

Mindfulness Training as a Clinical Intervention: A Conceptual and Empirical Review

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Interventions based on training in mindfulness skills are becoming increasingly popular. Mindfulness involves intentionally bringing one's attention to the internal and external experiences occurring in the present moment, and is often taught through a variety of meditation exercises. This review summarizes conceptual approaches to mindfulness and empirical research on the utility of mindfulness-based interventions. Meta-analytic techniques were incorporated to facilitate quantification of findings and comparison across studies. Although the current empirical literature includes many methodological flaws, findings suggest that mindfulness-based interventions may be helpful in the treatment of several disorders. Methodologically sound investigations are recommended in order to clarify the utility of these interventions.

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Mindfulness is a way of paying attention that originated in Eastern meditation practices. It has been described as “bringing one’s complete attention to the present experience on a moment-to-moment basis” (Marlatt & Kristeller, 1999, p. 68) and as “paying attention in a particular way: on purpose, in the present moment, and nonjudgmentally” (Kabat-Zinn, 1994, p. 4). The ability to direct one’s attention in this way can be developed through the practice of meditation, which is defined as the intentional self-regulation of attention from moment to moment

(Goleman & Schwartz, 1976; Kabat-Zinn, 1982). The current mindfulness literature describes numerous meditation exercises designed to develop mindfulness skills (Hanh, 1976; Kabat-Zinn, 1990, 1994; Linehan, 1993b). Many encourage individuals to attend to the internal experiences occurring in each moment, such as bodily sensations, thoughts, and emotions. Others encourage attention to aspects of the environment, such as sights and sounds (Kabat-Zinn, 1994; Linehan, 1993b). All suggest that mindfulness should be practiced with an attitude of non-judgmental acceptance. That is, phenomena that enter the individual’s awareness during mindfulness practice, such as perceptions, cognitions, emotions, or sensations, are observed carefully but are not evaluated as good or bad, true or false, healthy or sick, or important or trivial (Marlatt & Kristeller, 1999). Thus, mindfulness is the nonjudgmental observation of the ongoing stream of internal and external stimuli as they arise.

Until recently, mindfulness has been a relatively unfamiliar concept in much of our culture (Kabat-Zinn, 1982), perhaps because of its origins in Buddhism. Kabat-Zinn (2000) suggests that mindfulness practice may be beneficial to many people in Western society who might be unwilling to adopt Buddhist traditions or vocabulary. Thus, Western researchers and clinicians who have introduced mindfulness practice into mental health treatment programs usually teach these skills independently of the religious and cultural traditions of their origins (Kabat-Zinn, 1982; Linehan, 1993b). In the current empirical literature, clinical interventions based on training in mindfulness skills are described with increasing frequency, and their popularity appears to be growing rapidly. According to Salmon, Santorelli, and Kabat-Zinn (1998), over 240 hospitals and clinics in the United States and abroad were offering stress reduction programs based on mindfulness training as of

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1997. Mindfulness training is also a central component of dialectical behavior therapy (Linehan, 1993a, 1993b), an increasingly popular approach to the treatment of borderline personality disorder. The empirical literature on the effects of mindfulness training contains many methodological weaknesses, but it suggests that mindfulness interventions may lead to reductions in a variety of problematic conditions, including pain, stress, anxiety, depressive relapse, and disordered eating (e.g., Kabat-Zinn, 1982; Kabat-Zinn et al., 1992; Kristeller & Hallett, 1999; Shapiro, Schwartz, & Bonner, 1998; Teasdale et al., 2000).

This review summarizes the recent literature on mindfulness training as a clinical intervention. First, current methods for teaching mindfulness skills are described. Next, conceptual approaches that articulate how mindfulness skills may be helpful in treating clinical conditions are summarized. Finally, the empirical literature on the effects of mindfulness training is reviewed.

This review does not address transcendental meditation (TM) and other concentration-based approaches, which have been reviewed elsewhere (Delmonte, 1985; Smith, 1975). Concentration-based approaches train participants to restrict the focus of attention to a single stimulus, such as a word (e.g., a mantra), sound, object, or sensation. When attention wanders, it is redirected to the object of meditation. No attention is paid to the nature of the distraction. Mindfulness meditation, in contrast, involves observation of constantly changing internal and external stimuli as they arise.

This review also does not address Langer's (1989, 1997) cognitive model of mindfulness, which includes alertness to distinctions, context, and multiple perspectives, openness to novelty, and orientation in the present (Sternberg, 2000). Mindfulness interventions studied by Langer and colleagues (e.g., Langer, 1989; Langer & Moldoveanu, 2000) often include teaching participants to consider information or situations from multiple perspectives or within new contexts in order to increase learning or creativity. Although this concept of mindfulness shares with meditative approaches an emphasis on flexible awareness in the present, several important differences can be noted. Langer's (1989) mindfulness interventions usually involve working with material external to the participants, such as information to be learned or manipulated, and often include active, goal-oriented cognitive tasks, such as solving problems. In contrast, the meditation-based approaches

described in this review often are directed toward the inner experiences of the individual (e.g., thoughts, emotions) and emphasize a less goal-directed, nonjudgmental observation. Langer (1989) has cautioned against drawing unwarranted parallels between the two forms of mindfulness, noting that they are derived from very different historical and cultural backgrounds.

INTERVENTIONS BASED ON MINDFULNESS TRAINING

Mindfulness-Based Stress Reduction

The most frequently cited method of mindfulness training is the mindfulness-based stress reduction (MBSR) program, formerly known as the stress reduction and relaxation program (SR-RP; Kabat-Zinn, 1982, 1990). It was developed in a behavioral medicine setting for populations with a wide range of chronic pain and stress-related disorders. The program is conducted as an 8- to 10-week course for groups of up to 30 participants who meet weekly for 2–2.5 hr for instruction and practice in mindfulness meditation skills, together with discussion of stress, coping, and homework assignments. An all-day (7–8-hr) intensive mindfulness session usually is held around the sixth week. Several mindfulness meditation skills are taught. For example, the body scan is a 45-min exercise in which attention is directed sequentially to numerous areas of the body while the participant is lying down with eyes closed. Sensations in each area are carefully observed. In sitting meditation, participants are instructed to sit in a relaxed and wakeful posture with eyes closed and to direct attention to the sensations of breathing. Hatha yoga postures are used to teach mindfulness of bodily sensations during gentle movements and stretching. Participants also practice mindfulness during ordinary activities like walking, standing, and eating.

Participants in MBSR are instructed to practice these skills outside group meetings for at least 45 min per day, six days per week. Audiotapes are used early in treatment, but participants are encouraged to practice without tapes after a few weeks. For all mindfulness exercises, participants are instructed to focus attention on the target of observation (e.g., breathing or walking) and to be aware of it in each moment. When emotions, sensations, or cognitions arise, they are observed nonjudgmentally. When the participant notices that the mind has wandered into thoughts, memories, or fantasies, the nature or content of them is briefly noted, if possible, and then attention is returned to the

present moment. Thus, participants are instructed to notice their thoughts and feelings but not to become absorbed in their content (Kabat-Zinn, 1982). Even judgmental thoughts (e.g., “this is a foolish waste of time”) are to be observed nonjudgmentally. Upon noticing such a thought, the participant might label it as a judgmental thought, or simply as “thinking,” and then return attention to the present moment. An important consequence of mindfulness practice is the realization that most sensations, thoughts, and emotions fluctuate, or are transient, passing by “like waves in the sea” (Linehan, 1993b, p. 87).

