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CHAPTER 1

The Measurement of Pain and the Assessment of People Experiencing Pain

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> Just as "my pain" belongs in a unique way only to me, so I am utterly alone with it. I cannot share it. I have no doubt about the reality of the pain experience, but I cannot tell anybody what I experience. I surmise that others have "their" pain, even though I cannot perceive what they mean when they tell me about them. I am certain about the existence of their pain only in the sense that I am certain of my compassion for them. And yet, the deeper my compassion, the deeper is my certitude about the other person's utter loneliness in relation to his experience.
> —IVAN ILLICH (1976, pp. 147–148)

> . . . the investigator who would study pain is at the mercy of the patient, upon whose ability and willingness to communicate he is dependent.
> —LOUIS LASAGNA (1960, p. 28)

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Pain is ubiquitous and essential for survival; however, it is a prevalent and costly problem. One in four adult Americans reports an episode of pain during the last month that persisted more than 24 hours (National Center for Health Statistics [NCHS], 2006). Nearly 50% of Americans see a physician with a primary complaint of pain each year (Mayo Clinic, 2001). Pain appears to be equally prevalent in children and adolescents (Perquin et al., 2000). The NCHS (2006) estimated that approximately 25% of the U.S. population has chronic or recurrent pain, that 1 person in 10 reported pain that lasted a year or more, and that 40% stated the pain had a moderately or severely degrading impact on their lives. Data from the National Health Interview Survey (Lethbridge-Cejku & Vickerie, 2005) indicates that during the 3 months prior to the survey, 15% of adults had experienced a migraine or severe headache, and 15% had experienced pain in the neck area, 27% in the lower back, and 4%, in the jaw. Extrapolating to the adult U.S. population, these percentages would translate to 31,066,000 persons with migraine, 52,325,000 with low back pain, 28,401,000 with head and neck pain, and 9,535,000 with jaw pain. In the U.S. population-based study by the Gallup Organization, 14.7% of eligible women (773/5,263, 1 in 7) reported pelvic pain in the prior 3 months, 15% of employed women with chronic pelvic pain reported that they lost time from work, and 45% reported reduced work productivity due to their pain (Mathias, Kuppermann, Liberman, Lipschurz, & Steefe, 1996).

It is hardly surprising that pain is among the most common symptoms leading U.S. patients to consult a physician (Hing, Cherry, & Woodwell, 2006), accounting for 2.3% of all visits or approximately 17.4 million visits/year (Cherry, Burt, & Woodwell., 2001). The statistics cited earlier are derived from physician and hospital records, but they probably reflect only the tip of the iceberg when it comes to the prevalence of pain. Many people who experience pain self-manage their pain without seeking medical attention.

Comparable prevalence statistics have been reported internationally. For example, a World Health Organization (WHO) survey of primary care patients in 15 countries reported that 22% of patients reported pain present for 6 months or longer that required medical attention, medication, or interfered significantly with daily activities (Gureje, 1998). A population survey in the United Kingdom found that 25% of adults experienced back or neck (spinal) pain in the prior month, with half reporting chronic pain (Webb et al., 2003). Migraine has an estimated worldwide prevalence of approximately 10% (Sheffield, 1998).

Considering all sources of expenditures, chronic pain is projected to cost the U.S. economy roughly $100 billion each year ("Employer Health Care Strategy Survey," 2003; Washington Business Group on Health and Watson Wyatt Worldwide, 2003). Lost productive time from common pain conditions among workers cost an estimated $61.2 billion/year. The majority (76.6%) of the lost productive time was explained by reduced performance while at work, not work absence (Stewart, Ricci, Chee, Morganstein, & Lipton, 2003).

We can consider several persistent pain problems to illustrate the cost and impact on society. Over $12.5 billion is spent annually on the medical treatment of arthritis alone in the United States (Cantor, 2002). Estimates of the financial impact (e.g., lost productivity, uncompensated lost wages, loss in household services and tax revenues, social security benefits) of back pain range from $45 billion to $54 billion/year (National Academies of Sciences & Institute of Medicine, 2001). According to the National Headache Foundation (2005) more than 45 million American experience chronic headaches, with losses of $50 billion a year due to absenteeism and medical expenses, and an excess of $4 billion spent on over-the-counter medications. The estimated cost of annual lost productive work time from arthritis in the U.S. workforce was $7.11 billion, with 65.7% of the cost attributed to the 38% of workers with pain exacerbations (Ricci et al., 2005).

