

Assessment of Psychosocial and Functional Impact of Chronic Pain



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Abstract: The psychosocial and functional consequences of chronic pain disorders have been well documented as having significant effects on the experience of pain, presentation to health care providers, responsiveness to and participation in treatment, disability, and health-related quality of life. Thus, psychosocial and functional consequences have been incorporated as 1 of the 5 dimensions within the integrated Analgesic, Anesthetic, and Addiction Clinical Trial Translations, Innovations, Opportunities, and Networks (ACTTION)-American Pain Society (APS) Pain Taxonomy (AAPT): 1) core diagnostic criteria; 2) common features; 3) common medical comorbidities; 4) neurobiological, psychosocial, and functional consequences; and 5) putative neurobiological and psychosocial mechanisms, risk factors, and protective factors. In this article we review the rationale for a biopsychosocial perspective, on the basis of current evidence, and describe a set of key psychosocial and behavioral factors (eg, mood/affect, coping resources, expectations, sleep quality, physical function, and pain-related interference with daily activities) that are important consequences of persistent pain and that should be considered when classifying patients within the comprehensive AAPT chronic pain structure. We include an overview of measures and procedures that have been developed to assess this set of factors and that can be used as part of the comprehensive assessment and classification of pain and to address specific research questions.

Perspective: Psychosocial and functional consequences are important considerations in the classification of individuals with chronic pain. A set of key psychosocial and behavioral factors (eg, mood/affect, coping resources, expectations, sleep quality, physical function, and pain-related interference with daily activities) that should be considered when classifying patients within the comprehensive classification of chronic pain disorders developed by the AAPT are outlined and examples of assessment methods for each are described.

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Key words: Biopsychosocial, classification, physical function, beliefs, mood, fatigue, sleep, social support, taxonomy.

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The Analgesic, Anesthetic, and Addiction Clinical Trial Translations, Innovations, Opportunities, and Networks (ACTTION) public-private partnership with the U.S. Food and Drug Administration and the American Pain Society (APS) has collaborated to develop a classification system that incorporates current knowledge of biopsychosocial mechanisms, entitled the ACTTION-APS Pain Taxonomy (AAPT). The overriding objective of the AAPT is to develop, to the extent possible, an evidence-based taxonomy of the most common chronic pain conditions, which is on the basis of a consistently applied multi-dimensional framework, and then to commission experts to validate the classification by applying the proposed framework to individuals across the indicated set of chronic pain conditions. The results of these and

subsequent studies on the reliability and validity of the AAPT will determine the adequacy of and the need for refinements to the classification.

To accomplish the objective of developing a comprehensive taxonomy, a meeting was convened on May 17 and 18, 2013, bringing together clinical and basic scientists with expertise in pain mechanisms and in the major chronic pain disorders in adults and children. On the basis of extensive discussions the AAPT was developed and designed to be multidimensional, consisting of 5 interrelated dimensions, namely: 1) core diagnostic criteria; 2) common features; 3) common medical comorbidities; 4) neurobiological, psychosocial, and functional consequences; and 5) putative neurobiological and psychosocial mechanisms, risk factors, and protective factors. The recommendation of the AAPT working group was that all 5 dimensions comprising the AAPT framework should be applied to each chronic pain disorder.

In this article we focus specifically on 1 part of dimension 4 of the AAPT classification system—psychosocial and functional consequences of chronic pain. We also consider psychosocial and behavioral constructs and processes that interact with physiological features and mechanisms and their interrelationships contributing ultimately to the experience, effect, report, and response to pain, and thereby classification. Neurobiological consequences, also included in dimension 4, are not discussed in this article. It is important to acknowledge that many of the psychosocial constructions and processes contained in dimension 4 (psychosocial consequences) and dimension 5 (psychosocial mechanisms, risk factors, and protective factors) overlap. This occurs because chronic pain extends over time and many initial psychosocial consequences of the presence of pain can become mechanisms in the subsequent amplification and maintenance of symptoms over time. Taking a longitudinal perspective underscores how psychosocial mechanisms and consequences can represent causal factors as well as responses to the presence of persistent pain depending on when they are assessed. Thus, although the current article reviews the assessment of psychosocial and functional effect of chronic pain, we encourage readers to also examine the article by Edwards et al,⁶⁶ in this issue of *The Journal of Pain*, which covers psychosocial mechanisms and risk factors of chronic pain. We have attempted the broadest conceptualization of what is intended in dimensions 4 and 5 although we acknowledge that there are intrinsic overlaps between dimensions 4 and 5 of the AAPT. This taxonomy is envisioned as describing, within the limits of how we can reliably and pragmatically measure, these 2 dimensions as if they are relatively independent; however, we are aware that causation is complex, recursive, and nonlinear.

There are several goals for this article. First, we sought to provide a brief overview of the rationale for a biopsychosocial perspective in chronic pain and thus provide justification for including dimension 4 within the comprehensive AAPT system (see also Edwards et al,⁶⁶ in this issue of *The Journal of Pain*). Second, we identify

Assessment of Psychosocial and Functional Effect and describe a set of key psychosocial and behavioral variables (eg, affect, beliefs and expectations, coping resources, sleep quality, physical function, and pain-related interference with daily activities) that are influenced by the presence of chronic pain and have, in addition, an effect on symptoms. The third goal is to identify some of the most common ways of assessing this set of psychosocial and behavioral factors as well as the functional consequences of pain. Although the compendium of available measures and assessment procedures is voluminous with many designed for specific conditions (eg, osteoarthritis, back pain, fibromyalgia) and age groups (ie, infants, children, adolescents, adults, and the geriatric population), we focus on general concepts and include an overview of an illustrative sample of selected measures and procedures that have been widely used with adults and those who are able to communicate (Tables 1–5). We have included references in this set of tables so the reader can examine the studies and ascertain the psychometric properties and patient population characteristics. The reader should also review other sources describing more specific measures and populations in depth^{9,65,89,131,219} when considering appropriate measures to include in a study or within clinical practice where classification is important.

Pain: A Biopsychosocial Perspective

Historically, the concept of pain largely depended on the assumed linearity between identifiable organic pathology and pain report. Thus, the amount of pain was expected to be associated with and proportional to the nature and amount of tissue damage. When the presence and extent of a pain report was not “validated” by objectively determined pathology, the subjectively reported pain was considered “functional” or “psychogenic.” In these circumstances, psychological constructs and processes were presumed to be the underlying mechanisms and consequently were considered to be playing a causal role. In instances when “objective evidence” existed to support reports of pain, psychological factors, when considered, were treated as secondary reactions and largely irrelevant to the pure physiological, “real,” or “organic” pain. However, over the past 4 decades, research has repeatedly and consistently shown that pain of all types represents a complex biopsychosocial phenomenon. The report of pain is always subjective. A range of cognitive, behavioral, and affective constructs and processes, in addition to physical and other biomedical factors, have been identified as essential aspects of understanding the experience of pain and its consequences, namely, perception, effect, and responses of those reporting pain, particularly chronic pain. Although they are entwined, it is important to distinguish psychosocial constructs and processes as “causal” agents, from psychosocial constructs and processes as mediators and moderators of the ongoing pain experienced. The interaction of psychosocial factors with the physical domain such as tissue damage or impairment contributes to variation in disability and

Table 1. Illustrative Set of Measures of Psychosocial and Physical Functioning

MEASURE/REFERENCE	PURPOSE/CONTENT	NUMBER OF ITEMS	PROPERTIES/SCORING
Comprehensive measures: pain, physical, and emotional functioning			
General pain			
Brief Pain Inventory Short Form ^{50,51}	Assesses pain and interference of pain with functional activities. Interference scale includes activity, mood, walking ability, normal work, relations with others, sleep, and life enjoyment. Originally developed with cancer patients extended to noncancer. ⁴⁹ Scale: 0 (not at all), 10 (completely), higher scores = greater pain, greater Interference. 11-Point scale, 0 = does not interfere, 10 = completely interferes. Recall period, past week or past 24 hours, pain interference = mean of 7 interference items. 2 Scales, pain (3 items) and interference (7 items).	10	Higher score = greater pain or interference of pain with activities, sleep, and negative mood.
West Haven Yale Multidimensional Pain Inventory ¹¹⁴	Measures pain severity, pain interference, support, life control, affective distress, other's responses to pain, performance of 18 activities. Scales have variable numbers of items. Interference scale covers: day-to-day activities, ability to work, satisfaction social and recreational activities, ability to participate in social and recreational activities, satisfaction from family activities, marital and family relations, satisfaction from work, ability to do household chores, friendships. Recall period "Since pain began." Scores on 12 subscales with mean of number of items in each scale, 0 to 10 scale, 0 = no change, 10 = extreme change.	52/63	For all scales, pain and interference higher scores = negative; for mood, lower = worse; for control higher scores = greater feelings of control; support scale higher scores = better; significant other response scales higher scores = more typical response; activity scales higher number = greater activity.
General			
Nottingham Health Profile ⁹⁶	Measures effect of illness and change in health status. Assess emotional, social, and physical health. Two parts: 1: health status (ie, energy [3 items], pain [8 items], emotional reactions [9 items], sleep [5 items], social isolation [5 items], physical abilities [8 items]); 2: effect on daily life (ie, employment, home duties, social life, relationships, sex, interests, vacations).	38/7	0 = best, 100 = worst health.
PROMIS ^{44,160-165}	A collection of precise, patient-reported measures of symptoms, functioning, and health-related quality of life in chronic disease. Short-forms (static scales) containing a fixed number of items from 7 PROMIS domains (depression, anxiety, social roles satisfaction, physical functioning, pain intensity, fatigue, sleep). There are 3 (IRT) score profile lengths: the PROMIS-29 includes 4 items per domain, PROMIS-43 includes 6 items per domain; the PROMIS-57 includes 8 items per domain. Response interval "over the past 7 days" except for physical function, which has no time frame specified. Individual items for each of the 5 symptom scales (ie, anxiety, depression, pain, sleep, fatigue) use 5 response options (eg, 1 = not at all to 5 = very much), with scale scores (ranging from 4 to 20). Note item banks containing many items can be used in different ways with items selected.	29/43/57	Can be administered in a variety of formats (using static measures, selecting items for "item banks," computerized adaptive testing). Scoring manuals generate IRT transformed into T-scores centered on a mean of 50 (SD = 10) representing the estimated US general population mean. Higher scores indicate worse symptom severity. Raw scores can be converted T scores (using conversion tables available at: http://www.nihpromis.org), which are derived from IRT and each 10-point change represents 1 SD (eg, a score of 60 is 1 SD worse and a score of 40 is 1 SD better than the general population mean). The advantages of the T score are that the severity of different symptoms can be compared (eg, a T score of 60 for pain and 55 for fatigue would mean that an individual's pain is relatively worse than their fatigue).