Mindfulness-Based Cognitive Therapy

Teasdale, Segal, and Williams (1995) proposed that the skills of attentional control taught in mindfulness meditation could be helpful in preventing relapse of major depressive episodes. Their information-processing theory of depressive relapse suggests that individuals who have experienced major depressive episodes are vulnerable to recurrences whenever mild dysphoric states are encountered, because these states may reactivate the depressive thinking patterns present during the previous episode, or episodes, thus precipitating a new episode. Mindfulness-based cognitive therapy (MBCT) is a manualized (Segal, Williams, & Teasdale, 2002) 8-week group intervention based largely on Kabat-Zinn’s (1990) MBSR program. It incorporates elements of cognitive therapy that facilitate a detached or decentered view of one’s thoughts, including statements such as “thoughts are not facts” and “I am not my thoughts.” This decentered approach also is applied to emotions and bodily sensations. MBCT is designed to prevent depressive relapse by teaching formerly depressed individuals to observe their thoughts and feelings nonjudgmentally, and to view them simply as mental events that come and go, rather than as aspects of themselves, or as necessarily accurate reflections of reality. This attitude toward depression-related cognitions is believed to prevent the escalation of negative thoughts into ruminative patterns (Teasdale et al., 1995).

INTERVENTIONS INCORPORATING MINDFULNESS TRAINING

Dialectical Behavior Therapy

Dialectical behavior therapy (DBT) is a multifaceted approach to the treatment of borderline personality disorder (Linehan, 1993a, 1993b). It is based on a dialectical world-

view, which postulates that reality consists of opposing forces. The synthesis of these forces leads to a new reality, which in turn consists of opposing forces, in a continual process of change. In DBT, the most central dialectic is the relationship between acceptance and change. Clients are encouraged to accept themselves, their histories, and their current situations exactly as they are, while working intensively to change their behaviors and environments in order to build a better life. The synthesis of this apparent contradiction is a central goal of DBT.

DBT includes a wide range of cognitive and behavioral treatment procedures, most of which are designed to change thoughts, emotions, or behaviors. Mindfulness skills are taught in DBT within the context of synthesizing acceptance and change. Although the skills taught are similar to those targeted in MBSR, including nonjudgmental observation of thoughts, emotions, sensations, and environmental stimuli, the concepts are organized somewhat differently. For example, Linehan (1993a, 1993b) describes three mindfulness “what” skills (observe, describe, participate) and three mindfulness “how” skills (nonjudgmentally, one-mindfully, effectively). DBT clients learn mindfulness skills in a year-long weekly skills group, which also covers interpersonal effectiveness, emotion regulation, and distress tolerance skills. Clients work with their individual therapists on applying skills learned in group to their daily lives.

Linehan (1994) notes that some severely impaired individuals may be unable or unwilling to meditate as extensively as Kabat-Zinn’s (1990) MBSR program recommends. Thus, DBT does not prescribe a specific frequency or duration of mindfulness practice. Instead, goals for mindfulness practice are established by individual clients and their therapists. DBT offers numerous mindfulness exercises from which clients may choose (some adapted from Hanh, 1976). In one example, clients imagine that the mind is a conveyor belt. Thoughts, feelings, and sensations that come down the belt are observed, labeled, and categorized. In another exercise, clients imagine that the mind is the sky, and that thoughts, feelings, and sensations are clouds that they watch passing by. Several variations on observing the breath are taught, including following the breath in and out, counting breaths, coordinating breathing with footsteps while walking, and following the breath while listening to music. Some exercises encourage mindful awareness during everyday activities,

such as making tea, washing dishes or clothes, cleaning house, or taking a bath.

Acceptance and Commitment Therapy

Acceptance and commitment therapy (ACT; Hayes, Strosahl, & Wilson, 1999) is theoretically based in contemporary behavior analysis (Hayes & Wilson, 1993). Although ACT does not describe its treatment methods in terms of mindfulness or meditation, it is included here because several of its strategies are consistent with the mindfulness approaches described. Clients in ACT are taught to recognize an observing self who is capable of watching his or her own bodily sensations, thoughts, and emotions. They are encouraged to see these phenomena as separate from the person having them. For example, they are taught to say, "I'm having the thought that I'm a bad person," rather than "I'm a bad person" (Kohlenberg, Hayes, & Tsai, 1993, p. 588). They also are encouraged to experience thoughts and emotions as they arise, without judging, evaluating, or attempting to change or avoid them. Hayes (1987) describes an exercise in which the client imagines that his or her thoughts are written on signs carried by parading soldiers. The client's task is to observe the parade of thoughts without becoming absorbed in any of them. ACT explicitly teaches clients to abandon attempts to control thoughts and feelings, but instead to observe them nonjudgmentally and accept them as they are, while changing their behaviors in constructive ways to improve their lives (Hayes, 1994).

Relapse Prevention

Relapse prevention (RP; Marlatt & Gordon, 1985) is a cognitive-behavioral treatment package designed to forestall relapses in individuals treated for substance abuse. Mindfulness skills are included as a technique for coping with urges to engage in substance use. Marlatt (1994) notes that mindfulness involves acceptance of the constantly changing experiences of the present moment, whereas addiction is an inability to accept the present moment and a persistent seeking of the next "high" associated with the addiction. The metaphor of "urge surfing" encourages clients to imagine that urges are ocean waves that grow gradually until they crest and subside. The client "rides" the waves without giving in to the urges, thus learning that urges will pass. However, the client also learns that new urges will appear and that these urges cannot easily be

eliminated. Instead, urges must be accepted as normal responses to appetitive cues. Mindfulness skills enable the client to observe the urges as they appear, accept them nonjudgmentally, and cope with them in adaptive ways.

CONCEPTUAL APPROACHES: HOW MINDFULNESS SKILLS MAY HELP

The authors of these treatment strategies have suggested several mechanisms that may explain how mindfulness skills can lead to symptom reduction and behavior change.

Exposure

The first published study of the effects of MBSR (Kabat-Zinn, 1982) described its application in patients with chronic pain. MBSR is based, in part, on traditional meditation practices, which often include extended periods of motionless sitting. Although a relaxed posture typically is adopted, prolonged motionlessness can lead to pain in muscles and joints. Mindfulness meditation instructors often encourage students not to shift position to relieve the pain, but instead to focus careful attention directly on the pain sensations, and to assume a nonjudgmental attitude toward these sensations, as well as toward the various cognitions ("this is unbearable") emotions (anxiety, anger), and urges (to shift position) that often accompany pain sensations. The ability to observe pain sensations nonjudgmentally is believed to reduce the distress associated with pain.

Kabat-Zinn (1982) suggests that application of this strategy by chronic pain patients might serve several functions. For example, prolonged exposure to the sensations of chronic pain, in the absence of catastrophic consequences, might lead to desensitization, with a reduction over time in the emotional responses elicited by the pain sensations. Thus, the practice of mindfulness skills could lead to the ability to experience pain sensations without excessive emotional reactivity. Even if pain sensations were not reduced, suffering and distress might be alleviated.

Kabat-Zinn et al. (1992) describe a similar mechanism for the potential effects of mindfulness training on anxiety and panic. Sustained, nonjudgmental observation of anxiety-related sensations, without attempts to escape or avoid them, may lead to reductions in the emotional reactivity typically elicited by anxiety symptoms. This approach is similar to the interoceptive exposure strategy described by Barlow and Craske (2000), who instruct clients to in-

duce symptoms of panic through exercises such as hyperventilation and aerobic activity, and to practice tolerating these sensations until they subside. In contrast, however, mindfulness training does not include the deliberate induction of panic symptoms. Instead, participants are instructed to observe these sensations nonjudgmentally when they naturally arise.