Given the statistics cited here, it might be expected that pain would be well treated. Unfortunately, this is not the case. Most forms of chronic pain are poorly understood, and even when they are understood, the severity may not be adequately managed. Despite advances since our previous editions (Turk & Melzack, 1992, 2001), a central impediment to increased understanding and appropriate treatment of pain continues to be the inherent subjectivity of pain. This problem has been noted as far back as the early 1960s, as indicated by the Lasagna quote earlier. In the absence of objective methods to assess pain, we are dependent on people's responses and their attempts to communicate what they are experiencing or have experienced at some time in the past.

Many of the epidemiological data outlined earlier are based on patients' ability to retrieve information from memory, even though memory of subjective experiences can be notoriously faulty (Broderick et al., 2008). This observation has led some to suggest that more accurate information can be obtained from patients' daily diaries or from real-time data using technology rather than relying on recall. However, this issue remains controversial, and it appears that recall of, at least, relatively short duration (days and even weeks) can be reasonably accurate (e.g., Broderick et al., 2008; Jamison, Raymond, Slawsby, McHugo, & Baird, 2006) although it may deteriorate over more extended periods (e.g., many months). However, average pain over the past 6 months may be as important, if not more important, in some studies than average pain over the past week, which may not be representative of a patient's usual pain. Retrospective reports might also be expected to vary in accuracy depending on a multitude of factors discussed in some detail by Mason, Fauerbach, and Haythornthwaite (Chapter 14) and Von Korff (Chapter 23) in this volume.

It is difficult to describe pain, which is a subjective experience, a complex percep-

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tual phenomenon. Thus, by its very nature, pain can only be assessed indirectly by what people in pain tell us verbally; by their overt behavior (see Keefe, Somers, Williams, & Smith, Chapter 7, in this volume), including facial expressions (see Craig, Prkachin, & Grunau, Chapter 6, this volume); or by physiological correlates (see Flor & Meyer, Chapter 8, this volume). However, in order for patients, clinicians, and researchers, and policymakers to communicate, there needs to be a common language and a classification system that can be used in a meaningful and consistent fashion (Turk & Okifuji, 2001).

CLASSIFYING PAIN

One common way to classify pain is to consider it along a continuum of duration. Thus, pain associated with tissue damage, inflammation, or a disease process that is of relatively brief duration (i.e., hours, days, or even weeks), regardless of its intensity, is frequently referred to as *acute pain* (e.g., postsurgical pain; see Mason et al., Chapter 14, this volume). Pain that persists for extended periods of time (i.e., months or years), that accompanies a disease process (e.g., rheumatoid arthritis), or that is associated with an injury that has not resolved within an expected period of time (e.g., myofascial pain syndromes, neuropathic pain; see Chapter 16 by Robinson & Turk, and Chapter 17 by Gilron, Attal, Bouhassira, & Dworkin, this volume) is referred to as *chronic pain*. This duration continuum is inadequate, because it does not include acute recurrent pain (e.g., migraine headaches, sickle cell disease); it tends to ignore pain associated with progressive diseases, such as chronic obstructive pulmonary disease and metastatic cancer. In the case of acute recurrent pain, people may suffer from episodes of acute pain interspersed with periods of being totally pain-free (see Chapter 18 by Andrasik, Buse, & Lettich, this volume). In the case of pain associated with progressive diseases, certain unique features of the pain are influenced by the nature of the disease and need to be considered (see Anderson, Chapter 19, this volume). Finally, in the laboratory, a number of contextual factors need to be considered before extrapolations can be made to the clinical context. Using these five discrete classifications of pain (i.e., acute, acute recurrent, chronic, chronic progressive, and laboratory-induced) comprises a categorical approach to classification rather than a simple continuum based on duration. Another way to classify pain is based on diagnosis, such as back pain (see Watson, Chapter 15, this volume), fibromyalgia syndrome (see Robinson & Turk, Chapter 16, this volume), and somatization disorders (see Sullivan & Braden, Chapter 20, this volume). Related to diagnosis, but more specific, are recent calls for classification based on underlying mechanisms (see, e.g., Woolf et al., 1998).

A common way to classify pain is to use severity as a linear dimension—measured on categorical scales (e.g., "Mild," "Moderate," and "Severe"), numerical rating scales (e.g., 0, "No pain" to 10, "Worst pain possible"), visual analogue scales (a point along a 10-cm line; see Jensen & Karoly, Chapter 2, this volume)—or to use some adjectival descriptors (see Katz & Melzack, Chapter 3, this volume). Although intensity and descriptive characteristics are critical features of pain that demand attention, they are not sufficiently broad features to provide an adequate classification of the experience of even acute pain (see Mason et al., Chapter 14, this volume).