Table 1. Continued

MEASURE/REFERENCE	PURPOSE/CONTENT	NUMBER OF ITEMS	PROPERTIES/SCORING
Quality of Well-Being Scale ¹⁰⁹	Assess health-related quality of life. Preference-based measure that combines functioning and symptoms to produce a well-being index from 0 = death to 1 = symptom-free, fully functioning. Includes a wide range of physical and mental symptoms. Most items focus on a specific problem related to 1 body system, such as visual problems (eg, blindness) or central nervous system functioning (eg, paralysis). Symptom checklist and 4 function sections (ie, self-care, mobility, physical activity, usual activity), 58 symptoms, 2 self-care items, 3 items each for mobility and usual activity, and 8 items for physical activity. Symptoms: present/absent; remaining items, 4-point scale "over past 3 days experienced a problem: no days, yesterday, 2 days ago, 3 days ago."	74	Requires computerized scoring. Symptoms and 4 function scores combined into a total preference-weighted score of well-being from 0 = death to 1.0 = symptom-free, optimal functioning.
Medical Outcomes Trust SF-36 ²³²	Physical functioning assesses functional limitations across a range of activities (eg, walking, stair-climbing, lifting heavy objects), 10 items. Four items on level of energy and tiredness used to measure fatigue. Eight health domains: physical functioning, role physical, bodily pain, general health, vitality, social functioning, role emotional, and mental health. Response options vary across and within scales (3-6 options), recall period: 1- and 4-week. Mixture of positive- and negative-worded responses. Transform responses and sum total.	36	Score for physical and fatigue 0 to 100. Higher score > health or functioning; 2 summary scores: physical component summary score, an index of overall physical functioning, and mental component summary score, which is an index of mental and emotional health. Scores can be interpreted relative to the US population average of 50 with an SD of 10, with higher scores indicating better HRQoL.
Short Form ²³¹ SIP ^{24,58}	Short form of SF-36 Generic measure of health-related functional status. Designed to provide a descriptive profile of changes due to sickness. Twelve domains: sleep/rest (7 items), emotional well-being (9 items), body care and movement/balance (23 items), household (10 items), mobility (10 items), social interactions activities (20 items), ambulation (12 items), alertness/concentration (10 items), communication (9 items), work (9 items), recreation (8 items), and eating (9 items).	12 136/68	Complex weighting and scoring. Can score scale or composite scales, physical dimension, emotional dimension, and total. High scores = better health.
Disorder-specific Roland-Morris Disability Questionnaire ¹⁷⁵	Measures disability originally for back pain. Adapted from the SIP, added phrase "because of my back" to each item. Items represent execution of daily physical activities that may be affected by back pain (eg, housework, sleeping, mobility, dressing, getting help, appetite, irritable, and pain severity). Recall period, last 24 hours ("today"). "Check all questions that apply as of today" (yes/no format).	24	Scores 0 to 24, higher score, indicates greater activity limitation.
Western Ontario McMaster Universities Osteoarthritis Index ¹⁸⁻²⁰	Assesses lower extremity pain and functional, symptoms in OA (3 dimensions: pain, stiffness, physical activity). Items rated on a 5-point scale. Responses summed 0 to 100 using linear transformation separately for pain and function. Pain (5 items): amount of pain doing various activities, stiffness scale (2 items),	24	Higher score = greater pain and poorer physical function.

Table 1. Continued

MEASURE/REFERENCE	PURPOSE/CONTENT	NUMBER OF ITEMS	PROPERTIES/SCORING
	stiffness on awakening and later in the day, function, degree of difficulty in doing 17 activities due to the reference joint. Scale ranges from none to extreme.		
Disability of Arm, Shoulder and Hand Quick Form Outcome Measure: QuickDASH ¹⁴	Measures ability to perform personal, home, work, and community tasks, pain severity, interference, and sleep interruption related to the shoulder (original version, DASH, 30 items), 5-point scale: 0 = no disability, 100 = most severe disability.	11	Scores range from 0 to 100 with higher values = greater disability.
Neck Disability Index ²²⁶	Addressing functional activities such as personal care, lifting, reading, work, sleeping, and recreational calculated by totaling the responses of each activity as well as pain intensity, concentration, and headache. Six potential responses to each item ranging from no disability (0) to total disability (5).	10	An overall percentage score (of a total of 100), is calculated by summing the responses of each item and multiplying by 2.

Abbreviations: SF-36, 36-item short-form health survey; HRQoL, health-related quality of life; SIP, Sickness Impact Profile; OA, osteoarthritis; DASH, Disability of Arm, Shoulder and Hand.

responses to treatment over time (see the Edwards et al⁶⁶ companion article in this issue of *The Journal of Pain*).

The biopsychosocial model focuses on the objective disease and subjective illness, with illness being viewed as the complex interaction of biological, psychological, social, and contextual factors.^{73,79} The model presumes some form of physical pathology, or at least neurophysiological changes in the muscles, joints, or nerves, at least initially, that generate sensory input transmitted along central nervous system pathways to the brain, which processes, consciously perceives, and ultimately ascribes meaning to the percept. At the periphery, nociceptive fibers transmit sensory information that may or may not be interpreted and experienced by an individual as "pain." Such sensory information is not considered pain until subjected to higher-order psychological and mental processing that integrates sensory information with previous learning history, appraisals, and emotional factors all within a socioenvironmental context to create the perception of pain. Appraisal processes are important but we have limited understanding of these cognitive processes in very young children and those who may have cognitive limitations. They involve attributing meaning to somatosensory experiences and are influenced by previous experiences and expectations about the effect and course of the pain and by beliefs about coping strategies, along with environmental resources available to ameliorate the pain and return to one's usual physical and emotional functional state. A person may choose to ignore the sensory information and continue engaging in previous levels of activity such as working or household activities, or a person may interpret the sensory information as pain and thereby choose to refrain from all activity, seek health care, and assume the sick role and accompanying disability. It is important to acknowledge that nonconscious processes are also involved and contribute to the experience of pain. The contributions of these processes cannot be explicitly captured by self-report measures and can only be inferred from available

physiological parameters, observation of facial expressions and overt behavior, and information obtained from surrogates.

The biopsychosocial model shifts the emphasis from exclusive reliance on the pathophysiology involved in the initiation of nociception to involvement of the patient's cognitive and emotional state and conditioned responses that influence an individual's pain experiences and subsequent behavior. From this perspective, assessment, diagnosis, prognosis, and consequently treatment of the patient with persistent pain requires a broad strategy that examines and incorporates a wide range of psychosocial and behavioral factors in addition to, but not to the exclusion of, biomedical ones.

The presence of any symptom does not begin in isolation; pain does not represent just discomfort in a specific body part but occurs within a person with a unique phenotype, learning history, and adaptive resources. Moreover most people do not live in isolation but rather in a social context, and this context contributes to the experience of pain and adaptation. Whether psychological factors precede the onset of pain or evolve in response to the presence of longstanding symptoms, the physical and psychological contributors need to be considered, assessed, and subsequently addressed. For the purpose of classification, both sets of factors and processes need to be integrated. The biopsychosocial perspective and methods to test the model are, however, not without critics and a number of conceptual and operational limitations have been noted (see Edwards et al,⁶⁶ in this issue of *The Journal of Pain*).

Classification and diagnosis of the person experiencing a pain disorder therefore requires consideration of multiple factors comprising the biopsychosocial perspective. We will discuss a common set of psychosocial variables that have been identified as relevant and significant. Tables 1 through 4 contain examples of some of the most commonly used measures of the psychosocial variables described in the sections that follow.