Linehan (1993a, 1993b) describes individuals with borderline personality disorder as emotion phobic. That is, they are often afraid of experiencing strong negative affective states. This fear is understandable, because their negative affective states typically are very intense. However, their attempts to avoid these states often have maladaptive consequences. Linehan (1993a, 1993b) suggests that prolonged observation of current thoughts and emotions, without trying to avoid or escape them, can be seen as an example of exposure, which should encourage the extinction of fear responses and avoidance behaviors previously elicited by these stimuli. Thus, the practice of mindfulness skills may improve patients' ability to tolerate negative emotional states and ability to cope with them effectively.

Cognitive Change

Several authors have noted that the practice of mindfulness may lead to changes in thought patterns, or in attitudes about one's thoughts. For example, Kabat-Zinn (1982, 1990) suggests that nonjudgmental observation of pain and anxiety-related thoughts may lead to the understanding that they are "just thoughts," rather than reflections of truth or reality, and do not necessitate escape or avoidance behavior. Similarly, Linehan (1993a, 1993b) notes that observing one's thoughts and feelings and applying descriptive labels to them encourages the understanding that they are not always accurate reflections of reality. For example, feeling afraid does not necessarily mean that danger is imminent, and thinking "I am a failure" does not make it true. Kristeller and Hallett (1999), in a study of MBSR in patients with binge eating disorder, cite Heatherton and Baumeister's (1991) theory of binge eating as an escape from self-awareness and suggest that mindfulness training might develop nonjudgmental acceptance of the aversive cognitions that binge-eaters are thought to be avoiding, such as unfavorable comparisons of self to others and perceived inability to meet others' demands.

Teasdale (1999) and Teasdale et al. (1995), in their discussion of MBCT, suggest that the nonjudgmental,

decentered view of one's thoughts encouraged by mindfulness training may interfere with ruminative patterns believed to be characteristic of depressive episodes (Nolen-Hoeksema, 1991). That is, mindfulness training may enable formerly depressed individuals to notice depressogenic thoughts and to redirect attention to other aspects of the present moment, such as breathing, walking, or environmental sounds, thus avoiding rumination. Teasdale has described this perspective on one's thoughts as "metacognitive insight." Teasdale et al. (1995) also note that a practical advantage of mindfulness skills in encouraging cognitive change is that they can be practiced at any time, including during periods of remission, when depressogenic thinking may be occurring too rarely to permit regular practice of traditional cognitive therapy exercises, such as identification and disputing of cognitive distortions. That is, a mindful perspective about one's thoughts can be applied to all thoughts.

Self-Management

Several authors have noted that improved self-observation resulting from mindfulness training may promote use of a range of coping skills. For example, Kabat-Zinn (1982) suggests that increased awareness of pain sensations and stress responses as they occur may enable individuals to engage in a variety of coping responses, including skills not included in their treatment program. Kristeller and Hallett (1999) suggest that the self-observation skills developed through mindfulness training might lead to improved recognition of satiety cues in binge eaters, as well as increased ability to observe urges to binge without yielding to them. Marlatt (1994) suggests a similar effect in patients recovering from addictions. Teasdale et al. (1995) note that mindfulness training encourages awareness of all cognitive and emotional events as they occur, including those that may be early signs of potential depressive relapse. Thus, mindfulness training may promote recognition of early signs of a problem, at a time when application of previously learned skills will be most likely to be effective in preventing the problem. Linehan (1993b) suggests that nonjudgmental observation and description permits recognition of the consequences of behaviors (e.g., irritating one's boss with frequent lateness) in place of global judgments about the self (e.g., "I am a bad employee"). This recognition may lead to more effective behavior change, including reduction of impulsive, maladaptive behaviors. Linehan

(1993b) also suggests that learning to focus “one-mindfully” on the present moment develops control of attention, a useful skill for individuals who have difficulty completing important tasks because they are distracted by worries, memories, or negative moods.

Relaxation

The relationship between meditation and relaxation is somewhat complex. Several authors (Goldenberg et al., 1994; Kabat-Zinn et al., 1998; Kaplan, Goldenberg, & Galvin-Nadeau, 1993) have suggested that mindfulness-based stress reduction may be applicable to stress-related medical disorders, including psoriasis and fibromyalgia. These authors note that meditation often induces relaxation, which may contribute to the management of these disorders. The induction of relaxation through various meditation strategies has been well documented (Benson, 1975; Orme-Johnson, 1984; Wallace, Benson, & Wilson, 1984). However, the purpose of mindfulness training is not to induce relaxation, but instead to teach nonjudgmental observation of current conditions, which might include autonomic arousal, racing thoughts, muscle tension, and other phenomena incompatible with relaxation. In addition, evidence suggests that relaxation effects are not unique to meditation, but are common to many relaxation strategies (Shapiro, 1982). Thus, although practice of mindfulness exercises may lead to relaxation, this outcome may not be a primary reason for engaging in mindfulness skills.

Acceptance

The relationship between acceptance and change is a central concept in current discussions of psychotherapy (Hayes, Jacobsen, Follette, & Dougher, 1994). Hayes (1994) suggests that acceptance involves “experiencing events fully and without defense, as they are” (p. 30), and notes that empirically oriented clinicians may have overemphasized the importance of changing all unpleasant symptoms, without recognizing the importance of acceptance. For example, an individual who experiences panic attacks may engage in numerous maladaptive behaviors in an attempt to prevent future attacks, including drug and alcohol abuse, avoidance of important activities, and excessive anxious vigilance toward bodily states. If the individual could accept that panic attacks may occasionally occur and that they are time-limited and not dangerous, panic attacks would become unpleasant but brief experiences to be tol-

erated, rather than fearsome and dangerous experiences to be avoided, even at the cost of significant maladaptive behavior.

All of the treatment programs reviewed here include acceptance of pain, thoughts, feelings, urges, or other bodily, cognitive, and emotional phenomena, without trying to change, escape, or avoid them. Kabat-Zinn (1990) describes acceptance as one of several foundations of mindfulness practice. DBT provides explicit training in several mindfulness techniques designed to promote acceptance of reality. Thus, it appears that mindfulness training may provide a method for teaching acceptance skills.

Relationship Between Mindfulness Training and Cognitive-Behavioral Approaches

This discussion suggests that mindfulness training is consistent with cognitive-behavioral treatment procedures in several ways. Training in self-directed attention can result in sustained exposure to sensations, thoughts, and emotions, resulting in desensitization of conditioned responses and reduction of avoidance behavior. Cognitive change appears to result from viewing one’s thoughts as temporary phenomena without inherent worth or meaning, rather than as necessarily accurate reflections of reality, health, adjustment, or worthiness. Practice of meditation also may lead to relaxation and improved self-management.

However, mindfulness training differs from traditional cognitive-behavioral treatment in important ways. For example, mindfulness training does not include the evaluation of thoughts as rational or distorted, or systematic attempts to change thoughts judged to be irrational. Instead, participants are taught to observe their thoughts, to note their impermanence, and to refrain from evaluating them. Another important difference is that traditional cognitive-behavioral procedures usually have a clear goal, such as to change a behavior or thinking pattern. In contrast, mindfulness meditation is practiced with a seemingly paradoxical attitude of nonstriving. That is, although a task is prescribed (e.g., sit still, close your eyes, and pay attention), no specific goal is adopted. Participants are not to strive to relax, reduce their pain, or change their thoughts or emotions, although they may have sought treatment for these purposes. They are simply to observe whatever is happening in each moment without judging it. Finally, mindfulness researchers have suggested that effective teaching of mindfulness skills by mental health professionals requires that they engage in their own regular mindfulness

practice (Segal et al., 2002). Professionals using more traditional cognitive-behavioral strategies generally are not expected to engage in regular practice of the skills they are teaching.