Yet another continuum is based on ages of the individuals affected. For example, there has been much debate as to whether infants and children experience pain in the same way as adults do (see Ruskin, Amaria, Warnock, & McGrath, Chapter 11, this volume). At the other end of the lifespan, there has been considerable discussion regarding alterations in sensory sensitivity of people in the later stages of life, and the impact of age-related physical changes on pain perception (see Gauthier & Gagliese, Chapter 12, this volume).

The dimensions of intensity, duration, descriptive characteristics, diagnoses, or age are not completely satisfactory in predicting persistence of pain and the associated disability. One strategy is to develop a classification based on a combination such as intensity and degree of disability to create a prognostic index (see Von Korff, Chapter 23, this volume). More extensive assessment may be particularly relevant for clinical decision making (see Turk & Robinson, Chap-

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ter 10, this volume). So, no single system for classifying pain patients has been universally accepted by clinicians or researchers.

PURPOSES OF ASSESSMENT

The measurement of pain is essential for the study of pain mechanisms and the evaluation of methods to control pain. The procedures and measures used in the assessment of pain, and people who experience pain, depend on the purpose(s) of the assessment and the unique characteristics of the population being assessed (e.g., age, educational levels, ability to communicate verbally), and the context of the assessment (e.g., acute postsurgical, emergency department/trauma, chronic, cancer; medicolegal). The objectives of assessment can be varied and generally categorized as clinical outcomes, epidemiological, and quality improvement. Although it is important for all measures to meet basic psychometric properties of reliability (internal consistency, stability over time) and validity (for the intended use), the purposes of assessment influence number, nature, and content of measures selected.

From the clinical perspective, the intent of the assessment may be to make a differential diagnosis; to predict response to treatment; to evaluate the characteristics of pain and the impact of pain on patients' lives; to assist in disability determination and establishment of limitation of physical capacity; to monitor progress following initiation of treatment; and to evaluate the effectiveness of treatment, along with the need to continue or modify a treatment regimen, among others. When the issue is treatment success, it is important to consider who determines success. Patients, providers, managed care organizations, and workers' compensation carriers may have different criteria for judging the success of a treatment. For the patient, success might be defined by reduction in pain severity. Whereas a provider may consider both pain reduction and functional outcomes as being important, a managed care organization may base success on reduction in health care utilization, and a workers' compensation carrier may care little about pain reduction but prioritize the ability of a treatment to return workers to gainful employment.

High-quality outcomes research is based on methodological rigor with a careful study design but varying goals, from assessing treatment efficacy compared to a placebo treatment and/or active comparator, to determining appropriate dose, side effect profile, time to effect, or maintenance of treatment effect. Careful attention to the internal validity of the study is central. Specific inclusion and exclusion criteria are essential, and psychometrically sound assessment measures are included. The measures selected for assessment must be appropriate for the sample of patients actually included in the study. For example, a measure of functional activities developed for low back pain patients might not be appropriate for a study of patients with carpel tunnel syndrome. When possible, and when they are available, disease-specific measures should be used. However, if the intent is to compare across different diagnoses, then generic measures may be appropriate (Turk et al., 2003).

Epidemiological research includes the same rigor as clinical research but focuses on identification of risk factors, determination of incidence, and prevalence of pain diagnoses in specific populations. Since epidemiological research often is conducted in multiple countries and with different cultural groups, investigators need to pay particular attention to the appropriateness of even well-developed measures that have not been validated with the target populations. For example, a measure that has gone through rigorous psychometric evaluation with an English-speaking population cannot simply be translated to another language and used with speakers of that language, because the concepts may not make sense culturally.

The emphasis on quality improvement in pain management is enhancement of the quality of pain management delivery. The results of quality improvement evaluation provide a better understanding of the extent and nature of problems in service delivery, motivation for change, and points for comparison after change has been made in a system. A thorough evaluation of quality requires examination of the structure, process, and outcomes of care. In contrast to formal research, the results of a quality assurance study are not intended to produce

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new knowledge of widely generalizable or universal value (Berwick, 2008).

An important consideration in selecting from the vast array of assessment measures and procedures described throughout this volume and other publications, regardless of purpose, is *patient burden*; that is how long can patients with different types of pain (e.g., postsurgical, trauma in the emergency department, chronic noncancer, and terminally ill cancer patients) be expected to respond to questions, especially complex questions? Some tradeoff must be made between quantity and quality of responses. Although it might be acceptable for a chronic noncancer patient to complete a set of questionnaires requiring 1 hour and to complete home diaries several times a day for periods of weeks, such an assessment would be inappropriate in the context of a traumatic injury or acute pain following a medical procedure. Assessment addressing substance misuse and potential abuse might be relevant for a patient with chronic pain who is being considered for long-term opioid therapy, but it would be irrelevant to assess pain following a dental extraction, with pain expected to persist for only a few days at most.