Table 2. Illustrative Set of Measures of Emotional Functioning

MEASURE/REFERENCE	PURPOSE	NUMBER OF ITEMS	PROPERTIES/SCORING
Combination			
Hospital Anxiety and Depression Scale ²⁴⁵	Assesses anxiety and depressive symptoms. Focus on cognitive and emotional aspects. Seven depressive, 7 anxiety symptoms. Scale 0 to 3, total scale range 0 to 42; subscales, 0 to 21.	14	Total score can be used as a measure of global negative affect. Score 8 to 10 = mild, 11 to 15 = moderate, ≥ 16 = severe.
PHQ ¹²¹	Scores each of the DSM-IV criteria as 0 = not at all to 3 = nearly every day, total score ranges from 0 to 27. Measures depression through the frequency of anhedonia, depressed mood, sleep disturbance, lack of energy, appetite disturbance, negative self-feelings, difficulty concentrating, psychomotor retardation or agitation, and thoughts of self-harm in the previous 2 weeks.	9	Scores of 5, 10, 15, and 20 represent mild, moderate, moderately severe depression, and severe depression, respectively. A score of >10 recommended as a cutoff for clinically significant depression. ¹²¹
PHQ-4 ^{120,128}	Two items for major depression and 2 for generalized anxiety (DSM-IV criteria): 0 (not at all) to 3 (nearly every day).	4	Scores 0 to 12; higher scores = greater psychological distress.
Anxiety			
Beck Anxiety Inventory ¹⁵	Assess anxiety with a focus on somatic symptoms (eg, nervousness, dizziness) with an ability to discriminate anxiety from depression. Respondents indicate how much bothered by each symptom over past week.	21	Total score 0 to 63. Score 10 to 18 = mild to moderate anxiety, 19 to 29 = moderate to severe; ≥ 63 = severe anxiety.
Generalized Anxiety Disorder-7 (see PHQ above) ¹⁹⁸	Assesses moderate to severe anxiety. Module of the PHQ.	7	Validated cutoffs for screening ≥ 10 .
Pain Anxiety Symptoms Scale ¹³⁰	Assesses fear of pain across cognitive, emotional, and behavioral domains. Four subscales: fear of pain, cognitive anxiety, somatic anxiety, and fear and avoidance.	53	Higher scores = greater anxiety.
State-Trait Anxiety Inventory ¹⁹⁶	Assesses current symptoms of anxiety and generalized propensity to be anxious. Two subscales: state (right now) and trait anxiety (in general). Feelings of tension, apprehension, nervousness, worry, and arousal; trait includes general states of calmness, confidence, and security. State: 1 = not at all, 4 = very much, Trait: 1 = almost never, 4 = almost always.	40/20	Greater than 20 on State or Trait scale = significant anxiety. Range, 20 to 80, 39 to 40 clinically significant symptoms on state scale.
Depressive Symptoms			
BDI ¹⁷	Assesses cognitive, affective, and somatic symptoms of depression on a 0 to 3 scale; range, 0 to 63.	21	Different cutoffs for depression on the basis of normative samples; higher score, more depressive symptoms: psychiatric >16 ; medical >24 .
BDI-II ¹⁶	Substantial revision of BDI; omits items related to weight loss, body image hypochondria, work disability. Corresponding with DSM-IV criteria. Recall period, past 2 weeks.	21	Each item scored 0 to 3, range 0 to 63; higher scores = greater symptom severity: 0 to 13 = minimal; 14 to 19 = mild; 20 to 28 = moderate; 29 to 63 = severe.
Center for Epidemiological Studies–Depression scale ¹⁶⁶	Assesses depressive symptoms. Developed for use in the general population. Items assess perceived mood and level of functioning during the past week. Does not cover appetite, anhedonia, agitation or retardation, guilt, or suicidality. Four factors: depressed affect, positive affect, somatic problems, and retarded activity, and interpersonal relationship problems. Response scale: frequency over past 2 weeks: 0 = rarely/none of the time ($<1/d$), 3 = most of the time (5–7 days during past week).	20	Range, 0 to 60; ≥ 16 = moderate symptoms.

Table 2. Continued

MEASURE/REFERENCE	PURPOSE	NUMBER OF ITEMS	PROPERTIES/SCORING
Screening version ¹⁸⁹	Developed for use in screening for depressive symptoms.	5	
Older adult version ¹⁰¹	Short version designed for use with geriatric population.	10	
Geriatric Depression Scale ²⁴³	Screening depressive symptoms in the elderly; distinguishes depression from dementia. Affective (eg, sadness, apathy, crying) and cognitive (eg, thoughts of hopelessness, helplessness, guilt, worthlessness). No somatic concerns common in elderly (eg, appetite, sleep). Responses yes/no.	30	Score 0 = no depression, 30 = severe depression; 10 to 19 = mild depression, 20 to 30 = severe depression.
Short version ¹⁸⁷		15	Score 0 = no depression, 15 = severe depression; >5 suggestive of depression.
PHQ-9 ¹²¹	Scores each of the DSM-IV criteria as 0 = not at all to 3 = nearly every day; total score ranges from 0 to 27. Measures depression through the frequency of anhedonia, depressed mood, sleep disturbance, lack of energy, appetite disturbance, negative self-feelings, difficulty concentrating, psychomotor retardation or agitation, and thoughts of self-harm in the previous 2 weeks.	9	Scores of 5, 10, 15, and 20 represent mild, moderate, and moderately severe depression, respectively. A score of >10 recommended as a cutoff for clinically significant depression. ¹²¹
PHQ-Depression ¹²²	Eliminates item on self-harm from the PHQ-9.	8	

Abbreviations: DSM-IV, Diagnostic and Statistical Manual of Mental Disorders Fourth Revision; PHQ, Patient Health Questionnaire; BDI, Beck Depression Inventory.

Beliefs, Appraisals, and Thought Processes

People are active processors of their experience, which is always mediated by what they believe and how they interpret the situation. The influence of beliefs on pain is profound. In acute pain situations wherein pain directly arises from tissue damage, protecting the area of pain by refraining from activity may be adaptive. However, beliefs about acute pain are often applied to chronic pain, and such beliefs are accompanied by activity avoidance and deactivation, which in turn significantly contribute to greater pain and disability.^{55,210,228} The importance of beliefs in shaping pain experience has been shown in a wide range of pain conditions. For example, cancer patients who believed that their pain is related to cancer have been shown to report greater pain in response to physical therapy than those who believed that their pain came from another source.¹⁹² Modification of individuals' maladaptive beliefs about their pain seems to predict changes in pain, response to treatment, and disability.^{107,142}

People with pain often experience significant emotional distress and may be particularly vulnerable to the adverse effect of negative cognitions because deleterious thought processes are particularly common in people with depressive or anxiety disorders.⁴² Furthermore, depression and anxiety are also common problems for patients with significant pain, particularly of a chronic nature.^{132,152} Depressed patients with pain exhibit greater negative thought processes^{125,194,203} as well as reduced positive thought processes compared with nondepressed patients with pain.¹⁰⁰ Because of the potential contributory role of negative attributions

of pain and other somatic symptoms in patients with pain, assessment of maladaptive thoughts in depressed as well as nondepressed patients experiencing persistent pain seems essential. Table 3 includes some of the most common measures used to assess cognitive variables.

Catastrophizing

One common pain-related negative appraisal style is "catastrophizing." This is a cognitive process whereby one assumes the worst possible outcomes, dwells on these, and interprets even minor problems as major calamities. Catastrophizing can deleteriously bias perceptions, expectations, memories, and thereby experiences.²⁰³ As a further consequence such individuals may develop passive coping styles (eg, rumination and helplessness) that further exacerbate their plight.²⁰⁴

A large volume of evidence suggests that catastrophizing about pain plays a significant role in defining the actual pain experience.²⁰⁵ For example, in a large prospective study, Jarvik et al¹⁰³ reported that catastrophizing, compared with baseline physical measures, was more predictive of onset of back pain and disability. For people who undergo surgery, catastrophizing predicts time to hospital discharge,¹⁵³ postoperative pain severity, and poor quality of life, as well as the transition to chronic pain.¹¹⁵ Catastrophizing also is a significant predictor of pain-related disability in chronic pain (eg, Arnoff et al⁶).

Catastrophizing shows a significant association with emotional distress in a range of patients with pain.^{185,188,220,221} This has prompted a question as to whether catastrophizing is a symptom of emotional

