HHS Public Access

Author manuscript

Am Psychol. Author manuscript; available in PMC 2018 March 15.

Published in final edited form as:

Am Psychol. 2015 October ; 70(7): 593–620. doi:10.1037/a0039589.

Prospects for a Clinical Science of Mindfulness-Based Intervention

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Abstract

Mindfulness-based interventions are at a pivotal point in their future development. Spurred on by an ever-increasing number of studies and breadth of clinical application, the value of such approaches may appear self-evident. We contend, however, that the public health impact of mindfulness-based interventions can be enhanced significantly by situating this work in a broader framework of clinical psychological science. Utilizing the National Institute of Health stage model (Onken, Carroll, Shoham, Cuthbert, & Riddle, 2014), we map the evidence base for mindfulness-based cognitive therapy and mindfulness-based stress reduction as exemplars of mindfulness-based interventions. From this perspective, we suggest that important gaps in the current evidence base become apparent and, furthermore, that generating more of the same types of studies without addressing such gaps will limit the relevance and reach of these interventions. We offer a set of 7 recommendations that promote an integrated approach to core research questions, enhanced methodological quality of individual studies, and increased logical links among stages of clinical translation in order to increase the potential of MBIs to impact positively the mental health needs of individuals and communities.

Keywords

mindfulness; psychotherapy; mindfulness-based stress reduction; mindfulness-based cognitive therapy

The science and practice of mindfulness-based intervention (MBI) stands at a crossroads. It has witnessed exponential growth and interest in the last 15 years, with the establishment of research and clinical centers dedicated to the study and delivery of MBIs and an attendant proliferation of academic journals, magazines, and books. Given this context of expansion, we invite a pause in the forward movement to reflect on the durability and public health impact of this work. Our view is that such reflection is best promoted by considering MBIs in the broader framework of clinical psychological science and the recently proposed National Institute of Health (NIH) stage model (Onken et al., 2014). The NIH stage model

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emerged from an interest in shaping the training of future generations of clinical scientists by providing a well-articulated view of the goals and process of clinical psychological science. Specifically, as presented by Onken and colleagues (2014), the stage model is anchored in a vision "intended to unify various aspects of clinical science toward the common goal of developing maximally potent and implementable interventions, while unveiling new avenues of science in which basic and applied goals are of equally high importance…to propel the field to fulfill the public health goal of producing implementable and effective treatment and prevention interventions" (p. 22). In this paper, we use this framework to map MBI research, identify gaps in our knowledge and methods, and underscore priority questions and dilemmas for the future. Doing so allows us to identify both strengths and early indications of fault lines in the foundation of this rapidly developing field.

We first describe the use of the NIH stage model as a map for organizing the MBI evidence base. Next, with the aim of increasing the public health impact of MBI science and practice, we apply the NIH stage model. We identify strengths of the evidence base and limitations, including stages that have been under or overemphasized and pathways between stages that are weak or underdeveloped. We also outline seven stage-based sets of recommendations for ways in which the science and practice of MBI can be advanced to increase public health impact. It is our hope that by providing a broad and integrative framework at this critical juncture, we can help chart a course that supports deliberate, intentional, effective, and coordinated work on MBIs.

Mapping the MBI Evidence Base

Articles were identified through searches of the PsycINFO and PubMed databases. Database records were queried using the search terms *MBCT* (i.e., mindfulness-based cognitive therapy), *MBSR* (i.e., mindfulness-based stress reduction), and *mindful** in the title or abstract fields for PubMed and in the title or subject fields for PsycINFO, and were limited to those conducted with human subjects and published between January 1, 1985 and December 31, 2013, in English, and in a peer-reviewed journal. Records for the total number of articles returned from each query were compiled and duplicates were removed, yielding 3,217 articles in the initial search. Research assistants reviewed the title and abstract of these records to confirm relevance to the topic based on the article title and abstract. Articles were included if they addressed MBCT or MBSR using case reports, open trials, controlled trials, or development of intervention fidelity measurement tools. Articles were excluded if they primarily examined topics such as trait or state mindfulness, trait or state mindfulness rating scales, basic research on mindfulness techniques without a clinical focus, and samples of experienced meditators. Interviews, personal essays or narratives, theoretical and review articles, and meta-analyses also were excluded. Final inclusion decisions were made the authors, resulting in a total of 309 articles (MBCT $n = 118$, MBSR $n = 191$). These were categorized by the authors for intervention type and target problem or population, and within each treatment model, by the appropriate stage based on Onken et al. (2014) using the descriptions that follow. See Tables 1 and 2 for the categorizations of the evidence base for MBCT and MBSR, respectively.