Although the practice of mindfulness generally involves acceptance of current reality, rather than systematic attempts to change reality, individuals who practice these skills may experience reductions in a variety of symptoms. The empirical literature addressing this issue is reviewed next.

EMPIRICAL RESEARCH ON MINDFULNESS-BASED INTERVENTIONS

The empirical literature investigating the effects of mindfulness-based interventions is reviewed here. Meta-analytic procedures were incorporated to facilitate quantification of findings and comparisons across studies. To locate relevant studies, a computer search (using PsycInfo and Medline databases) was conducted of articles and chapters including the terms *mindfulness* or *meditation*. Reference lists of all articles were searched for additional articles. Studies were included if they were published in English and compared a group of participants trained in mindfulness with a group not trained, or a group who provided data before and after mindfulness training. Unpublished dissertations and conference papers were excluded, as were studies addressing nonmindfulness forms of meditation, such as transcendental meditation (TM). Studies of mindfulness as defined by Langer (1989, 1997) also were excluded, for reasons described earlier. Twenty-one studies meeting these criteria were found.

For each study, several demographic and methodological variables were coded, including number, type, and characteristics of participants, research design, the nature of the mindfulness intervention, type of comparison group, whether participants were randomly assigned to intervention or comparison groups, the dependent variables reported, and follow-up intervals and data.

Effect sizes (Cohen's d) were calculated for all studies that provided sufficient data. Cohen's d expresses effect size in standard deviation units; thus, an effect size of 1.0 on a given dependent measure indicates that the treatment group scored one standard deviation better, on average, than the comparison group on that measure. For studies using between-groups designs, effect sizes were calculated with the following formula: $d = (M_t - M_c) / SD_p$, in which M_t = the mean of the treatment group on a specific mea-

sure, M_c = the mean of the comparison group on that measure, and SD_p = the pooled standard deviation of the two groups. If means or standard deviations were not provided, effect sizes were calculated from the significance level (p). For studies using within-groups designs, effect sizes were calculated from t or F (1 df), or from the significance level when t or F were not reported. Calculations of effect sizes relied on methods described by Rosenthal (1984).

Overview of Treatment Literature

Studies examining the effects of mindfulness-based interventions are summarized in Table 1. The studies are grouped by participant population, beginning with studies of chronic pain patients. Next are studies of patients with other Axis I disorders (anxiety, eating, and major depressive disorders), followed by studies of patients with other medical problems (fibromyalgia, psoriasis, and cancer). Next are studies with mixed populations, including psychotherapy and medical patients. The last group includes studies of nonclinical populations (students and other volunteers). Within each group studies are listed in order of publication date.

Sample sizes in these studies have ranged from 16 to 142. Mean age of participants has ranged from 38–50 years, with a mean of 45 years. Gender ratio of the samples has ranged from 0 to 46% male. Education and race/ethnicity were rarely reported.

Nine studies used pre-post designs with no control group. Nine used between-groups designs with Treatment As Usual (TAU) or waiting-list control groups. Most studies used the 8–10 week MBSR group intervention (Kabat-Zinn, 1982, 1990), or a variation of this intervention tailored to the population under study. Two studies (Teasdale et al., 2000; Williams, Teasdale, Segal, & Soulsby, 2000) examined MBCT. Dependent variables have included a variety of self-report measures of pain, other medical symptoms, anxiety, depression, eating behaviors, and general psychological functioning, as well as objective measures such as analysis of urine chemistry.

For each study effect sizes were calculated separately for each dependent measure completed at the conclusion of treatment and at all reported follow-up intervals. Post-treatment effect sizes then were averaged across dependent measures within studies, yielding a single posttreatment effect size for each study. Similarly, effect sizes for all dependent measures completed at all follow-up intervals were averaged, yielding a single follow-up effect size for each

Table 1. Empirical studies of effects of mindfulness-based interventions

Study	N	Type Participant	Mean Age	% Male	Research Design	Treatment Group	Control Group	Rand Assn	% Att	Dependent Variables	d Post	d Foll (Months)
Kabat-Zinn (1982)	51	Chronic pain patients	46	35	Pre-post	MBSR	None	No	12	Pain Rtg Index Body Parts PA Interfere rtg MSCL	0.70	0.35 (2-7)
Kabat-Zinn et al. (1985) Part 1	90	Chronic pain patients ^a	44	33	Pre-post	MBSR	None	No	15	POMS total SCL-90-R GSI Same as above	0.36	0.51 (2-15)
Kabat-Zinn et al. (1985) Part 2	42	Chronic pain patients ^b	48	24	Between group	MBSR (n = 21)	TAU (n = 21)	No	—	Same as above	0.26	
Kabat-Zinn et al. (1987)	30-142	Chronic pain patients ^c	—	31	Series of follow-ups 2.5-48 months post-MBSR	MBSR	None	No	—	Pain Rtg Index Body Parts PA MSCL	—	0.53 (6-48)
Randolph et al. (1999)	78	Chronic pain patients	50	31	Pre-post	MBSR	None	No	—	SCL-90-R GSI Pain rtps BSI-GSI	0.15	0.08 (2-12)
Kabat-Zinn et al. (1992)	22	Anxiety patients	38	23	Pre-post	MBSR	None	No	8	POMS total Pain beliefs Hamilton Anx Hamilton Dep BDI; BAI; FSS	0.88	1.35 (3)
Miller et al. (1995)	18	Anxiety patients from Kabat-Zinn et al., 1992	—	—	3-year follow-up (patients from Kabat-Zinn et al., 1992)	MBSR	None	No	—	Mobility Inv Hamilton Anx Hamilton Dep BDI; BAI; FSS	—	1.10 (36)
Kristeller & Hallett (1999)	18	Binge eating disorder	46	0	Pre-post	Variant of MBSR	None	No	14	Mobility Inv Binge freq Binge Eat Sc BDI; BAI	1.65	—
Teasdale et al. (2000)	132	Remitted MDD after medic tx	44	24	Between group	MBCT (n = 63)	TAU (n = 69)	Yes	17	Eating rtps MDD relapse	0.60	—
Williams et al. (2000)	41	Remitted MDD after medic tx ^d	43	27	Between group	MBCT (n = 21)	TAU (n = 20)	Yes	—	Autobiog Memory test	0.71	—
Kaplan et al. (1993)	59	Fibro-myalgia patients	46	10	Pre-post	Variant of MBSR	None	No	23	VAS's pain, sleep, etc. MSCL SCL-90-R GSI Coping Strat Q Fibro Impact Q	— ^e	—

