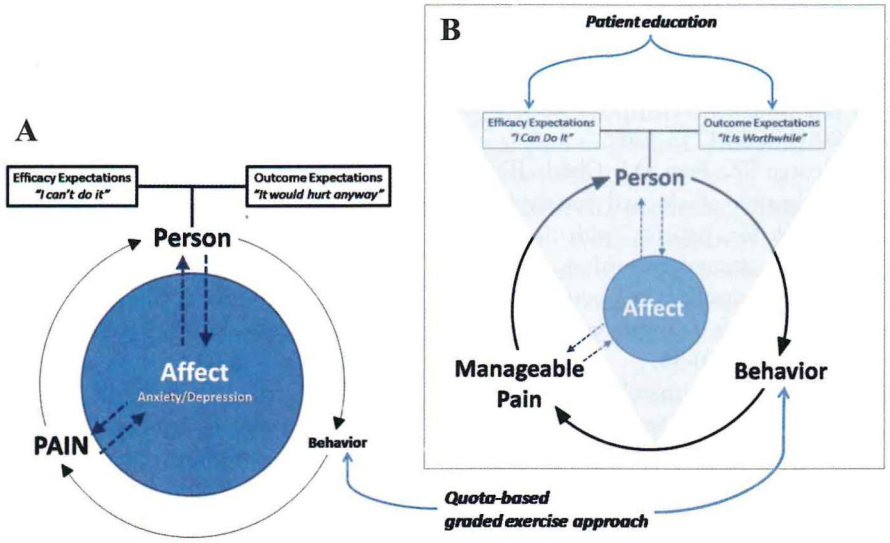

Figure 2. Predicted effects of selected interventions for pain-related activity avoidance according to the CAB Model. Interventions at the level of behavior, such as a quota-based graded exercise programs, may run the risk of reinforcing maladaptive cognitive and affective responses to activity because they are not directly addressed (A). Empirically sound approaches to patient education that addresses maladaptive cognitive and affective responses to activity that occurs simultaneously with behavioral interventions may provide patients the opportunity to practice implementing new cognitive and affective strategies and optimize clinical outcomes (B).

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.[100-103] Existing questionnaires that were designed to measure pain-related fear, such as the Fear Avoidance Beliefs Questionnaire[104] and Tampa Scale for Kinesiophobia,[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.[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[107] and Beck Depression Inventory.[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,[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 **C**ognition and **A**ffect in designing patient education programs that facilitate change in avoidant **B**ehavior. Future studies should examine the construct validity of this model, as well as its optimal application to physical therapist practice.

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