Specifically, we map at Stage 0 studies that use neuroscience and behavioral, cognitive, affective and social science methods to explicate the target of intervention and mechanisms of change. Two broad categories of basic research are relevant to clinical intervention. First, basic research studies can be conducted "upstream," or temporally preceding the other stages of research at any level of analysis that informs intervention development or modification. This work can offer a critical scientific foundation for why and how an intervention may be helpful for a particular problem or population. Second, basic research methods can be conducted in an integrated manner in tandem with intervention research by assessing intervention outcomes on levels that extend beyond mental health symptom report and by answering questions about how an intervention works and for whom.

The scope of "upstream" basic research on the problems targeted by MBIs is vast and beyond the scope of this review (e.g., studies identifying the pathophysiology of major depression or anxiety disorders, etc.). Thus our mapping focuses on the second category of basic research—that which is integrated with applied research at Stages I–V. These studies encompass varying degrees of methodological rigor; however, they share the common element of seeking to understand whether an MBI works beyond simply symptom report as well as how and for whom. Because this work integrates basic research paradigms as part of later stage intervention studies, it is mapped with an asterisk at the relevant later-stage study.

We include studies that examine multiple units of analysis to measure treatment outcome (e.g., measurement of neural circuits, physiology, performance on behavioral or cognitive tasks, etc.). For example, in a study testing MBSR with HIV-positive patients, Creswell, Myers, Cole, and Irwin (2009) examined the effects on biological markers of disease progression (e.g., CD4+ T lymphocytes); as this study integrates basic research methods to characterize precise biological outcomes within the context of a "Stage II" study, it is denoted with an asterisk in Table 2. We also include studies that test mediation or moderation of intervention outcomes (even if only limited to one unit of analysis such as self-report). For example, Arch and Ayers (2013) measured self-report of baseline clinical severity and examined the extent to which such information could identify which treatment worked better for which patients; as this study integrated a focus on treatment moderation in the context of a Stage II study, it is denoted in Table 2 with an asterisk.

Onken et al. (2014) define Stage 1 as "all activities related to the creation of a new intervention, or the modification, adaptation, or refinement of an existing intervention (Stage IA), as well as feasibility and pilot testing (Stage IB)" (p. 28). This stage also is defined to encompass a focus on the development of training, supervision, and fidelity promotion materials. Our mapping at this stage includes mainly feasibility and pilot testing studies including nonrandomized open-trial designs of an MBI, whether conducted in the research lab or community settings. Most of these studies focus on extending the MBI to a novel problem or population, although some also represent early phase work in extending an MBI to a new setting. Some of these studies may examine as well the relationship between intervention exposure and outcome (e.g., dosage effects).

As defined by Onken et al. (2014), "Stage II is consists of testing of promising behavioral interventions *in research settings, with research therapists/providers*…Stage III is similar to

Stage II research, except that instead of research providers and settings, it consists of testing in a community context while maintaining a high level of control necessary to establish internal validity" (page 29). We map at Stage II efficacy trials of promising MBIs conducted in research settings, and at Stage III efficacy trials conducted in community settings, using community providers. These studies place a premium on internal validity, and focus on testing efficacy and identifying mechanisms of change. We extend the NIH model by mapping separately at Stage II studies that use randomized designs that test *efficacy*, with comparisons often to treatment-as-usual (TAU) or waitlist control (WLC) conditions, and randomized designs that test *comparative or specific* efficacy, with comparisons to an active control or an established treatment. Although the distinction between active control and other comparison groups is relevant for Stages III–V, we have not mapped those separately due to the paucity of work at those stages. As more studies at these stages are conducted, it will be vital for future efforts to map the nature of the control and comparison conditions in finer granularity. Although Onken et al. (2014) allow for the inclusion of nonrandomized designs at Stage II, we view the methodological rigor of randomized controlled trials as of specific value for the future of research on MBI; thus, we map all nonrandomized designs at Stage I.

Stages IV and V cover effectiveness research and implementation and dissemination research, respectively. As defined by Onken et al. (2014), effectiveness research (Stage IV) places a premium on external validity, as researchers examine interventions as implemented by community providers under routine conditions "in the real world." Stage V places relatively less emphasis on the intervention itself and instead foregrounds the study of methods to increase the adoption, integration, scaling up, and sustainability of an intervention in everyday settings. An important contribution of the NIH model is defining these stages as integral components of the clinical science endeavor. The inclusion of these stages codifies an inherent value that "intervention development is incomplete until the intervention is maximally potent and implementable for the population for which it was developed" (Onken et al., 2014, p. 25).