Goldenberg et al. (1994)	121	Fibro-myalgia patients	46	7	Between group	MBSR (n = 79)	Wait list (n = 18); declined MBSR (n = 24) TAU	No	9	Vas's pain, sleep, etc. Fibro Impact Q SCL-90-R GSI	0.42	—
Kabat-Zinn et al. (1998)	37	Psoriasis patients receiving light therapy	43	46	Between group	Mindfulness tapes during light tx	—	Yes	—	Days to clearing of psoriasis	0.63	—
Speca et al. (2000)	90	Cancer patients	51	19	Between group	Variant of MBSR	Wait list	Yes	13	POMS SOST	0.60	—
Carlson et al. (2000)	54	Cancer patients	51	19	6-month follow-up in Speca et al. (2000)	Variant of MBSR	None	No	—	POMS SOST	—	NS (6)
Kutz et al. (1985)	20	Long-term dynamic therapy clients	38	—	Pre-post	MBSR	None	No	—	SCL-90-R POMS Interfere rtg Thera rfts SCL-90-R BAI MSCL	0.72	0.52 (6)
Roth & Creasor (1997)	86	Outpatients inner city Latino/Latina Mixed dx	43	16	Pre-post	MBSR	None	NO	40	SCL-90-R GSI	0.69	—
Reibel et al. (2001)	121	Medical patients, Mixed dx	47	29	Pre-post	MBSR	None	No	11	Self-esteem SF-36 MSCL SCL-90-R GSI	0.56	NS (12)
Massion et al. (1995)	16	Healthy women	42	0	Between group	Regular mediators	Non-mediators	No	—	Melatonin metabolite in urine	0.98	—
Astin (1997)	19	College students	—	5	Between group	MBSR (n = 12)	Wait list (n = 7)	Yes	14	SCL-90-R GSI Control Inv INSPIRIT	1.51	—
Shapiro et al. (1998)	73	Premed and med students	—	44	Between group	MBSR	Wait list	Yes	3	SCL-90-R GSI SCL-90-R Dep STAI	0.50	—
Williams et al. (2001)	75	Community volunteers	43	28	Between group	MBSR	Wait list and info	Yes	15	Empathy rtg INSPIRIT DSI SCL-90-R GSI MSCL	0.67	0.67 (3)

Notes: rand asgn = random assignment; att = attrition from treatment group; post = posttreatment; foll = follow-up; MDD = major depressive disorder; medicn = medication; tx = treatment; dx = diagnosis; MBSR = Mindfulness-Based Stress Reduction; MBCT = Mindfulness-Based Cognitive Therapy; TAU = Treatment As Usual; rfg = rating; PA = problem assessment; MSCL = Medical Symptom Checklist; POMS = Profile of Mood States; SCL-90-R = Symptom Checklist-90 Revised; GSI = General Severity Index; Anx = anxiety; Dep = depression; BDI = Beck Depression Inventory; BAI = Beck Anxiety Inventory; FSS = Fear Survey Schedule; Inv = inventory; Autobiog = autobiographical; VAS = visual analog scale; Strat = strategies; O = questionnaire; fibro = fibromyalgia; SOSI = Symptoms of Stress Inventory; SF-36 = Short Form 36; INSPIRIT = Index of Core Spiritual Experiences; STAI = State-Trait Anxiety Inventory; DSI = Daily Stress Inventory; NS = no significant difference between posttest and follow-up.

^aIncludes 51 patients from Kabat-Zinn (1982).

^bIncludes 21 patients from Part 1 of this study.

^cIncludes patients from Kabat-Zinn (1982) and Kabat-Zinn et al. (1985).

^dSubset of patients in Teasdale et al. (2000).

^eInsufficient data to calculate.

^fSubset of patients in Speca et al. (2000).

study that reported follow-up data. Mean posttreatment and follow-up effect sizes are presented in the final two columns of Table 1.

No studies of DBT, ACT, or RP were included, because none were found that examined the mindfulness component independently of the behavior change strategies also included in these treatment approaches. Thus, although empirical studies support the efficacy of these treatments (Curry, Marlatt, Gordon, & Baer, 1988; Ito, Donovan, & Hall, 1988; Koons et al., 2001; Linehan, Armstrong, Suarez, Allmon, & Heard, 1991; Linehan, Heard, & Armstrong, 1993; Linehan, Tutek, Heard, & Armstrong, 1994; Strosahl, Hayes, Bergan, & Romano, 1998; Zettle & Raines, 1989), the relative contribution of mindfulness training to these treatment effects has not been investigated. In contrast, studies of MBCT were included, because mindfulness training appears to be the central focus of this approach, although some cognitive techniques have been incorporated.

General Findings

Chronic Pain. Four studies have examined the effects of MBSR on patients with chronic pain. The first study (Kabat-Zinn, 1982) describes pre-post data for 51 patients. The second study (Kabat-Zinn, Lipworth, & Burney, 1985), has two parts. Part 1 presents pre-post data for a sample of 90 patients, including the 51 patients from Kabat-Zinn (1982). In Part 2, 21 of these 90 patients are compared to 21 other pain patients who had received TAU in the pain clinic but had not participated in MBSR. Parts 1 and 2 of this study are entered separately in Table 1. The third study (Kabat-Zinn, Lipworth, Burney, & Sellers, 1987) is an extensive series of follow-up evaluations of chronic pain patients who had completed MBSR over the preceding several years, including patients in the previous two studies. Thus, the first four entries in Table 1 are derived from three published articles with overlapping participant samples. Finally, Randolph, Caldera, Tacone, and Greak (1999) investigated the effects of MBSR in an independent sample of 78 chronic pain patients.

In general, findings for chronic pain patients show statistically significant improvements in ratings of pain, other medical symptoms, and general psychological symptoms. Many of these changes were maintained at follow-up evaluations. Most of these comparisons used pre-post designs with no control group.

Axis I Disorders. Kabat-Zinn et al. (1992) examined a sample of 22 patients with generalized anxiety and panic disorders, and found significant improvements in several measures of anxiety and depression, both at posttreatment and at 3-month follow-up. A no-treatment control group was not included. Miller, Fletcher, and Kabat-Zinn (1995) reported a 3-year follow-up of the same participants and found that treatment gains had been maintained.

Kristeller and Hallett (1999) examined the effects of MBSR on binge eating disorder. In a pre-post design with no control group, 18 female patients showed statistically significant improvements in several measures of eating and mood.

Teasdale et al. (2000) examined the effects of MBCT on rates of depressive relapse in a large sample of patients whose major depressive disorder (MDD) had remitted after treatment with medication. All participants had discontinued their medications at least 12 weeks before the study began. Patients were randomly assigned to either MBCT (8-week manualized group treatment) or TAU and then followed for 1 year. For patients with three or more previous depressive episodes, results showed much lower relapse rates for MBCT patients (37% of patients relapsed) than for the TAU group (66% of patients relapsed) during the 1-year follow-up period. However, relapse rates for the MBCT and TAU groups did not differ for patients with only one or two previous episodes.

Using a subset of the participants from Teasdale et al. (2000), J. M. G. Williams et al. (2000) found that those who had completed MBCT produced fewer general and more specific memories when asked to recall events from their pasts in response to cue words. The authors speculate that mindfulness training may modify the overgeneral autobiographical memory believed to be characteristic of individuals with depression (Kuyken & Brewin, 1995).

Other Medical Disorders. Two studies have investigated effects of MBSR on fibromyalgia. Both reported improvements in a variety of symptoms. In a study of psoriasis patients, Kabat-Zinn et al. (1998) found that patients who listened to mindfulness audiotapes during individual light-therapy sessions showed quicker clearing of their skin (*Mdn* = 65 days) than did patients who received light therapy alone (*Mdn* = 97 days). Specca, Carlson, Goodey, and Angen (2000) examined the effects of MBSR in a group of cancer patients and reported significant reductions in

mood disturbance and stress levels. Carlson, Ursuliak, Goodey, Angen, and Speca (2001) reported that these changes were maintained at 6-month follow-up.