Even for patients with chronic pain, one must be concerned about the quality of responses toward the end of lengthy assessment batteries. An important and related issue that has not received sufficient attention relates to the order of questions and the influence of earlier questions on subsequent ones—a *priming effect* (Haythornthwaite & Fauerbach, 2001). For example, what is the impact of asking patients to give a global rating of how well they are doing following the implementation of a particular treatment after they have responded to a set of questions about physical and emotional functioning, and the converse?

Some pain measures are indirect and make no direct demands on the patient, in that they assess behavior, facial expression, or physiological indices, after which inferences are made about the presence, strength, and characteristics of pain. Although such methods may reduce patient burden, they raise clinician burden, another factor that has to be taken into consideration in developing an assessment protocol. Measures and procedures that do not rely on patient self-reports often require special equipment and training, which may not be feasible in quality improvement studies or in the context of clinical practice.

Given the objectives of assessment, differences in populations and samples, and extent of burden involved, it becomes obvious that no single measure is appropriate for all purposes. It is this fact that motivated us to develop this volume and its two predecessors. Regardless of the way one classifies pain and people with pain, and the purposes of assessment, there appear to be a number of commonalities that transcend the age of the affected person, the duration of pain, or the diagnosis. Many of these are discussed in chapters in this volume. However, before we can hope to understand pain, we need to consider how to measure it.

MEASUREMENT OF PAIN

There is no simple thermometer that can objectively record how much pain an individual experiences. As we have noted, all that can be determined about the intensity of a person's pain is based on what the patient verbally or nonverbally communicates about his or her subjective experience. Often patients are asked to quantify their pain by providing a single general rating of pain: "Rate your *usual* level of pain on a scale from 0 to 10, where 0 equals 'no pain' and 10 is the 'worst pain you can imagine.'" Here a patient is being asked to quantify and to average his or her experience of pain over time and situations. These ratings are retrospective, and a number of studies have reported that patients significantly overestimate and underestimate their pain when asked to recall previous levels of pain (e.g., Stone, Broderick, Shiffman, & Schwartz, 2004). Moreover, pain intensity is likely to vary over time and depends on what the individual is doing. It has also been demonstrated that present levels of pain tend to influence memory; consequently, present pain levels may serve as anchors that influence the averaging of pain (see Mason et al., Chapter 14, and Von Korff, Chapter 23, this volume). Furthermore, it is possible that patients may be unable to discriminate reliably between the points on a scale and, for some, the points may not even be considering the

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same dimensions. The anchor words of the scale may also influence the distribution of responses. We noted concerns about retrospective reports earlier in this chapter, and many of these points are discussed by Jensen and Karoly (Chapter 2), Mason and colleagues (Chapter 14), and Von Korff (Chapter 23) in this volume.

Despite the concerns noted, intensity of pain is without a doubt the most salient dimension of pain, and a variety of procedures have been developed to measure it. However, pain is a complex, multidimensional, subjective experience. The report of pain is related to numerous variables, such as cultural background, past experience, the meaning of the situation, personality variables, attention, arousal level, emotions, and reinforcement contingencies (see DeGood & Cook, Chapter 4; Romano, Cano, & Schmaling, Chapter 5; and Turk & Robinson, Chapter 10, this volume). Using a single dimension, such as intensity, will inevitably fail to capture the many qualities of pain. In short, pain intensity, although frequently used in clinical practice to quantify the disorder, is inadequate. Moreover, pain intensity itself does not provide a good reflection of either psychological or physical disruption caused by specific disorders (as noted in many chapters in this volume).

Considerable attention has been devoted to developing measures of physical functioning. A number of attempts have relied on people's self-reports of their abilities to engage in a range of functional activities in general (e.g., Bergner, Bobbitt, Carter, & Gilson, 1981; Millard, 1989; Pollard, 1984) or disease-specific activities (Bennett et al., 2009; Roland & Fairbank, 2000), and the pain experienced upon performance of those activities (e.g., Jette, 1987) by using verbal statements or pictorial representations of specific activities (Kugler, Wijn, Geillen, de Jong, & Vlaeyen, 1999; Turk, Robinson, Sherman, Burwinkle, & Swanson, 2008). Although many investigators are skeptical of the validity of self-report measures and prefer more objective measures, studies have revealed a high level of concordance among self-report and disease characteristics, physicians' or physical therapists' ratings of functional abilities, and objective functional performance (e.g., Deyo & Diehl, 1983; Jette, 1987). Despite obvious limitations of bias, self-report instruments have several advantages. They are economical; they enable the assessment of a wide range of behaviors relevant to the patient that may not be directly observable or measurable by any other means; and they permit emotional, social, and mental functioning to be assessed. Investigators have also developed systematic procedures for physical examination and evaluation of functional capacity that directly assess the individual's physical limitations and capabilities (see Polatin, Worzer, Brede, & Gatchel, Chapter 9, and Watson, Chapter 15, this volume).