Table 3. Illustrative Set of Cognitive Measures: Attitudes, Beliefs, Coping

MEASURE/REFERENCE	PURPOSE	NUMBER OF ITEMS	PROPERTIES/SCORING
Attitudes and Beliefs			
Pain Beliefs and Perceptions Inventory ²³⁸	Measures pain beliefs, 3 dimensions: self-blame, mystery (pain viewed as mystery), and stability (stable over time).	16	Higher scores = greater agreement with the statement.
Pain Beliefs Questionnaire ⁶⁷	Assesses beliefs about pain. Two subscales: organic beliefs (8 items), psychological beliefs (4 items).	12	Higher scores = greater agreement with the beliefs.
Survey of Pain Attitudes ¹⁰⁶	Measures beliefs about pain. Seven dimensions: control, disability, harm, emotion, medication, solicitude, and medical cure.	52	Higher scores = greater agreement with the beliefs.
Fear-Avoidance Beliefs Questionnaire ²²⁹	Evaluates patient's beliefs about how physical activity and work may affect their back pain. Two scales: fear-avoidance beliefs related to work, and fear-avoidance beliefs about physical activity in general. Physical activity subscale (4 items), work subscale (7 items); range, 0 to 24, and 0 to 42, respectively.	11	Higher scores = higher fear avoidance.
Tampa Scale of Kinesiophobia ¹¹⁸	Evaluates beliefs that physical activity may result in (re)injury or increased pain and beliefs in underlying and serious medical problems. Two constructs; activity avoidance or fear-avoidance and somatic focus or harm. Total score = 17 to 68; 2 scales, activity avoidance (8 items), somatic focus (5 items). ^{86,174}	17 Thirteen-item version	Items scores 1 = strongly disagree, 4, strongly agree. Higher scores = higher fear-avoidance beliefs
Coping			
Chronic Pain Coping Inventory ¹⁰⁸	Illness and wellness-focused coping strategies. Eight subscales: guarding, resting, asking for assistance, relaxation, task persistence, exercising/stretching, coping self-statements, and seeking social support.	64	Higher scores = higher frequency of use.
CSQ ¹⁷⁹	Assess specific coping strategies; 6 cognitive and 1 behavioral. Seven subscales: diverting attention, reinterpreting pain, coping self-statements, ignoring pain, praying/hoping, catastrophizing, and increasing activity.	44	Higher scores = higher frequency of use.
Vanderbilt Pain Management Inventory ³³	Patients rate frequency of use of various coping strategies when pain is moderate. Five-point response scale; 2 factors: active "adaptive" "When in pain do something you enjoy"; passive "maladaptive" "When in pain, tell others you hurt a lot".	18	Higher scores = higher frequency of use.
Catastrophizing			
Catastrophizing Scale ¹¹¹	The Catastrophizing Scale from the CSQ. Specifically assess catastrophizing as a form of coping.	6	Higher scores = higher frequency of use.
Pain Catastrophizing Scale ²⁰³	Designed to assess other elements of catastrophizing related to pain. Degree to which agree or disagree to set of thoughts and feelings during pain (eg, I become afraid that the pain may get worse). The scale yields a total score and subscale scores for rumination, magnification, and helplessness; score as 0 = not at all, 4 = all the time.	13	Score ≥ 30 suggestive of clinically relevant levels of catastrophizing. Total score 0 to 42. No validated cut points. Authors ²⁰³ suggest score of ≥ 30 = clinically relevant. Lower cut scores (ie, ≥ 16 have also been suggested). ¹⁷²

Table 3. Continued

MEASURE/REFERENCE	PURPOSE	NUMBER OF ITEMS	PROPERTIES/SCORING
Control			
Pain Locus of Control ²¹¹	Sense of perceived control over pain and health-related outcomes, internal subscale: degree perceive control over pain as internal; chance and powerful others subscale: attribute control over pain to either fate, luck, or to health care providers. Six-point format, 12 items for each of the 3 subscales.	36	Higher score = greater agreement regarding control.
Self-efficacy			
Pain Self-Efficacy Scale ¹³⁹	Assesses strength and generality of respondents' confidence in their ability to accomplish their daily activities despite their pain. Seven-point scale: 0 = not at all confident, 6 = completely confident. Total score, sum responses, range 0 to 60.	10	Higher score = greater confidence.
Abbreviated ²⁹	Two items: "I can still accomplish most of my goals in life, despite pain," "I can live a normal lifestyle despite the pain."	2	Total = sum responses on 2 items; range, 0 to 12.
Abbreviated ¹⁴⁰	Two items: "I can live a normal lifestyle despite the pain" (Same as Bot et al ²⁹), "I am able to perform some form of work (whether paid or not) despite pain."		Authors suggest score of ≥ 8 = high self-efficacy.
Chronic Pain Self-Efficacy Scale ⁴	Assesses perceived self-efficacy to cope with the consequences of chronic pain.	22	Higher score = greater self-efficacy.
Arthritis Self-Efficacy Scale ¹²⁷	Assess self-efficacy beliefs of individuals with arthritis. Beliefs that they can perform specific tasks or behaviors to cope with the consequences of arthritis (eg, "walk 100 feet on flat ground, in 20 seconds," "Scratch your upper back with your right and left hand") and performance attainment items (eg, decrease your pain quite a bit; control your fatigue). Three subscales: self-efficacy for managing pain (5 items), physical function 9 items); and controlling other symptoms 6 items). Asks "how certain are you that you can..." There are several versions; scale 10 = very uncertain, 100 = very certain. Rating in 10-point increments; high scores = greater confidence. No cutoffs.	20/11/8	Higher score = greater self-efficacy.

Abbreviation: CSQ, Coping Strategies Questionnaire.

distress itself, rather than a separate construct. Research generally supports the idea that catastrophizing and depression are fundamentally different and relatively independent concepts. For example, Geisser et al⁸⁰ showed that catastrophizing mediated the relationship between depression and the affective aspect of pain but not the sensory aspect. One study⁶ also indicates that depression and catastrophizing contribute independently to pain-related disability in patients with chronic pain. These results suggest that it is important that catastrophizing be assessed along with depressed mood in patients with pain.

Evidence also suggests that catastrophizing seems to worsen the pain experience by attenuation of the centrally mediated diffuse noxious inhibitory control (conditioned pain modulation) mechanisms.²³³ Imaging studies may offer additional explanations as to how catastrophizing may influence pain perception. For example, Seminowicz and Davis¹⁸⁴ used functional magnetic resonance imaging to assess cerebral responses while their healthy participants underwent laboratory pain testing and reported that the effect of catastrophizing on neural response to painful stimulation may depend on the stimulus intensity levels.

Table 4. Illustrative Set of Measures of Disability/Functionality

MEASURE/REFERENCE	PURPOSE	NUMBER OF ITEMS	PROPERTIES/SCORING
<p>General (for a review see White et al²³⁴)</p> <p>EuroQoL⁹⁷</p>	<p>Assesses health status; 2 components, 5 domains: mobility, self-care, usual activity (eg, work, housework, family, or leisure activities), pain, and mood plus 1 item, self-rated health (VAS, 1 item for self-rated health, "best imaginable health" to "worst imaginable health"). Five index scores and perceived health. Each item, 3 levels 1 = no problem, 2 = some problem, 3 = extreme problem. Range, 0 = worst imaginable, 100 best imaginable health state.</p>	6	Complex weighting and scoring.
<p>Functional Independence Measure¹¹³</p>	<p>Measures level of assistance needed for patients to complete basic activities of daily living. Items cover independence in self-care, sphincter control, mobility, locomotion, communication, and social cognition. Score ranges from 1 (total assistance needed) to 7 (complete independence). Organized into 4 subscales for the motor domain and 2 subscales for the cognitive domain. Motor domain subscales include self-care (6 items: eating, grooming, bathing, dressing upper body, dressing lower body, and toileting); sphincter control (2 items, bladder management, bowel management); transfers (3 items: bed/chair/wheel chair, toilet, tub/shower); and locomotion (2 items: walk or wheelchair, tub/shower). The cognitive domain subscales include communication (2 items: comprehension, expression) and social cognition (3 items: social interaction, problem solving, memory). Scores range from 18 to 126.</p>	18	Higher = more independence, 18 = complete dependence, 126 = complete independence.
<p>HAQ⁷⁸</p>	<p>Assesses general functioning, difficulties in performing activities of daily living. Twenty specific functions grouped into 8 categories: dressing and grooming (2 items), arising (2 items), eating, (3 items) walking (2 items), personal hygiene (3 items), reaching (2 items), gripping (3 items), other activities (3 items). Each item rated 0 to 3, 0 = no difficulty, 3 = unable to do. Highest score in a category = category score. HAQ core = mean 8 categories. Scores range from 0 to 3 in increments of .125.</p>	20	Higher score = greater activity limitations.
<p>Jaw Function Limitation Scale¹⁴⁴</p>	<p>Measures functional limitation of the jaw, which is relevant for assessing patients with temporomandibular disorders. Includes 20 items (eg, chew tough food, open wide enough to bite into a sandwich, yawn) on which patients report limitations over the past month on a 0 to 10 scale. Psychometric data are strong, and short forms are available.</p>	20	Scores range 0 to 200, higher score = worse jaw function.