Mixed Clinical Populations. Kutz et al. (1985) studied a sample of long-term psychodynamic therapy patients with diagnoses including anxiety and obsessive neuroses, and narcissistic and borderline personality disorders. They completed a 10-week MBSR program while continuing with their individual psychotherapy and showed statistically significant improvements in a variety of self- and therapist-rated symptoms. Roth and Creasor (1997) studied outpatients from a low-income, primarily Latino population attending an inner city health clinic and showed statistically significant improvements on several measures of medical and psychological functioning. Reibel, Greeson, Brainard, and Rosenzweig (2001) studied medical patients with a variety of medical and psychiatric diagnoses and found significant improvements in medical and psychological symptoms. None of these studies used control groups.

Nonclinical Populations. Massion, Teas, Hebert, Wertheimer, and Kabat-Zinn (1995) analyzed urine levels of a melatonin metabolite in two groups of women. Levels were significantly higher in women previously trained in MBSR who continued to meditate regularly than in women who had never been trained and did not meditate. The authors cite previous findings suggesting that melatonin level may be related to immune function (Bartsch et al., 1992; Guerrero & Reiter, 1992), and suggest that mindfulness meditation may influence health status through its effects on melatonin. Astin (1997) and Shapiro et al. (1998) studied student populations who completed group MBSR, reporting significant effects on psychological symptoms, empathy ratings, and spiritual experiences. Both of these studies used waiting-list control groups. Williams, Kolar, Reger, and Pearson (2001) studied community volunteers who completed MBSR to reduce their stress levels, reporting significant improvements in medical and psychological symptoms.

Mean Effect Size at Posttreatment

Posttreatment effect sizes ranged from 0.15 to 1.65. An overall mean of these effect sizes, collapsed across studies, was calculated. In order to include only independent mean

effect sizes in this calculation, the effect sizes obtained from Kabat-Zinn (1982) and Parts 1 and 2 of Kabat-Zinn et al. (1985) first were averaged, because these comparisons have overlapping participant samples. Similarly, the mean effect sizes obtained for Teasdale et al. (2000) and J. M. G. Williams et al. (2000) were averaged, because these two studies also have overlapping participant samples. After these preliminary calculations, 15 independent posttreatment mean effect sizes, each from a separate sample, were available for analysis. Their mean was 0.74 ($SD = 0.39$). When each of these 15 effect sizes was weighted by sample size, overall mean effect size was 0.59.

Mean Effect Size at Follow-Up

Follow-up data were reported less often. Effect sizes at follow-up ranged from 0.08 to 1.35. Before an overall mean of these effect sizes was calculated, mean effect sizes obtained from studies with overlapping participant samples were averaged. The overall mean of these independent follow-up effect sizes was 0.59 ($SD = 0.41$).

Cohen (1977) has described effect sizes of $d = 0.2$, $d = 0.5$, and $d = 0.8$ as small, medium, and large, respectively. Thus, on the average, the literature reviewed here suggests that mindfulness-based interventions have yielded at least medium-sized effects, with some effect sizes falling within the large range. Many of the effect sizes calculated for these studies are probably conservative, because several studies did not present means, standard deviations, or t values, making it necessary to calculate d from the p value. In many cases exact p values were not reported. Instead, for example, a p value between .01 and .05 might have been reported as .05, which was then used to compute d . Larger ps yield smaller ds . In addition, when findings were reported only as nonsignificant, effect sizes of zero were recorded. If means, SDs , or t values had been reported in these cases, the calculated effect size might have been larger than zero.

Relationships Between Mean Effect Size at Posttreatment and Study Characteristics

Relationships between mean effect sizes at posttreatment and selected methodological variables can be seen in Table 2. (Follow-up effect sizes are not included in this table.) The small number of studies available and the nonindependence of some of the effect sizes make statistical analyses of these differences impractical. Thus, these findings

Table 2. Mean effect size at posttreatment and methodological variables

Variable	<i>N</i>	Mean <i>d</i>	<i>SD</i>
Research design			
Pre-post	8	0.71	0.44
Between group	10	0.69	0.34
Random assignment (between group)			
Yes	7	0.75	0.34
No	3	0.55	0.38
Type of control group			
Wait list	5	0.74	0.44
TAU	4	0.55	0.20
Participant population			
Chronic pain	4	0.37	0.24
Other Axis I ^a	4	0.96	0.47
Medical ^b	4	0.55	0.09
Nonclinical ^c	4	0.92	0.44
Dependent measure			
Pain	17	0.31	0.30
Other medical (self-rated) ^d	11	0.44	0.26
Anxiety	8	0.70	0.41
Depression	5	0.86	0.30
Stress	2	0.63	0.02
Global psychological ^e	18	0.64	0.42
Objective medical ^f	2	0.80	0.25
Method of Calculating <i>d</i>			
Using <i>M</i> s and <i>SD</i> s, or <i>t</i>	10	0.87	0.40
Using <i>p</i>	8	0.48	0.22

^aIncludes anxiety, depression, and binge eating.

^bIncludes fibromyalgia, psoriasis, and cancer.

^cIncludes students and nonclinical volunteers.

^dIncludes fatigue and sleep ratings, and medical symptom checklist.

^eIncludes POMS total mood disturbance, SCL-90-R GSI.

^fIncludes urine and skin analysis.

should be interpreted cautiously, as differences may not be significant. Mean effect sizes were similar for studies using pre-post and between-groups designs. Mean effect size was somewhat larger when participants had been randomly assigned to groups. Studies using waiting-list control groups yielded slightly larger effect sizes than those using TAU. When organized by type of participant, mean effect sizes appear somewhat larger for comparisons using nonclinical populations or patients with selected Axis I problems than for those with chronic pain or medical problems. When organized by the type of dependent variable, mean effect sizes ranged from 0.31 for pain measures to 0.86 for measures of depression.

Finally, effect sizes derived from means and *SD*s or *t* values were somewhat larger, on average (0.87) than those derived from *p* values (0.48). This finding illustrates the importance of including means, standard deviations, and *t* values in future research. Given the small number of available studies, examination of interactions between method of calculating *d* and other methodological variables is not feasible. However, because none of the chronic pain stud-

ies reported means, *SD*s, or *t* values, effect sizes for these studies were calculated from *p* values. It is possible that mean effect size for chronic pain patients might have been larger if these studies had provided additional data.

Clinical Significance of Findings

The clinical significance of the changes reported in these studies is difficult to assess. Several studies reported only raw scores on dependent measures, whereas others reported percentage change in scores or the statistical significance of the change in scores. In these cases the severity of participants' problems before treatment, or their proximity to the normal range of functioning afterwards, cannot readily be determined.

In order to assess the clinical significance of some of the findings reviewed here, reported raw scores for more frequently used dependent measures were converted to T-score equivalents or ranges of functioning, with use of the instruments' published manuals or profile sheets. For example, several studies reported pre- and posttreatment raw scores for the Global Severity Index (GSI) of the Symptom Checklist 90-Revised (SCL-90-R) (Derogatis, 1983). These scores were converted to T scores (T-score equivalents for males and females were averaged) and then averaged across studies. This procedure yielded a mean pretest T score for the GSI of 67, with a mean posttest T score of 60. Because T scores have a mean of 50 and a *SD* of 10, this finding suggests that patients scored nearly 2 *SD*s above the mean before treatment and 1 *SD* above the mean after treatment. Several studies using the GSI could not be included in this procedure because they did not report scores, instead reporting only percentage decrease in scores, or the statistical significance of the change in scores.