Despite evidence to the contrary, in an effort to avoid the many problems inherent in self-reports of pain severity, some investigators and many clinicians suggest that the report of pain should be ignored, since it is a symptom rather than an "objective" sign (which is believed to be more reliable and valid). For example, the Social Security Administration in the United States bases disability determination solely on physical examination, and on imaging and laboratory diagnostic tests. It is only when these objective findings are identified that subjective report of pain is considered (Cocchiarella & Andersson, 2001; Robinson, Turk, & Loeser, 2004).

Biomedical research and advanced technology have been used in an attempt to identify the physical basis of the report of pain. The implicit assumption of this research seems to be that there is an isomorphic relationship between the report of pain and tissue pathology. Thus, once the extent of tissue pathology is identified, the intensity of pain can be known. Using objective physical assessment, diagnostic nerve blocks and sophisticated imaging, and laboratory diagnostic procedures to identify the nature and extent of pathology is assumed to provide direct knowledge of the subjective state (see Watson, Chapter 15, this volume).

To date, biomedical research has been disappointing (see Polatin et al., Chapter 9, and Robinson, Chapter 21, this volume). Little information is available on how to integrate effectively and appropriately the information derived from multiple physical examinations, diagnostic imaging, and laboratory tests. Moreover, the relationships among pathology, physical measurements of muscle strength and range of motion, behav-

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ior, and reports of pain have not been firmly established, and these factors appear to be only weakly associated (e.g., Deyo, 1986; Waddell, 2004). A number of studies demonstrate significant pathology in individuals who have little or no pain (e.g., Boden, Davis, Dina, Patronas, & Wiesel, 1990; Hitselberger & Witten, 1968; Jensen, Brant-Zawadski, Obuchowski, Modic, & Malkasian Ross, 1994; Weishaupt, Zanetti, & Hodler, 1998; Wiesel, Tsourmas, & Feffer, 1984) but, conversely, little identifiable pathology in patients who report severe pain (e.g., Deyo, 1986).

In short, the association between physical abnormalities and patients' reports of pain is often ambiguous or weak. In addition, physical pathology has been reported not to be predictive of disability (Cats-Baril & Frymoyer, 1991; Hagglund, Haley, Reveille, & Alarcon, 1989; see Robinson, Chapter 21, this volume), of return to work after an injury (e.g., Turner, Franklin, & Turk, 2000), or of treatment outcome following surgery, other invasive procedures, or rehabilitation (e.g., Waddell, 2004). One possible factor contributing to the apparent lack of correlation among pathology, symptoms, and outcome is the observation that the reliability of many physical examination procedures is questionable (see, e.g., Hunt et al., 2000; Nitschke, Nattrass, & Disler, 1999; see also Watson, Chapter 15, this volume). In addition, although physical examination measurements such as flexibility and strength may be objective, they are influenced in many cases by the patient's motivation, effort, and psychological state.

A number of physicians who have tried to develop systematic approaches to physical assessment have suggested that sophisticated laboratory and imaging techniques should form the basis of pain assessment (see Watson, Chapter 15, this volume). However, a preponderance of research has demonstrated that there is no isomorphic association between physical pathology and pain (see Robinson & Turk, Chapter 16, this volume). Many factors seem to mediate this association in both acute (Bonica, 1990) and chronic pain (Waddell, Bircher, Finlayson, & Main, 1984), as well as pain associated with terminal illnesses (Turk & Feldman, 2009). Identification of pain-specific physiological response has also met with mixed success (cf. Sternbach, 1968; Turk, 1989). The reliability of many psychophysiological parameters has been questioned (see, e.g., Arena, Blanchard, Andrasik, Cotch, & Meyers, 1983). As Sternbach (1968) noted, "Because of the variability of response elicited by different pain stimuli, and because of the additional variance contributed by individual differences in response-stereotype, it is difficult to specify a pattern of physiological responses characteristic of pain" (p. 259).