Table 4. Continued

<i>MEASURE/REFERENCE</i>	<i>PURPOSE</i>	<i>NUMBER OF ITEMS</i>	<i>PROPERTIES/SCORING</i>
Modified HAQ ¹⁵⁶	One item from each of the HAQ function categories; 4 subscales: degree of difficulty, satisfaction with function, change in function over past 6 months, and perceived need for help with each activity. Each item (ie, dressing, arising, eating, walking, hygiene, reaching, gripping, getting in and out of car) repeated in each of the 4 subscales. Different subscales have different anchors.	8	Scale scores are the mean of the scores on the 8 items in the scale: difficulty (0–3), satisfaction (0–1), change in function (0–2), need for help (0–1); higher score = poorer health.
Pain Disability Index ¹⁵⁹	Degree to which patients believe pain interferes with family/home responsibilities, recreation, social activities, occupation, sexual behavior, self-care, life-support activity. Eleven-point scale, total score. Range, 0 to 70.	7	Higher scores = great disability.
World Health Organization Disability Assessment Schedule II ²²³	Assess a range of activity limitations and participation restrictions. Six domains: cognition (6 items), mobility (5 items), self-care (4 items), getting along with people (5 items), life activities (4 items), and participation (8 items); 5-point scale, 1 = none, 5 = extreme or cannot do. Time frame: past 30 days.	36	Total and domain scores on the basis of a weighted sum of items transformed to a standard scale (0–100). Higher score = greater disability. Brief scale (12 items, 1 or 2 from each domain) and 3 global questions about days with health difficulties is available.
Disorder-specific Arthritis Impact Measurement Scale ¹³⁴	Health status measure. Physical that assesses physical functioning, pain, psychological status, social interactions and support, health perceptions, demographic, and treatment information. Physical function component (physical disability) has 6 domains (ie, using transportation, errands, assistance getting around outside the home); walking and bending, hand and finger function (eg, writing, opening jars), arm function (eg, brushing hair), self-care tasks (eg, help dressing), household tasks (eg, meal preparation). Other domains include symptoms, role (work), social interactions (ie, social activity, family support), and affect (tension, mood). 5-point scales with different anchors. Recall period, past month.	78	High scores = poor health. No cut scores or normative values.
Fibromyalgia Impact Questionnaire-Revised ^{22,35}	Assess 3 domains: physical functioning (9 items), overall impact (2 items), and symptoms (eg, pain, stiffness, memory; 10 items): 0 to 10 scales range, physical functioning (0–30), impact (0–20), symptoms (0–50), total (0–100).	21	Higher score = greater severity. Sum responses in each of the 3 domains, normalize by domain 1 by 3, leaving domain 2 unchanged and divide domain responses in each of the 3 domains. Total score reflects the sum of the resulting normalized domain scores.
Oswestry Disability Index ⁷⁰	Assess pain-related disability pain or back pain, pain (1 item), activities of daily living (personal care, lifting, walking sitting, standing, sleeping, sex life, social life, traveling; 9 items). Several versions available. Six-point scale, best (eg, "pain walking and distance") to worst (eg, "I am in bed most of the time and have to	10	Score of 0 to 20 = minimal disability, 20 to 40 = moderate disability, 40 to 60 = severe disability, 60 to 80 = housebound, and 80 to 100 = bedbound.

Table 4. Continued

MEASURE/REFERENCE	PURPOSE	NUMBER OF ITEMS	PROPERTIES/SCORING
PROMIS measures of physical function ¹¹⁶ (Short Form-8a ^{44,177,178} ; PROMIS physical function scoring manual ¹⁶³)	crawl to the toilet"). Total score ranges from 0 = no disability to 100 = maximum disability. Assesses current ability, normed to a mean of 50, SD = 10 in a US general population. Assesses upper, central, and lower extremity functions and instrumental activities of daily living. Five-point scales.	124-item bank	In simulations 10-item computerized adaptive test eliminated floor and ceiling effects, achieving higher precision than comparable length measures. ¹⁷⁷
Participation (for a review of measures see Wilkie et al ²³⁶) Impact on Participation and Autonomy ⁴¹	Assess person-perceived participation and autonomy. Four dimensions: social relationships, autonomy in self-care, mobility, leisure and family role, 5-point scale: 0 = excellent, 4 = very poor. Recall period: "current." Scores summed within domains.	23	Increasing scores = greater perceived participation.
Cardol et al ⁴⁰	Five domains: autonomy indoors, autonomy outdoors, family role, social relations, work and education and 8 problem experience items. Problem experience scale, 0 = no, 3 = severe. Several variations have added domains and items.	31 + 8	
Keele Assessment of Participation ²³⁷	Assesses person-perceived performance of participation "as and when you want." Domains: mobility, self-care, domestic life, interpersonal interaction, major life, community, and social life. Five-point adjectival scale (all of the time to none of the time). Recall period = 4 weeks. Each item dichotomized to define the presence or absence of participation restriction. Total scores sum number of items where restrictions occur (0–11): 0 = no restrictions, 1 to 11 = any restrictions.	11 + 4 Screening	Higher scores = greater restrictions.
Participation Objective, Participation Subjective ³²	Assess participation as defined by the International Classification of Functioning. Five domains: domestic life (8 activities), interpersonal interactions and relationships (8 activities), major life areas (3 activities), transportation (2 activities), and community/recreational and civic life (5 activities). For each of the 26 activities there are 3 questions (ie, frequency/duration, important engagement, like to change current level). Varied response options, recall varies from current to 1 month.	78	Scores range with higher scores = greater participation.
Sleep (for reviews see Omachi ¹⁴⁷ and Smith and Wegener ¹⁹⁵) Insomnia Severity Index ¹³	Assesses severity and effect of insomnia symptoms of past 2 weeks and degree of concern caused by 1 item for each difficulty with sleep with maintenance, early awakening, satisfaction, notice by others, distress caused. Scores range 0 to 28.	7	Scores ≥ 15 = moderate insomnia; 22 to 28 = clinical insomnia.
Pittsburgh Sleep Quality Index ^{38,39}	Assesses sleep quality and sleep quantity and sleep disruption over past month, 7 components: sleep quality, sleep	19 + 5/Bed partner	Higher score = better sleep quality.

Table 4. Continued

MEASURE/REFERENCE	PURPOSE	NUMBER OF ITEMS	PROPERTIES/SCORING
PROMIS Sleep Disturbance (Short Form-8b) ^{39,44,165,244}	duration, habitual sleep efficiency, use of sleep medication, daytime dysfunction. Varied scale range. Global score, 7 component scores, each range 0 to 3. Score range 0 to 21.		
The MOS Sleep Scale ⁹¹	Sleep over past 7 days.		Five-point scales.
The SLP-9 subscale (derived from the MOS sleep scale) ¹⁹⁷	Assessing sleep quality, 6 dimensions of sleep: sleep disruption, sleep adequacy, daytime somnolence, snoring, awakening short of breath or with headache, and the quality of sleep.	12	Does not provide cutoffs for disorders.
Sleep Problems Scale ¹⁰⁴	Sum of 9 items from the 6 sleep dimensions, measure for the overall sleep quality. Six-scale score, range from "none of the time" to "all of the time," converted to a score out of 100 using conventional scoring rules; all subscales except sleep adequacy represent worse sleep outcomes and a higher score in the sleep adequacy subscale is representative of better sleep.	9	Higher score = poorer sleep quality.
	Assesses recent problems with sleep (ie, trouble falling asleep, waking during the night, trouble falling asleep including waking too early, nonrestorative sleep). Indicate number of days in the past month in which they had difficulties. Three-point scale (0 = not at all; 1 = on some nights; 3 = on most nights). Scores range from 0 to 12.	4	Higher score = more sleep problems.
Fatigue			
Chalder Fatigue Questionnaire ⁴⁶	Assess fatigue severity in hospital and community populations. Covers physical fatigue (eg, lack of energy, feelings of weakness, muscle strength, need to rest) and mental fatigue (eg, concentration, memory). Global score, and 2 domain scores (physical and mental) over past month, 4 response options: 0 = no more than usual; 3 = much more than usual), total score (0–33), physical (0–21); mental (0–12).	11	Higher score = greater fatigue.
Functional Assessment of Chronic Illness Therapy-Fatigue ^{133,242}	Measures fatigue during the previous week. Global score, 5 response options: 0 = not at all; 4 = very much so; total score (0–52).	13	Higher score = greater fatigue.
Multidimensional Assessment of Fatigue ¹⁵⁷	Measures 4 dimensions of fatigue (ie, severity, distress, interference with activities [eg, chores, change dressing, work exercise, walking, sex, leisure], and frequency and change during previous week).	15	Global 1 to 10, different score and anchors/question. Global Fatigue Index, 1 = no fatigue, 50 = severe fatigue.
Work disability and productivity (for reviews see Gignac et al ⁸⁴ and Tang et al ²⁰⁶)			
Workplace Activity Limitations Scale ⁸³	Measures limitations while performing workplace activities (mobility, sitting, and standing, working with hands, crouching, bending, or kneeling, reaching, scheduling, work hours, pace of work, concentration, meeting job demands), 11-item version does not	11/12	Higher score = greater workplace activity limitations.

Table 4. Continued

MEASURE/REFERENCE	PURPOSE	NUMBER OF ITEMS	PROPERTIES/SCORING
Work Limitations Questionnaire ⁸⁵	include concentration. Assumes no assistance available. Originally developed for arthritis. Four-point scale, 0 = no difficulty, 3 = not able to. Not applicable to job = 0. Unrelated to arthritis = 0. Recall period: "in general" or "typically." Score: mean of all scales or summed total 0 to 33/0 to 36. Limitations while performing job demands. Four domains: time management (5 items), mental-interpersonal demands (9 items), output demands (5 items), physical demands (6 items). First 3, proportion of time with difficulty 0% = none, 4 = all of the time (100%). Physical demands reverses score to proportion of time without difficulty. Recall period = 2 weeks. Shorter versions (16, 8, or 6 items) are available.	25	Multiple scoring approaches.
Work Productivity and Activity Impairment Questionnaire ¹⁶⁹	Assess effect of health/symptoms on work productivity and nonwork activities. Measures extent of absenteeism, presenteeism, and impairment in daily activities: number of hours missed because of health, number of hours missed because of other reasons, hours actually worked, degree to which health affected productivity while working, degree to which health affected regular nonwork activities, current employment status. Recall period, 7 days.	6	Each item has unique response options, items are not intended to be summed, separate scores for each question and different combinations; higher scores = greater effect.
Significant other support scales			
Duke-UNC Functional Social Support Questionnaire ³¹	Assesses satisfaction with support provided in different situations. Two dimensions of functional social support: affective support and confidant support, 5-point scale, 1 = very dissatisfied, 5 = very satisfied.	11	Higher score = greater satisfaction.
Multidimensional Pain Inventory ¹¹⁴ (see above)	Includes a general support scale and 3 specific significant other response scales: punishing (4 items), solicitous (6 items), and distracting (4 items). Assess perception of support from significant others and perceptions of the types of responses provided, positive and negative, scale range 0 to 5.	14	Higher scores = greater support or more frequent responses.