Similar procedures were followed for the Beck Depression Inventory (BDI) and the Beck Anxiety Inventory (BAI) with use of ranges of functioning described in the manuals (Beck & Steer, 1987, 1993). On the BDI raw scores of 0-9 are considered asymptomatic, whereas scores of 10-18 indicate mild to moderate depression. For two studies reporting BDI scores, the mean pretreatment score was 16.82 (mild-moderate), and the mean posttreatment score was 8.64 (asymptomatic). For two studies reporting BAI scores, the mean pretreatment score was 20.43 (moderate) and the mean posttreatment score was 7.94 (minimal to mild).

These indications of clinical significance must be considered tentative, because they are based on very few stud-

ies, some of which used uncontrolled pre-post designs. However, they suggest that mindfulness training, on average, may bring participants with mild to moderate psychological distress into or close to the normal range.

Attrition, Adherence, and Maintenance of Mindfulness Practice

Thirteen studies reported both the number of individuals who agreed to participate in mindfulness training and the number who completed it. Program completion usually was defined as attendance at a minimum number of sessions, or was undefined. Percentage of enrolled participants who completed treatment ranged from 60 to 97, with a mean of 85% ($SD = 8.91$). The lowest completion rate (60%) was noted by Roth & Creasor (1997), who studied an inner city health clinic population. The highest completion rate (97%) was reported by Shapiro et al. (1998), whose participants were premedical and medical students.

The most extensive analysis of program completion was provided by Kabat-Zinn and Chapman-Waldrop (1988), who reported completion rates for the MBSR program (at that time known as the Stress Reduction and Relaxation Program) at the University of Massachusetts Medical Center. (This study is not included in Table 1, because it did not examine treatment effects.) During the 2-year period examined (1982–1984), 1,155 patients were referred to the program, mostly by their physicians. Of these patients, 75% completed an intake interview, and 90% of those interviewed enrolled in the program. Of the 784 patients who enrolled, 76% completed the program, whereas 15% dropped out after beginning and 9% never attended a session. Regression analyses showed that patients with stress-related problems (hypertension, anxiety, sleep disorders, etc.) were significantly more likely to complete the program than those with chronic pain complaints (lower back, headache, etc.). Completers also had somewhat higher pretreatment scores than noncompleters on the GSI and the Obsessive-Compulsive (OC) scales of the SCL-90-R. Within the chronic pain group, women were slightly more likely than men to complete the program.

Only three studies reported the extent to which participants completed their assigned home practice during the course of the mindfulness intervention. Kristeller and Hallett (1999), in a sample of women with binge eating disorder, noted that participants reported engaging in a mean of 15.82 hr of meditation ($SD = 3.15$) across the 6-week intervention program. Reported practice time was significantly correlated with improvements in Binge Eating Scale

scores ($r = .66$) and in BDI scores ($r = .59$). Astin (1997), in a sample of college students, reported that participants practiced meditation for an average of 30 min per day, 3.5 days per week. Reported practice time and improvement on the GSI of the SCL-90-R were not significantly correlated. Reibel et al. (2001) reported that 90% of their mixed sample of medical patients practiced three times per week or more and 57% practiced nearly every day, most for 15–30 min each time.

Four studies reported the extent to which participants trained in mindfulness skills continued to practice these skills after treatment had ended. In a series of follow-up studies of former MBSR patients, Kabat-Zinn et al. (1987) noted that 75% of former patients reported that they still practiced meditation (averaged across follow-up intervals of 6–48 months). Of these patients, 43% meditated regularly (\geq three times weekly, \geq 15 min each time), whereas 19% meditated sporadically (one or two times weekly, \geq 15 min each time, or \geq three times weekly, \leq 15 min each time), and 38% were classified as marginal meditators ($<$ one time weekly for any length of time, or $<$ three times weekly, $<$ 15 min each time). Practice of yoga two or more times per week was reported by 31% of respondents, and 49% reported using awareness of breathing in daily life *often*.

Kabat-Zinn et al. (1992), at 3-month follow-up of 22 patients with anxiety disorders, found that 84% reported practicing meditation or yoga three or more times per week, for 15–45 min each time. Mindfulness of breathing in daily life was practiced by 95% (77% *often* and 18% *sometimes*). Miller et al (1995) contacted 18 of these patients for a 3-year follow-up evaluation and reported that 10 (56%) still practiced meditation: 4 regularly, 3 sporadically, and 3 marginally (as defined above). Sixteen of 18 (89%) reported that they used awareness of breathing in daily life (4 *often*, 11 *sometimes*, and 1 *rarely*).

K. A. Williams et al. (2001), in a sample of community volunteers self-identified as “stressed out,” reported that at 3-month follow-up 81% of MBSR participants were practicing either meditation, yoga, or awareness of breathing in daily life.

Patients' Reactions to Treatment

In their follow-up study of former MBSR patients, Kabat-Zinn et al (1987) found that the majority of those who considered themselves improved since completing MBSR attributed 50–100% of their improvement to the MBSR

program. The majority gave ratings of 8–10 on a 10-point rating of the importance of completing the program (1 = *not at all important*; 10 = *very important*), and 86% reported that they “got something of lasting value” from the program. Most commonly reported changes included a “new outlook on life” and improved ability to control, understand, and cope with pain and stress.

Miller et al. (1995), in their 3-year follow-up of patients with anxiety disorders, asked participants to rate the importance of the MBSR program on a 1–10 scale (1 = *no importance*; 10 = *very important*). The majority gave ratings of 7 or higher, and 89% reported that the program had “lasting value” for them.

Astin (1997) asked undergraduate participants to rate the extent to which their mindfulness program had “lasting value and importance.” On a 10-point scale, participants gave a mean rating of 9.3. Randolph et al. (1999) reported that 98% of their patients with chronic pain reported benefits of “lasting value” and rated the program’s importance at 8.3 on a 10-point scale. Reibel et al. (2001) reported that their mixed sample of medical patients rated their satisfaction with MBSR at 4.90 on a 5-point scale.

Although these findings suggest that participants in mindfulness-based interventions rate these programs highly, they should be interpreted cautiously. They are derived only from participants who completed their treatment programs. Participants who dropped out might have given lower ratings. Kazdin (1994) notes that client satisfaction measures may not correlate with measures of dysfunction, and Brock, Green, Reich, and Evans (1996) suggest that participants who have invested substantial time and effort in a treatment program may be unwilling to evaluate it negatively. However, Kazdin (1994) also notes that client satisfaction is an important consideration when one is choosing among treatment alternatives, and these results suggest that many clients find mindfulness interventions beneficial.

Methodological Issues

As noted in Table 1, the published literature on the effects of mindfulness training reports changes in the therapeutic direction in several populations on a variety of dependent measures. However, many studies have significant methodological weaknesses that make it difficult to draw strong conclusions about the effects of mindfulness-based interventions. These issues are summarized below.

Control Groups. Several of the studies reviewed examined the effects of MBSR with pre-post design and no control group. Although most of these studies reported statistically significant improvements in a wide range of dependent variables, none controlled for passage of time, demand characteristics, or placebo effects, or compared MBSR to other treatments.