The Clinical Application of Mindfulness and Current Evidence Base: A "Bird's Eye View"

MBSR originated in the work of Jon Kabat Zinn and colleagues in 1979 at the University of Massachusetts Medical Center (Kabat-Zinn, 1990). Nearly a decade later, Segal, Williams and Teasdale (2012) built upon this early foundation with the development of MBCT, extending and integrating the framework and practices of MBSR with cognitive-behavioral therapy. Both of these interventions are organized around the use of mindfulness meditation as a core intervention component, and engage such specific practices as sitting meditation, walking meditation, body scan meditation, yoga stretching, and a range of forms of daily informal practice (e.g., mindful eating). These practices are taught to support participants in developing mindfulness as skills or means to personal goals (e.g., prevention of depression or reduction of stress) and, to borrow from Lutz, Jha, Dunne, and Saron (2015), "a way of life." Each session is delivered using an eight-session, weekly structure featuring extended experiential practice and inquiry about practice. The essential role of daily formal and

informal mindfulness practices is emphasized throughout. The role of the instructor in these interventions is multilayered and comprises guiding practice (e.g., in person during classes and via audio recorded practice guides for participants to use between classes), embodying "mindfulness" using the broadest conceptualization of this term (J. M. G. Williams & Kabat-Zinn, 2011), and delivering intervention specific content (e.g., about stress or depression risk). Instructors are asked to teach from a foundation of their own personal mindfulness meditation practice.

Although other conceptually and clinically related interventions developed in parallel to MBSR and MBCT exist (e.g., acceptance and commitment therapy; Hayes, Strosahl, & Wilson, 1999; and dialectical behavior therapy; Linehan, 1993), MBSR and MBCT are distinguished by the predominant focus on mindfulness meditation practices, the 8-week course structure, active daily home practice of mindfulness meditation and the role and training requirements of the instructor. Moreover, since the first studies of MBCT and MBSR were published, multiple "next generation" MBI models have been developed. We focus, however, on MBCT and MBSR as the target interventions for this review because each has amassed a sufficient empirical record to enable mapping of this nature. In a final section, we offer reflections about "next generation" interventions and recent findings that reflect promising advancements in the field. As the field develops, we expect that updates to our mapping will be required for MBSR, MBCT, and next generation interventions.

Multiple meta-analytic studies including MBSR and MBCT trials have been published in recent years (Goyal et al., 2014; Hofmann, Sawyer, Witt, & Oh, 2010; Piet & Hougaard, 2011), with generally convergent findings. These meta-analyses have been focused largely on the question "do MBIs work?" And, although most have emphasized problems with the methodological quality of many individual studies, the overall consensus appears to be "yes." We concur with these interpretations, and building on this foundation, we think the field is ripe for considering the evidence base from the broader "bird's eye view" of the NIH stage model.

Figure 1 illustrates the core stages of the NIH model with the color saturation of each stage corresponding to the proportional amount of published research on MBCT and MBSR, considered together, at each given stage. The NIH stage model is proposed not as a fixed and linear set of steps to take in chronological order, but rather as a set of overlapping and mutually informing points along a continuum of research. Within this context, there are indications that some stages and the links between stages warrant greater attention. The greatest focus of activity in the MBI field has been dedicated to the development and exploration of applications of MBIs with novel populations and target problems. This pattern may be implicit in the early development of a field; however, it also represents a point of vulnerability. If the weight of clinical and scientific attention remains devoted to increasing the range of applications rather than the depth of the evidence base, public health impact may be limited. Or, put simply, with reference to Tables 1 and 2, it would be misguided to prioritize increasing the number of rows in each table, without emphasizing simultaneously the development and integration of studies across the columns. Here, we offer a set of seven recommendations for increasing the public health impact of this work.