Abbreviations: VAS, visual analogue scale; HAQ, Health Assessment Questionnaire; MOS, Medical Outcomes Study; SLP, sleep; BPI, Brief Pain Inventory.
NOTE. BPI has a single item on sleep interference.

With mild pain, catastrophizing was related to activity in brain regions representing attention, vigilance, and emotion; whereas with moderate pain, catastrophizing was negatively correlated with activity in the descending inhibitory system, likely making it more difficult to disengage from pain. Similar results have been reported in an imaging study of patients with fibromyalgia in which catastrophizing, independent of depression, was associated with pain-related activation in the brain areas reflecting the attentional, anticipatory, and emotional response to pain.⁸⁷ These studies

suggest that catastrophizing adversely affects pain experience by means of increased attention and negative anticipation of pain.

Sense of Control/Helplessness

A sense of control represents the perceived ability to manage pain or pain-related matters. How patients conceptualize their ability to control pain and associated stress seems to be an important determinant for how they actually cope with pain. Indeed, increased sense of

Table 5. Examples of Observation Methods

MEASURE	PURPOSE/CONTENT	PROPERTIES/SCORING
Mobility or activity measures (see Bennell et al ²¹)		
Chair Stand Test	Assesses the ability to rise from a chair and sit back down from a straight-backed chair with no arm rests as well as lower body strength and power. Measured by either time it takes to complete a specified number of repetitions (eg, 1, 5, 10) or number of repetitions/time interval specified (eg, 30 seconds).	Normative data for some populations are available (eg, community-dwelling older adults). ^{27,173}
Self-Paced Walk Test	Assesses the time it takes to walk short distances (150 feet). A number of different distances have been suggested (ranging from 8 to 150 feet). Individuals asked to walk quickly without overexerting themselves. Time recorded in seconds.	Can compare with means and SDs for healthy adults. ²⁸
Six-Minute Walk Test ¹²	Assesses endurance and ability to transverse longer distances on a hard, flat, indoor surface over a fixed time. Standardized verbal encouragement (eg, "4 minutes left to go, keep going you are doing really well") can be provided at fixed intervals (eg, each minute) and rest is allowed as needed but time is not stopped. Distanced covered is recorded.	Can compare with norms for healthy individuals or relevant comparison groups (eg, Rikli and Jones ¹⁷³).
Stair Climb Test	Ability to ascend and descend a flight of stairs and lower extremity strength, power, and balance. A number of variations developed for different populations. Number of steps/specified time interval, or time to go up, down, or both for a fixed number of steps (eg, 9–12) have been used as well as different time intervals and number of steps.	
Timed Up and Go ¹⁵⁸	Assesses basic mobility skill as well as strength, balance, and agility. Time (seconds) to rise from sitting in an armchair, walk 3 meters, turn, walk back to chair, then sit down. Walking aid can be used if required. Recommended that 2 trials are performed.	Normative age group references for older than age 60 available. ²⁶

See online summary of some measures at <http://www.rehabmeasures.org/default.aspx>.

control has been shown to be linearly related to greater functionality in patients with chronic pain.²²⁰ Furthermore, improvement in control beliefs after treatment typically has been shown to result in reduction of pain and disability.¹⁰⁷ The opposite end of the control spectrum is a sense of lack of control—that is, helplessness, which has been associated with greater pain and poorer physical and psychological adjustment in chronic pain.¹¹²

Neural mechanisms accounting for how sense of control affects pain may be parallel to those for catastrophizing as reviewed previously. Perceived controllability of pain seems to influence the neural activation in the anterior cingulate cortex and insula (areas representing attentional and emotional responses); the responses in these areas were attenuated in individuals who were led to believe that they could control the stimulus level compared with those who were led to believe that there was nothing they could do to change the level.¹⁸⁰ A subsequent study¹⁸¹ suggested that modulation of pain by sense of control depends on the top-down influences mediated by prefrontal cortex on insula, secondary somatosensory cortex, and periaqueductal gray.

Self-Efficacy

Self-efficacy is defined as a personal conviction that one can successfully execute a course of action to produce a desired outcome in a given situation. Efficacy beliefs are task- and situation-specific; for the assessment of chronic pain, they typically include self-efficacy beliefs to manage pain, pain-related symptoms, and physical functioning. Self-efficacy beliefs for people experiencing chronic pain incorporate not just the expectation they can perform a particular activity, but also their confidence in their ability to accomplish this despite pain.

Lower self-efficacy is consistently related to greater clinical pain ratings in various chronic pain conditions.^{34,48,199} Low level of self-efficacy belief has been related to greater disability.^{23,182} As was the case with a sense of control, self-efficacy beliefs mediate the relationship between pain and psychological functioning^{7,8} in chronic pain. Furthermore, recent longitudinal studies suggest that poor pain-related self-efficacy beliefs are a risk factor for development of functional

disability associated with chronic pain⁵⁴ and work absenteeism.³⁷ Burns et al³⁶ reported that cognitive factors, and particularly changes in perceived self-efficacy, were the best predictors of response to pain rehabilitation treatment.

Coping

Coping refers to efforts to address events that tax perceived available adaptive resources.¹²⁴ Coping strategies can be behavioral (eg, relaxation, pacing activities) as well as cognitive (eg, distraction, positive thinking). Efforts may be active such as attempting to obtain information, problem solving, or engaging in behaviors to resolve the issue, or efforts may be passive such as withdrawing from situations, seeking help from others, and so forth. These efforts can be adaptive in producing positive results or they can be maladaptive such as withdrawing or becoming dependent on others. Coping is not a trait and evolves over time and may vary depending on the particular problem. Thus, how a person copes with a particular problem at a particular point in time may not predict how they might deal with a different problem at the same point in time or the same problem at a different point in time. How individuals cope with pain predicts pain perception, levels of emotional distress, adaptation, and functional disability (eg, Evers et al⁶⁹ and Jensen et al¹⁰⁵). See Table 3 for a description of examples of measures that are used to assess cognitive constructs (ie, attitudes and beliefs, catastrophizing, coping, perceived control, and self-efficacy).

We have reviewed several cognitive constructs and processes that have been implicated in the experience of pain and related disability. These cognitive variables do not occur in isolation and thus are likely to be all inter-related. Whether these variables represent some aspects of a larger construct or they are independent processes associated with pain and stress is not clearly delineated.

Mood and Behaviors

We already described how beliefs can affect peoples' mood; here we will now briefly review how pain may affect mood and behaviors, and vice versa. These are vast areas and the in-depth review of the literature is beyond the scope of this article^{73,79} (see also Table 2 for some of the most frequently used measures and procedures to assess mood and behavior).

Depression

The prevalence of depression as a comorbid psychological condition in chronic pain varies greatly from 5 to 100%, depending on how and where patients were assessed and the criteria for depression used. However, rates of depression are higher in chronic pain populations than in the general population, and it is quite common in specialized pain clinic patients for >50% of patients evaluated to experience significant emotional distress.¹¹ Depression adds significant burden to patients with chronic pain, and is one of the

Assessment of Psychosocial and Functional Effect significant determinants of pain-related disability,²¹² and depression also drives the costs associated with disability and health care utilization upward.¹¹⁰

Fear and Anxiety

Anxiety and fear-related problems are more prevalent in patients with chronic pain than in the general public. Among people with chronic pain, the prevalence of any anxiety disorder may be twice as high as in the general population (35% vs 18%); panic disorder and post-traumatic stress disorder are 3 times more common in chronic patients with chronic pain.¹³² Although fear and anxiety are often viewed as a single mood condition, they are likely separate entities with distinctive physiological and emotional experiences. Anxiety is a future-oriented emotion; it is experienced as worry and nervousness related to some often vague future issues, whereas fear is a present-oriented mood state about something specific that one wants to escape from or avoid.

Fear and anxiety reflect key components of the dysfunctional circle of pain maintenance. The revolving model of fear-avoidance in chronic pain²²⁸ is depicted in Figure 1. As the model suggests, pain-related fear and avoidance play a significant role in the interplay between pain, dysfunctional cognitive and affective experience, and disability resulting in the perpetuation of the chronic pain circle. Indeed, some studies have shown that pain-related fear-avoidance is significantly associated with functional limitations in various life domains and perceived disability in patients with acute and chronic pain.^{55,82,88,184} However, the literature supporting the fear-avoidance model is not always consistent^{171,191} and efforts to refine the model and to identify and acknowledge the limitations have been reported.^{90,228}

The findings we highlighted to this point were presented to illustrate the important role of psychological factors that contribute to the disability and distress associated with persistent pain. The discussion was not intended to provide an exhaustive review of the extensive literature that has been published. Thoughts, feelings, and contextual factors all contribute to the



Figure 1. Expanded Fear-Avoidance Model. From: Vlaeyen and Linton.²²⁸

experience of pain, especially as it extends over time. Thus, we attempted to build a case for the importance of evaluating these constructs and processes when assessing patients with chronic pain. A comprehensive assessment is essential to form the basis for classification, treatment planning, and decision-making. In contrast, simply attempting to treat the assumed biological causes of pain and the symptom of pain alone has been proven to be inadequate despite the advances in medically-focused treatments deriving from the expanding and evolving understanding of the neurophysiology of pain. See Table 2 for a description of examples of measures (ie, anxiety, depression, fear avoidance) that were developed and have been used to assess emotional factors associated with persistent pain.