In many patients, objective physical findings to support their reports of pain are absent. Thus, reliable and valid measures of pain and function must be developed. Some investigators have challenged the validity of patients' self-reports of activities as inaccurate (e.g., Kremer, Block, & Gaylor, 1981); however, a number of studies have demonstrated that self-report questionnaires can be highly valid measures of functional status (see, e.g., Deyo & Diehl, 1983). Physical and laboratory measures are useful primarily to the degree that they correlate with symptoms and functional ability (see Flor & Meyer, Chapter 8, this volume). However, self-report functional status instruments seek to quantify symptoms, function, and behavior directly rather than to infer them (Deyo, 1988).

Psychologists have also been concerned with the development of assessment procedures that do not rely on self-reports to evaluate patients with pain. Fordyce (1976) provided an important contribution by emphasizing the important role of environmental contingencies on the communication of pain, distress, and suffering. Patients experiencing pain display a broad range of observable manifestations that communicate to others the fact that they are feeling pain—that they are distressed and suffering. These behaviors, termed *pain behaviors*, include verbal report, paralinguistic vocalizations, motor activity, facial expressions, gesticulations, and postural adjustments (Fordyce, 1976; see Keefe, Somers, Williams, & Smith, Chapter 7, this volume). Because pain behaviors, unlike pain per se, are observable, they are susceptible to conditioning and learning influences. Patients have many opportunities to learn that the display of pain behaviors may lead to reinforcing consequences, such as attention, and the opportunity to avoid unwanted responsibilities. In some cases,

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these pain behaviors may be maintained by their reinforcing consequences long after the normal healing time for injury.

According to operant theory, behavior is controlled to a great extent by its consequences. With an initial injury or pathological state, these behaviors may be reflexive responses (in the language of behavioral theory, *respondents*); however, over time, these initially reflexive responses may be maintained by reinforcement contingencies; that is, attention or financial gain may be positively reinforcing and thereby contribute to the maintenance of the behaviors long after the initial cause of pain has been resolved. These insights have led to an emphasis on the assessment of these pain behaviors (see Keefe et al., Chapter 7, this volume), as well as treatments designed to extinguish maladaptive pain behaviors and to increase activity (i.e., adaptive or well behaviors).

Typically, methods used to assess pain behaviors have relied on patients' self-reports of their activities. For example, patients have been asked to indicate in general how much time they spend in specific activities such as sitting, standing, and walking (*uptime*), or to complete daily monitoring forms that record the frequency of such activities. Keefe and his colleagues (for a review, see Chapter 7, this volume) have developed specific behavioral observation methods to assess pain behaviors that are not dependent on patients' self-reports.

Unfortunately, none of the pain behaviors appear to be uniquely or invariably associated with the experience of pain. Craig and his colleagues (Chapter 6, this volume) have made a strong case for the priority of nonverbal facial expression of pain for making judgments about the pain experienced by others. These investigators have conducted fine-grained observations of the facial musculature associated with pain. As noted previously, assessment of pain based on nonverbal communication may be particularly important for those who have restrictions in their ability to communicate.

Interestingly, Flor and Turk (1988), among others (e.g., Waddell, 1987), have found that although physical impairment is related to disability, it bears a much smaller association with self-reported pain. Council, Ahern, Follick, and Kline (1988) found that the actual physical performance of patients with back pain was best predicted by their *beliefs in their capabilities* and not by pain per se. Moreover, Vlaeyen and Linton (2000) have demonstrated that fears of pain and injury are particularly potent predictors of physical functioning. Turk and colleagues (Flor & Turk, 1988; Turk, Okifuji, Sinclair, & Starz, 1996) examined the relationship among general and specific pain-related thoughts, convictions of personal control, pain severity, and disability levels in patients with chronic back pain, rheumatoid arthritis, and fibromyalgia. The general and situation-specific convictions of uncontrollability and helplessness were more highly related to pain and disability than to disease status for the patients with back pain and rheumatoid arthritis. For the patients with fibromyalgia syndrome, there was only a low correlation between what patients *said* they were able to do and their actual activities. These data suggest that it is important to assess not only how much patients report they hurt and what they say they are able to do, but also how much they actually do.

The failure to find a relationship between reported pain and pathology has resulted in the suggestion that personality factors may be the cause of pain or may influence reports of pain that are "disproportionate" to the identified pathology. The search for a "pain-prone personality" (see, e.g., Blumer & Heilbronn, 1982) and for "psychogenic pain" has proven to be futile (see Sullivan & Braden, Chapter 20, this volume). The many variables that have been perceived to be part of a personality constellation related to psychogenic pain may actually be reactions to illness, independent of psychiatric diagnosis. A number of investigators have begun to examine the predictive power of individual-difference measures to predict response to diverse treatments for pain. Many third-party payers are beginning to require presurgical screening prior to surgery or use of implantable devices (i.e., spinal cord stimulators, pumps; see Gatchel, Chapter 22, this volume), and measures have been developed in an effort to predict patients at risk for opioid misuse. However, many of the common psychological instruments have not demonstrated clear utility in diagnostic or treatment outcome predictions (Turk, 1989; Turk, Swanson, & Gatchel, 2008). This area holds promise for improving outcomes but

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calls for additional research to confirm the predictive validity of the assessment protocols.