Stage-based Recommendations to Increase the Public Health Impact of MBI Research

Recommendation 1. Attend to the Basics: Specify Intervention Targets and Populations

A close link between basic and intervention research exists in the foundation of clinical innovation and research on MBIs. For example, the first application of mindfulness meditation for the prevention of depression was rooted in basic research on the nature of depressive relapse. In such studies, formerly depressed patients were compared to healthy controls before and after a sad mood induction; formerly depressed patients showed greater increases in depressogenic thinking styles, suggesting that a history of depression was associated with increased access to depressive cognition in the context of mild sad mood (Teasdale, 1988). Moreover, studies suggested that such increased access prospectively predicted relapse risk (Segal et al., 2006). This work identified a potential target for intervention (i.e., ruminative emotion linked cognitive processes), a population for whom this target was relevant and identifiable (i.e., individuals with histories of recurrent depression), and a logical basis for the application of mindfulness meditation (i.e., to enable regulation of dysphoric mood states in ways that inhibited the activation of habitual, mood-linked mental content) (Teasdale, Segal, & Williams, 1995).

The rapid proliferation of new potential indications for MBIs risks neglecting the link between Stage 0 and subsequent stages. In an era in which specification of clear intervention targets and meditating processes of change is increasingly prioritized, failure to attend to the “basics” may undermine the potential public health impact of research on MBIs. A glance at the range of problems for which MBIs are being applied suggests possible vulnerability in this regard. For example, recent studies have extended MBCT to other populations and problems (e.g., bipolar disorder, psychosis) based on the evidence of care-gaps in the psychosocial treatment of these groups; however, they have less frequently identified the targets that mindfulness practice is intended to engage, nor have they identified the degree to which the interventions alter (or fail to alter) the target when they achieve their intended clinical effects. Although intervention studies suggest that MBCT has promise for such patients, the basic research necessary to support a rationale for “why” is often lacking (although, see final section for recent exceptions).

Moreover, our mapping indicates that only a small number of studies have explored candidate mediators or moderators of outcome; and of these, even fewer have tested mediation formally or incorporated recent methods that move the field closer to a personalized medicine framework in which patient characteristics determine treatment selection (e.g., DeRubeis et al., 2014). Exceptions include the work of Vøllestad, Sivertsen, and Nielsen (2011) who describe a well-conceived analysis in which mindfulness statistically mediated changes in anxiety symptoms following MBSR, but owing to the absence of temporal precedence for these changes did not demonstrate true mediation. Such efforts represent an advance beyond work that simply reports the magnitude of pre-post intervention change of a potential mediator. Arch and Ayers (2013) provide another instructive example, in which patients with anxiety disorders were randomized to MBSR or cognitive behavioral therapy, with results indicating the response to intervention depended in

part on baseline depressive symptom severity comorbidity and anxiety sensitivity. Similarly, studies of MBCT suggest that effects may be moderated by vulnerability factors, including more recurrent depressive episode histories (Ma & Teasdale, 2004; Teasdale et al., 2000) and residual depressive symptoms (Segal et al., 2010).

Underemphasizing links to basic research and precise specification of for whom and how a treatment works risks situating the study of MBI less as science and more as pseudoscience in which mindfulness is seen as a panacea for all problems. Absence of clear attention to both "boundary conditions" and "scientific plausibility" is often cited as hallmarks of pseudoscience (Lilienfeld, 2003). Future work on MBI will be strengthened by attending to these requirements—specifying both what mindfulness is *not* likely to help with, and, not only predicting that an MBI will produce clinical benefit, but also specifying plausible mechanisms by which such benefits are attained. Moreover, extensions of MBSR, MBCT, and other MBIs to new populations and conditions may require modifications and tailoring to address their salient pathogenic mechanisms; such work represents the heart of Stage 1 but requires close and iterative links to Stage 0 methods and concepts. Many basic research studies have investigated correlates of mindfulness meditation (see Lutz et al., 2015) and provide methods or proxy markers to consider for integration in applied trials. Studies identified with asterisks in Stages I–V provide examples of movement to such integration.

Recommendation 2. Don't Conflate Promise With Efficacy

In contrast to the relative paucity of Stage 0 studies, research efforts have saturated heavily Stage I. The non-randomized and, most often, uncontrolled studies, mapped here at Stage I, clearly support valid excitement about the use of MBI in clinical settings across a wide range of target populations and problems. This excitement, however, must be tempered, given the risk that the field will fail to advance if Stage I research is seen as a sufficient "green light" to proceed to broad dissemination and implementation of MBI, or if the field "stalls out" by simply amassing more studies at Stage I. Thus, the NIH stage model underscores the value of the full cycle of research stages, and notably does not specify a direct pathway from Stage I to Stages IV or V. Among problems targeted by MBCT, only work on depression and comorbid health and mental health conditions, and within MBSR studies, primarily work with patients with cancer, show incremental progression from Stage I to subsequent stages. The sheer quantity of promising uncontrolled studies cannot substitute for later stage studies; researchers, practitioners, and the public must be cautious not to conflate a lot of studies at Stage I with indications of efficacy or effectiveness.