As noted, beliefs of patients with pain about the cause of symptoms, their trajectory, and their beneficial treatments will have important influences on emotional adjustment and adherence to therapeutic interventions. A habitual pattern of maladaptive thoughts will become a treatment target because it contributes to a sense of hopelessness, dysphoria, and unwillingness to engage in activity, and in turn, deactivates the patient and severely limits his/her coping resources.

Contextual Elements

People do not exist in isolation but rather are embedded within a socioenvironmental context. Features of this context will influence the exacerbation, effect, and maintenance of pain and associated disability.¹⁰⁵ Perhaps the largest body of research evaluating the role of contextual effects has focused on social support and responses to communication (overt expressions) of pain, distress, and suffering ("pain behaviors"), and thus, we highlight these.

Significant attention has been devoted to the important role of social context at each step along the trajectory of chronic pain. Social support is defined as the resources perceived as or actually being available from others in social networks and includes family, friends, and coworkers, among others. There are 2 sides to social support because the effects of supportive behaviors have been shown to be beneficial (eg, buffering effects) and deleterious (eg, positively reinforcing maladaptive behaviors) depending on a range of features such as context, perceived intent, content, and fit to patient preference. The literature suggests that those with chronic pain who perceive high degrees of social support report less distress and pain as well as better adjustment promoting adaptive coping responses.^{69,95,105} Conversely, support in the form of solicitous behavior in response to communications of pain behaviors has been shown to be associated with increased pain and pain behaviors and maintenance of disability.^{74,176,218}

To help the patient understand the psychosocial aspects of pain, attention should focus on the patient's reports of specific thoughts, behaviors, emotions, and contextual factors including the social environment and social support and physiological responses that precede, accompany, and follow pain episodes or

exacerbation. Moreover, the environmental conditions and consequences associated with cognitive, emotional, and behavioral responses in these situations are important and should be considered.

Some Caveats About Self-Report Measures

Historically, psychological measures designed to evaluate psychopathology have been used to identify specific individual differences associated with reports of pain, even though these measures were usually not developed for or standardized on samples of medical patients. However, it is possible that responses by medical patients may be distorted as a function of the disease or the medications that they take. For example, common measures of depression ask patients about their appetites, sleep patterns, and fatigue. Because disease status and medication can affect responses to such items, patients' scores may be elevated, thereby distorting the meaning of their responses.

It is important to emphasize that before any assessment measures and procedures are selected for use for any purpose, classification or otherwise, they need to be subjected to the appropriate psychometric evaluation showing their reliability, validity, and utility. Furthermore, before use, the applicability of the measure or method for use with the population of interest should be considered. In particular, the availability of normative data from relevant groups should be examined (see Turk et al²¹⁷). Investigators and clinicians will need to determine which measures, from among those available, are appropriate as part of the comprehensive assessment and classification of the patient and to address particular research questions.

Finally, because traditional psychometric assessments are often time-consuming and impractical for routine clinical use, especially in light of the number of constructs that warrant assessment in the individual with pain, an important goal is to identify streamlined methods for assessing important psychosocial constructs in a more feasible manner. One approach would be to take advantage of the National Institutes of Health Patient Reported Outcomes Measurement Information System (PROMIS) that developed a set of item banks and applied item response theory (IRT) to identify the psychometric properties of each item, in contrast to the traditional approach that reports on the psychometric properties of entire measures.^{43,44} The IRT approach permits selection of items from the large set included in item banks rather than requiring use of an entire scale.^{45,77,168} Research has shown that a relatively small number of highly targeted items are required to assess a number of constructs.^{3,10,112,154,177,178} Because IRT-based measures do not require that every item needs to be administered to an entire sample, IRT provides a potentially more efficient method of data collection. Computer Adaptive Testing using the PROMIS item banks can provide a particularly efficient strategy for assessing relevant constructs with items adaptively selected from banks based on participants' responses.^{53,167,170} This approach reduces the need for redundant items

and lowers respondent burden.¹⁶⁸ A set of brief, static measures suitable for paper administration have also been created on the basis of selected items from the PROMIS item banks (eg, PROMIS-29⁹⁴). One limitation of PROMIS is that it does not currently have item banks for all of the relevant psychosocial constructs identified as important for dimension 4 of the AAPT.

A common alternative to using PROMIS is the development of abbreviated screening questionnaires with the potential of covering the relevant areas identified and that may be used initially for efficiency; however, more comprehensive assessment will be appropriate, especially in the research context. Several brief pain-related screening instruments have been developed,^{119,121,198} some have been created specifically for prediction of chronicity or course,^{92,93,126,210} or as minimal data sets for research.^{59,235} However, to our knowledge, none have been proposed for use as part of a comprehensive diagnostic classification across the range of chronic pain-related diagnoses.

Assessment of Physical Function

Self-reported and performance-based measures can be used to assess function and provide complementary information. A large number of general and disorder-specific objective assessments of physical performance that involve observation during a standardized task have been developed. Some of these are listed in [Table 5](#). In addition, functional capacity evaluation (FCE) is another type of performance-based measure that is used to assess a person's ability to safely perform work activities. There is growing research on the reliability, validity, and clinical utility of FCEs in different occupational patient populations.^{25,75,213,214} For example, in a cohort of 354 patients with chronic occupational musculoskeletal disorders, FCE scores were responsive to a functional restoration program and predicted successful return to work 1 year after rehabilitation.⁷⁵ Although performance-based measures provide objective information, they do not capture one's functioning in the context of their work, home, or community environment.

Self-report functional status measures seek to directly quantify symptoms, function, and behavior. Self-report measures have been developed to assess individuals' reports of their abilities to engage in a range of functional activities, such as the ability to walk up stairs or to sit for specific periods of time, the ability to lift specific weights, the ability to chew foods of certain types, and the ability to perform activities of daily living, as well as the severity of the pain experienced upon the performance of these activities. There are a number of well established, psychometrically supported generic measures of health-related quality of life (see [Tables 1](#) and [4](#) for information on selected measures).

Disease-specific measures are designed to evaluate the effect of a specific condition (eg, ability to wear clothing in patients with postherpetic neuralgia) and may be more appropriate than general measures, because they focus on functions relevant to a partic-

ular disorder. For example, a patient with carpal tunnel syndrome may have some limitation in typing but have no limitations on walking up stairs, conversely, a patient with osteoarthritis of the knee may have minimal limitations in using a keyboard but trouble going up stairs. In this example, a general measure may not be focusing on relevant physical activities of particular importance to a particular diagnosis. Disease-specific measures may therefore be more likely to reveal clinically important improvement or deterioration in function that is a consequence of disease. Generic measures provide information about physical functioning that can be compared across different conditions and studies.^{64,76} Each of these approaches has strengths. For individual patients in clinical practice it would be most appropriate to use measures developed on samples with comparable characteristics. Thus, for example, the Western Ontario McMaster Universities Osteoarthritis Index¹⁸ might be the preferred measure of function to use with patients with osteoarthritis. If the clinician wishes to compare across a group of patients, then one of the broader-based pain-specific measures should be considered. If the assessment is being performed as part of a research study, some combination of disease-specific and general instruments might be appropriate to compare chronic pain samples with a larger population of people with diverse medical diseases (eg, 36-item short-form health survey [SF-36]²³²).

Although self-reported assessments can help guide clinical care, permit monitoring over time, and assess responses to treatments, they are prone to recall biases (eg, memory, recency) and are influenced by current mood and pain intensity.^{68,102} Indeed, multiple investigations have shown substantial differences in estimations of daily levels of physical activity when assessed using self-reported measures compared with objective methodology.^{224,225} Moreover, self-reports usually measure experience and behavior at a single point in time or assess an averaged experience over a recalled period of time. However, it is well known that pain can vary considerably over time depending on a range of factors, including activity, mood, and environmental factors that can affect physical function.^{1,2,20,98} The ability to objectively monitor clinically relevant outcomes, such as physical function and activity, over time would improve our understanding of the dynamics and influence of pain in daily life and potentially improve pain management.

Objective Assessment of Physical Functioning—Actigraphy (Accelerometry)

Accelerometers are small, lightweight devices that objectively measure the duration, frequency, and intensity of physical activity over days or weeks. Actigraphy is a useful technology to accurately capture the amount of physical activity in people with various painful conditions. Actigraphy can be particularly useful in characterizing daily patterns of physical activity.

Actigraphy has been used successfully to characterize changes in activity duration and intensity within a single day or across days, and to discriminate between changes in activity between weekdays and weekends.²³⁹ The identification of variability can be used to design therapeutic physical activity regimens.^{57,137,151,229}

In addition to global assessments of activity patterns, actigraphy can be used to assess other pain-related outcomes. For example, the device can provide detailed information about characteristics of gait such as variability of movement, balance, stride time, and stride length. These gait parameters can further be analyzed to evaluate balance and risk for falls, and have been used successfully to discriminate between gait patterns of older adults with balance problems and those without.⁵⁶ Accelerometers have also been widely used to characterize the relationship of pain with patterns and quality of sleep, which is found to be compromised in many patients with chronic pain.³⁰

Actigraphy should not be viewed as a replacement for patient self-reports of physical activity because these perceptions likely influence patients' willingness to engage in physical activity and how patients view their capabilities and disability status. This technology can, however, complement self-report measures and provide a more refined understanding of the relationships among symptoms, perceptions, mood, and environmental factors, and objectively measured physical activity.