A BROADER PERSPECTIVE IN THE PERSON EXPERIENCING PAIN

Over the past 45 years, major research advances have greatly increased knowledge of the anatomy and neurophysiology of nociception. The landmark papers by Melzack and his colleagues (Melzack & Casey, 1968; Melzack & Wall, 1965) formulating the *gate control* theory of pain expanded the conceptualization of pain from a purely sensory phenomenon to a multidimensional model that integrates motivational–affective and cognitive–evaluative components with sensory–physiological ones. The gate control model served as an important impetus to physiological research and research on identifying and demonstrating the modulation of pain perception by psychological variables. The gate control model emphasizes that pain is not exclusively sensory, and that simple measures of pain intensity are inadequate to understand it. In the 1970s, Melzack and colleagues (Melzack, 1975; Melzack & Torgerson, 1971) developed the first assessment instrument, the McGill Pain Questionnaire, designed to measure the three components of pain postulated by the gate control theory (see Katz & Melzack, Chapter 3, this volume).

Since Melzack and his colleagues' pioneering work on pain assessment, a number of investigators have emphasized that pain that extends over time (i.e., chronic pain, acute recurrent pain, pain associated with progressive diseases) has an important impact on all domains of the sufferer's life. Persistent pain is so prepotent that psychological factors may come to play an even greater role in influencing the subjective experience, report, and responses. Physicians have long recognized that disease categories provide minimal information about the impact of illness upon patients' experiences. A diagnosis is important, because it may identify a cause of symptoms and suggest a course of treatment. Yet within each specific diagnosis, patients differ considerably in how they are affected (see, e.g., Turk & Rudy, 1990) and how they respond to treatment. Consequently, appropriate evaluation of these patients requires assessment of much more than just the direct components of pain; it also calls for assessment of mood, attitudes, beliefs, coping efforts, resources, and the impact of pain on patients' lives (see DeGood & Cook, Chapter 4, and Turk & Robinson, Chapter 10, this volume). Moreover, because people do not live in isolation, chronic pain influences interpersonal relationships and is influenced by them. Thus, it is important to consider both contextual and individual patient characteristics (see Romano et al., Chapter 5, this volume).

In conclusion, health care providers have long considered pain as being synonymous with nociceptive stimulation and pathology. It is important, however, to make a distinction among *nociception*, *pain, suffering*, and *pain behavior* (Turk & Wilson, 2009). *Nociception* is the processing of stimuli that are related to the stimulation of nociceptors and capable of being experienced as pain. *Pain*, because it involves conscious awareness, selective abstraction, appraisal, ascribing meaning, and learning, is best viewed as a perceptual process that comprises the integration and modulation of a number of afferent and efferent processes (Melzack & Casey, 1968). Thus, the experience of pain should not be equated with peripheral stimulation. *Suffering*, which includes interpersonal disruption, economic distress, occupational problems, and myriad other factors associated with pain's impact on life functioning, is largely associated with the interpretive processes and subsequent response to the perception of pain. A number of studies dating back over 20 years (e.g., Reesor & Craig, 1988) have demonstrated that cognitive processes appear to amplify or distort patients' experience of pain and suffering. In sharp contrast to the nociceptive model, operant pain *behaviors* can occur in the absence of and may thus be independent of nociception.

Although biomedical factors appear to instigate the initial report of pain in the majority of cases, psychosocial and behavioral factors may serve over time to exacerbate and maintain levels of pain and subsequent disability. It is important to acknowledge that disability is not solely a function of the extent of physical pathology or reported pain severity (see, e.g., Fordyce et al., 1984; Waddell et al., 1984; see Robinson, Chap-

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ter 21, this volume). Disability is a complex phenomenon that incorporates tissue pathology, the total individual's response to that physical insult, and environmental factors that can serve to maintain the disability and associated pain even after the initial physical cause has resolved. Pain that persists over time should be viewed not as the result of either solely physical or solely psychological causes, but rather as a set of biomedical, psychosocial, and behavioral factors contributing to the total experience of pain.