Several studies used between-groups designs with waiting-list or TAU control groups. The latter studies provide better controls for demand characteristics and placebo effects, and permit comparisons with alternative treatments. However, in the studies reviewed here, TAU consisted of medical approaches or unspecified mental health approaches. For example, in Kabat-Zinn et al. (1985, Part 2), TAU included medical approaches to chronic pain, such as nerve blocks, physical therapy, analgesics, and antidepressants. In Kabat-Zinn et al. (1998), TAU consisted of phototherapy for psoriasis. For Teasdale et al. (2000) and J. M. G. Williams et al. (2000), TAU included depression-related visits to a general practitioner, psychiatric treatment, counseling, psychotherapy, and other mental health contacts. Thus, these studies do not allow comparison of mindfulness training with other specific psychological approaches.

Sample Sizes. Some of the studies reviewed here report small sample sizes. According to Cohen (1977), an 80% chance of detecting a medium-to-large treatment effect ($d = 0.70$) with a two-tailed t test at $\alpha = .05$ requires 33 participants per sample. Future research should include sample sizes adequate to detect medium-to-large treatment effects.

Evaluation of Integrity of Treatment. Evaluation of the effects of any treatment requires that it be adequately administered (Kazdin, 1994). Integrity of treatment implementation can be enhanced through rigorous training and regular supervision of therapists, with procedures such as direct observation, review of audio- or videotapes of sessions, and feedback. The studies reviewed here do not describe the procedures used to train therapists or to evaluate their delivery of mindfulness treatment. Teasdale et al. (2000) report that MBCT sessions were video- or audio-taped to allow monitoring of treatment integrity, but analysis of these tapes is not described. In several studies therapists are described as “experienced,” but the term is

not well defined. Many of the studies reviewed here were conducted in the program developed by the originator of MBSR (Kabat-Zinn, 1982, 1990). Similarly, the MBCT groups in Teasdale et al. (2000) were led by the developers of the treatment. In these cases it seems likely that therapists conducted the treatment competently. However, because mindfulness-based interventions are relatively new and may be less familiar than more established cognitive-behavioral interventions, descriptions of the training and supervision of the therapists conducting the mindfulness treatment might increase confidence in the findings from future studies.

Clinical Significance. The clinical significance of the effects of an intervention can be evaluated in several ways (Jacobson & Revensdorf, 1988; Jacobson & Truax, 1991; Kazdin, 1994). For example, after patients have completed the experimental treatment, the extent to which they fall within the normal range on relevant dependent measures can be examined. Alternatively, their diagnostic status can be reevaluated to determine whether they continue to meet criteria for the disorder for which they sought treatment. The studies reviewed here do not explicitly address the clinical significance of their findings in either of these ways. Increased attention to the issue of clinical significance would contribute substantially to the utility of future studies.

CONCLUSION

In spite of significant methodological flaws, the current literature suggests that mindfulness-based interventions may help to alleviate a variety of mental health problems and improve psychological functioning. These studies also suggest that many patients who enroll in mindfulness-based programs will complete them, in spite of high demands for homework practice, and that a substantial subset will continue to practice mindfulness skills long after the treatment program has ended. Mindfulness-based interventions appear to be conceptually consistent with many other empirically supported treatment approaches and may provide a technology of acceptance to complement the technology of change exemplified by most cognitive-behavioral procedures (Linehan, 1993a).

Thus, it appears that methodologically sound studies of mindfulness-based interventions would be very informative. Randomized clinical trials are needed to clarify

whether observed effects are due to mindfulness training or to confounding factors such as placebo effects or passage of time (Chambless & Hollon, 1998). Outcome studies using waiting-list or no-treatment controls might shed more light on the effects of mindfulness training as a treatment package, but more rigorous tests would compare mindfulness-based interventions to established treatments. Dismantling studies of treatment packages that include both mindfulness and behavior change strategies, such as DBT, ACT, and RP, could clarify the relative contributions of acceptance-based and change-based strategies in these packages. Whether the effectiveness of established treatment programs may be increased by adding mindfulness training is also an important question. Additional research could investigate the effects of mindfulness practice on a broader range of outcomes, such as subjective well-being and quality of life, as well as symptom reduction. The mechanisms through which mindfulness training may create clinical change, such as exposure, relaxation, and cognitive change, also should be examined.

The Division 12 Task Force on Promotion and Dissemination of Psychological Procedures (1995) proposed definitions for well-established and probably efficacious treatments. Well-established treatments have been shown to be superior to a placebo or alternative treatment, or equivalent to an already established treatment, in group-design studies with adequate sample sizes and conducted by different investigators. Alternatively, they have demonstrated efficacy in a large series of single case designs that compare the intervention to another treatment. In all cases, well-established treatments have been investigated for specific disorders, with use of treatment manuals and well-specified samples.

Designation as “probably efficacious” requires two studies showing the treatment to be more effective than a waiting-list control group, or than another treatment (but conducted by the same investigator), or two studies demonstrating effectiveness in heterogeneous client samples.

Five studies of MBSR using group designs with random assignment are reviewed here (Astin, 1997; Kabat-Zinn et al., 1998; Shapiro et al., 1998; Speca et al., 2000; K. A. Williams et al., 2001). All show MBSR to be more effective than a waiting-list or TAU control group. Samples include students (two studies), psoriasis patients, cancer patients, and community volunteers complaining of high stress levels. Thus, MBSR may meet criteria for the “prob-

ably efficacious” designation in that it has been shown to be more effective than waiting-list or TAU control groups in several studies using heterogeneous samples.

MBCT may be approaching the “probably efficacious” designation for the prevention of depressive relapse. Teasdale et al. (2000) is among the strongest of the studies reviewed here. It shows MBCT to be superior to TAU in preventing relapse, using a treatment manual (Segal et al., 2002) and a large and clearly specified sample of formerly depressed patients. Additional studies conducted by independent investigators confirming this finding, or showing MBCT to be equivalent or superior to another treatment in preventing depressive relapse, would qualify MBCT for the “well established” designation.

Two issues may complicate the empirical validation of mindfulness-based interventions. The empirical evaluation of any intervention requires clear operational definitions of concepts and procedures, and the identification of conceptually sound mechanisms that may account for changes produced by the intervention. The preceding discussion illustrates that mindfulness-based interventions can be rigorously operationalized, conceptualized, and empirically evaluated. However, to do so risks overlooking important elements of the long tradition from which mindfulness meditation originates. As described by Kabat-Zinn (2000), the practice of mindfulness meditation is concerned with the cultivation of awareness, insight, wisdom, and compassion, concepts that may be appreciated and valued by many people yet difficult to evaluate empirically. Thus, although methodologically rigorous investigations of the effects of MBSR are both possible and necessary, perhaps researchers should consider ways to incorporate these other concepts, in addition to more readily measured constructs such as symptom reduction.

In addition, unlike many empirically supported treatments, MBSR was not developed to treat any specific disorder. Although the initial publications examined its effects in chronic pain patients, it is generally taught in groups of people with a wide range of complaints. As the term *stress reduction* implies, it is designed to reduce suffering and improve health and well-being, and to be broadly applicable to many problems. Thus, evaluation of its effectiveness with specific disorders, although necessary for empirical validation, may not be entirely consistent with current methods of application in many settings. When studies are conducted with mixed populations, thorough diagnostic

assessment of participants would help clarify effects on specific conditions.

Although the empirical literature supporting its efficacy is small, MBSR programs are widely available. Scheel (2000) and Swenson (2000) have described a similar proliferation of DBT programs, of which mindfulness training is an important component. Given the potential benefits and increasing popularity of mindfulness training, it seems critically important to conduct methodologically sound empirical evaluations of the effects of mindfulness interventions for a range of problems, both in comparison to other well-established interventions and as a component of treatment packages.

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