Assessment of Sleep and Fatigue

Sleep disturbances are common among patients with chronic pain,^{136,155,182,183,190,193,207,209} and pain and sleep problems appear to have a reciprocal interaction.⁷¹ Acute and chronic pain disrupt sleep, with difficulty falling or staying asleep, poor subjective sleep quality, short sleep duration, or disrupted sleep architecture.^{49,72,150,186} Conversely, experimental and clinical data indicate that sleep deprivation lowers the pain threshold, lowers the cognitive ability to cope with pain, and increases ratings of pain intensity, which in turn exacerbates poor sleep.^{145,146,149} Sleep disturbance can aggravate pain and inflammatory processes, reduce endogenous pain inhibitory responses, and increase emotional distress and reduce well-being.^{207,208} Hence, poor sleep may lower the pain threshold, which may in turn contribute to increased pain, creating a vicious cycle.^{61,62,123}

The relationship between chronic pain and sleep appears to be mediated by a range of factors. In particular, interactions with psychological factors have been reported in a number of studies. Previous reviews⁷¹ have suggested that mental health problems (depression, anxiety) are also associated with poor sleep. Finan and Smith's⁷¹ review of cross-sectional and prospective studies examining insomnia, chronic pain, and depression concluded that the 3 conditions frequently co-occur and are mutually interacting conditions, with each increasing the risk for the emergence or exacerbation of the other, or both. For example, people with

chronic pain and sleep problems are more likely to have features of depression and anxiety than patients with pain without sleep problems.^{129,138,143,208} Meneff et al¹³⁵ suggested that biological, behavioral, cognitive, and social pathways by which physical disorders such as pain can lead to affective disturbance, particularly noting that in those who experience pain, sleep disturbance can lead to the development of depression.

Objective and subjective (see [Tables 4 and 5](#)) measures are used to quantify sleep disturbance. Objective measures include polysomnography and actigraphy, with polysomnography being the "gold standard" for measuring sleep disturbances.¹³⁵ This approach involves using a polygraph device to record changes in brain wave patterns, eye movements, and muscle activity by means of electrodes placed on the scalp and face. After the polysomnographic tracing is produced, it is analyzed and sleep is categorized into the various stages according to standard criteria.

Although polysomnography is considered the gold standard for assessing sleep disturbances, the expense and time involved limit its use. Many clinical studies, therefore, use self-report sleep diaries or questionnaires to assess the effects of various treatments on sleep parameters in people with chronic pain. Subjective measures of sleep quality and quantity include daily sleep diaries (in which individuals record their sleeping habits on a daily basis) and sleep questionnaires (such as the Pittsburgh Sleep Quality Index or the Sleep Disorders Questionnaire, in which patients retrospectively report their sleep quality; see [Table 4](#)).^{38,60,135} Sleep diaries have the advantage of their potential for real-time ratings rather than retrospective reports that require respondents to characterize their sleep patterns and quality over some time interval (eg, days, weeks, or months). Although patients are mostly reliable in reporting their total sleep time and sleep efficiency in sleep diaries, they appear to overestimate sleep latency and underestimate the number of night-time awakenings they experience each night.²⁴⁰

A disadvantage of sleep diaries (and any diary) is that some respondents may complete ratings in advance (ie, "fill forward") or all at some later time point (ie, "fill back").²⁰² These response patterns have led to some suggestions that methods for real-time data capture (ie, using computer technology, such as palm-top computers or smart telephone) be used to obtain more valid measures.^{81,200}

The validity of self-report data regarding sleep compared with objective assessment indicates that subjective assessments of sleep may have a poor correlation with objective assessments, and that other factors, such as depression, affect subjective sleep reports.²³⁰ An "objective" measurement of sleep may also be considered, because a patient's self-report may differ from polysomnography- or actigraphy-derived indices, especially in patients with persistent pain.¹⁴⁶ Wrist actigraphs provide a 24-hour measure of motor activity that decreases sharply during sleep. They are convenient and unobtrusive, and are increasingly being used in sleep and pain

research, showing prospective associations with postsurgical pain²⁴¹ and with daily variation in long-term pain.¹⁴³

In addition to sleep disturbance, fatigue is very commonly reported by patients with chronic pain and it may influence perceptions of pain and ability to engage in physical activities.^{141,227} As noted by the Outcome Measures in Rheumatology group, simple visual analogue scales and several multi-item measures such as the Multidimensional Fatigue Inventory show good reliability and validity and have been widely recommended for use as outcome measures.¹¹⁷ These would be a reasonable choice for phenotyping fatigue; the Multidimensional Fatigue Inventory in particular has been used in multiple pharmacologic treatment studies of patients with chronic pain.^{5,133} Sleep disruption and fatigue often co-occur within symptom clusters in the context of a variety of persistent pain conditions, but to date, no published studies appear to have examined pretreatment fatigue phenotypes as predictors of variability in analgesic outcomes.

In addition to the application of wearable devices for physical activity and sleep monitoring, there has been substantial growth in mobile technology for the assessment of self-reported symptoms such as pain, depression, and fatigue. Smart phones and tablet computers are increasingly used to gather data on patients' real-world daily experiences, commonly referred to as ecological momentary assessments or experienced sampling methods. Ecological momentary assessments can provide insights into the temporal dynamics of pain, sleep, fatigue, and emotional functioning, which might be lost when using standard self-reported measures that involve recall and the aggregation of experiences and activities, which might be influenced by mood.^{200,201,215} Further research on statistical methods and standards for collecting high-density experiential data are needed. Highlighting the critical importance of these methods, the U.S. Food and Drug Administration is working on regulations for mobile medical applications.²²²

We have only noted some of the measures that have been developed for the evaluation of different components of activity and physical functioning. More in-depth descriptions and uses of objective measures of physical performance have been published (see Table 3). These publications describe the methods and instruments themselves, the psychometric data, various uses, and availability of each.

Screening Assessment

Core domains for outcomes assessment have been recommended by several initiatives (Core Outcome Measures in Effectiveness Trials [COMET],⁵² IMMPACT,^{99,216} Outcome Measures in Rheumatology,¹⁴⁸ etc). In addition, minimal data sets have been recommended for specific conditions such as temporomandibular disorders^{63,183} and back pain.^{47,59} These efforts have some common elements because they identify general areas that should be included in pain assessment; namely, pain

Assessment of Psychosocial and Functional Effect intensity, emotional functioning (depression, anxiety), physical functioning, patient attitudes, beliefs, and expectations (concerns for future, fears of activities that might exacerbate pain and related symptoms and cause additional physical damage, beliefs about ability to control symptoms and one's own life), and sleep. Further, specific core outcome measures have also been recommended for chronic pain trials. For example, IMMPACT recommends core outcome measures such as the 0 to 10 numeric rating scale for pain intensity, and recommends reporting the percentage of study participants with reductions in pain intensity from baseline of 30% and 50% to identify treatment responders.²¹⁷ Comprehensive assessment of each of the constructs and processes described for classification within the AAPT is likely to be perceived as excessively burdensome to investigators and clinicians as well as respondents. Consequently, research is essential to develop and demonstrate the utility of abbreviated instrument(s) or the PROMIS item banks in contributing to the characterization of individuals in a meaningful way within the AAPT. The lack of availability of abbreviated measures and methods will impede the acceptance and inclusion of the set of psychosocial and functional variables described in classification.

Conclusions

The presence of chronic pain has a number of psychosocial and functional consequences in multiple areas of functioning—cognition, emotion, and behavior. Because chronic pain persists over time, each of these areas will, in turn, affect the experience and reporting of pain and related symptoms. Moreover, the context in which individuals reside will also have an important role.

We reviewed the rationale for a biopsychosocial perspective and described a set of key psychosocial and behavioral constructs and processes (eg, affect, coping resources, expectations, sleep quality, physical function, and pain-related interference with daily activities) that should be considered when classifying patients within the comprehensive AAPT system. Multiple measures have been developed to assess this range of psychosocial constructs and processes, some of which are general and transcend the disorder; whereas others are condition-specific, especially those assessing different aspects of physical functioning that are strongly related to particular pain disorders (eg, lower back, knee). We reviewed an illustrative set of measures and procedures that have been developed to assess this set of factors and that can be used as appropriate as part of the comprehensive assessment and classification of various chronic pain conditions and to address particular research questions. We did not intend this article to present a comprehensive and exhaustive review of all assessment measures and procedures available, because this would be impossible in any single publication. Moreover, we did not intend to cover specific details of the psychometric properties

of the listed measures and procedures but rather provided relevant citations that can be examined in depth by interested investigators.

The choice of instruments and procedures should be on the basis of the diagnostic and research questions but must also consider the availability of relevant psychometric data, including the content validity of the measure (ie, does it cover the relevant areas of interest) and the availability of normative data that will permit use

with the population and in the context of interest. Future research needs to investigate the appropriateness of each measure balanced by respondent burden and clinician and investigator burden. There is a need for development and evaluation of brief, screening measures that can be used efficiently and that would provide guidance as to how the results of the assessment would be used as a component of the diagnostic classification within the AAPT.

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