CHANGES IN HEALTH CARE

Over the past few years, there has been a marked change in health care. Much greater attention is being given to evidence for not only the clinical effectiveness but also the cost-effectiveness of treatments. Health care providers are being asked—actually, challenged—to provide evidence of the effectiveness of the treatment they propose to perform, and reimbursement will be based on actual outcomes—"pay for performance." Many decisions regarding reimbursement are based on the availability of convincing data that the treatment results in positive outcomes—ones that are important to third-party payers (i.e., reduction in health care consumption, reduction in indemnity payments, return to gainful employment) and are less costly than alternatives. To be responsive to these demands, it has become incumbent on health care providers to make available information supporting the effectiveness of their treatments and demonstrating that they achieve positive outcomes in their practices. Effective dissemination of evidence of treatment outcomes is also becoming crucial. Thus, health care providers need to give greater attention to the performance of clinical trials, to program evaluation, and to effective communication of their own and others' published results of relevant outcome studies and epidemiological research (see Chapter 23 by Von Korff and Chapter 24 by O'Connor & Dworkin, this volume). In selecting measures to use for communication, for treatment decision making, for the interpretation of published results, and for the evaluation of their own practices, they need to be aware of the basic requirements of psychometrics.

SOME PROSPECTIVE CAVEATS

In this volume, detailed discussions are presented, and descriptions of a broad range of assessment techniques, methods, and measures are provided. At this point, it seems appropriate to provide some cautions that may serve to inoculate the reader. One of us (DCT) is reminded of the examination question he gave to graduate students in the course on tests and measurements he taught: "Imagine that you read a journal article describing a new assessment battery, and you believe it is the answer to your prayers for the research study that you are proposing in a grant application. Describe how you would go about convincing your collaborators and the grant reviewers that this battery is appropriate and should be used."

We must balance the tendency to focus on variables for which there are existing reliable and valid measures against the need to examine what is truly important. Clinicians and researchers should also guard against picking instruments blindly "off the shelf" simply because they are well known, popular, or have received extensive validation. It is essential that the instrument or procedure under consideration has been standardized on the population of interest and addresses the question(s) of interest in the study. We should not assume that because an instrument or procedure has been demonstrated to have good psychometric properties in one population it can be applied to another population without a demonstration of the instrument's psychometric properties in the new population.

Currently there is no single agreed-upon method for evaluating patients with pain. Many competing instruments, procedures, and methods are available. Each investigator or clinician develops his or her own set by selecting from the many available techniques or by developing personalized assessment instruments—often without giving sufficient attention to the psychometric properties of the measures used. This practice makes it difficult to compare results across studies. There needs to be some agreement with regard to what set of instruments and procedures will be used as the standards for each relevant domain of assessment. This is something of a double-edged sword, and we must be careful not to preclude using some

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new measures that may provide important new information.

Developing assessment instruments and procedures that have appropriate psychometric properties is necessary but not sufficient. Given the complexities inherent in the construct of subjective pain, there is a need to obtain a diversity of assessment information that must then be integrated to understand the patient's pain and to contribute to treatment decision making. Many clinical outcome studies report on the mean differences between groups that receive the treatment of interest compared to a placebo or an active comparator. Although the results tend to report on the between-group statistical significance of prespecified outcome measures (i.e., primary endpoint) such mean effects do not provide any indication of the results' clinical importance or their importance to patients. There is a growing acknowledgment of the need to report on meaningfulness of the outcomes rather than to rely solely on statistical significance; that is, with sufficient sample size, a change of one-half point on a 10-point numerical rating scale may prove to be statistically significant, but how meaningful is such a small change? A number of parameters can be used as indications of meaningfulness, such as effect sizes, number needed to treat (to produce a positive benefit or harm), and more formal approaches to determine the minimally important difference (Busse & Guyatt, 2009; see also O'Connor & Dworkin, Chapter 24, this volume).

Most of what is known about patients with chronic pain has been learned from studying patients referred to specialized pain clinics. These patients represent a very small percentage of patients who experience chronic pain—those who have gone through a selective filtering process (Turk & Rudy, 1990). The degree to which this segment of patients is representative of the larger population of people with chronic pain is highly questionable. As epidemiological surveys seem to suggest, pain clinic samples may differ in many ways from community samples. For example, the association between psychological findings and pain frequently noted in pain clinics is less frequently observed in epidemiological studies (Crook, Weir, & Tunks, 1989).

Our primary purpose in this volume is to provide a comprehensive and practical review of the advances in the measurement of pain and the assessment of patients with pain, and to recommend the most appropriate tests and procedures given the current state of knowledge. Our hope is that the reader will, upon examination of each of the contributions, be in a better situation to provide psychometrically acceptable and sufficiently comprehensive approaches to the problem to be investigated.

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