Moreover, as the field focuses more on the incremental progression of MBI research from Stage I to V, it will be important to consider directly indications of both failure and harm. In fact, a "failed" individual trial in which the MBI does not outperform the comparator intervention may be a "success" when viewing the advancement of the field broadly. Such findings help to inform the "boundary conditions" necessary for scientific progress and strengthen the pathway between Stage I and Stage 0, in which failures in one context create fertile ground in the other. The field will be well served by frank acknowledgement of failure rather than obscuring such findings with multiple or ambiguous primary and secondary outcomes or falling victim to the "file drawer" problem in which failed trials simply are not

published. An instructive example is provided by Craigie, Rees, Marsh, and Nathan (2008) regarding the relatively poor performance of MBCT in an open trial when compared to benchmarks of cognitive behavioral therapy in other studies targeting generalized anxiety disorder. They highlight valuable questions that can be "sent back" to Stage 0 about potential maintaining factors in generalized anxiety disorder. In addition to addressing directly "failed" trials, it also will be important to consider potential harmful effects of MBI. With the exception of recent work by Britton and colleagues (2012), it is notable that few publications have reported data on adverse effects of MBI. This area will be important for future investigators to address directly, consistent with recommendations for psychotherapy interventions generally (e.g., Dimidjian & Hollon, 2010).

Recommendation 3. Engage the Thorny Question of Clinician Training

To be considered "complete," stage I work requires attention not only to questions of "promise" but also to the thorny questions of clinician training. These questions are of particular salience given the unique expectations for MBI instructors, which require a personal practice in mindfulness meditation in addition to professional training in the clinical approach. This element may challenge future implementation efforts and has received surprisingly little attention to date in the scientific literature. Operationalizing this requirement and developing scaffolding resources for instructors learning MBI are gaps that exist currently at Stage I. In fact, few studies have examined measures of instructor fidelity (R. S. Crane et al., 2013; Segal, Teasdale, Williams, & Gemar, 2002). The lack of attention to developing formal measures, methods, and standards for determining instructor quality may have its roots in core guiding principles about how MBI is best delivered. For example, in a cautionary note about overreliance on formal guidelines, Kabat-Zinn expressed, "It has always felt to me that MBSR is at its healthiest and best when the responsibility to ensure its integrity, quality, and standards of practice is being carried by each MBSR instructor him or herself…to keep it very real and close to our everyday experience held in awareness with kindness and discernment." It will be important for the field to grapple directly with tensions that may exist in the very foundation of the scientific study of MBI and that may be accentuated as research on these interventions expands from early Stage I work to larger, more distributed later stage studies.

Recommendation 4. It's Time to Get Specific About the Specific Effects of MBI

The main strength of Stage II research is the use of randomized designs and intervention controls that support inference about causality. As Tables 1 and 2 illustrate, such work has been conducted with a greater emphasis on randomized comparisons to WLC or TAU than to active controls. Such designs permit valid inference about whether the MBI produces an effect on the measured outcome but not about what, *specifically,* is driving the effect. MBIs are multimodal interventions. Although a frequent and automatic assumption is that mindfulness meditation is the "active ingredient," findings are equivocal.

Segal et al. (2010) compared MBCT to maintenance pharmacotherapy, the current standard of care for preventing depressive relapse, and a pill placebo condition. The lack of differences in relapse prevention between MBCT and maintenance pharmacotherapy among patients with residual depressive symptoms suggested that MBCT offers benefit on par with

pharmacological treatment, *and* the superiority of MBCT relative to the placebo control suggested that such benefits are *specific* to components of MBCT rather than factors common to clinical care that were also present in the placebo condition—a credible rationale, clear guidelines for action, expectancies for improvement, and a positive working alliance with a treatment provider. However, this comparison did not control for other relevant dimensions such as time with clinicians, group support, and completing home practices. Thus, the question remains: is the mindfulness meditation component specifically efficacious?

MBCT showed no significant benefit as compared to an educational control for caregivers of dementia patients, although both active treatments outperformed a respite only control (Oken et al., 2010). In contrast, MBCT demonstrated superiority to psychoeducational controls for treatment of refractory depressed patients (Chiesa, Mandelli, & Serretti, 2012), and specific benefits on some outcomes as compared to a relaxation control for patients with tinnitus (Philippot, Nef, Clauw, de Romree, & Segal, 2012).

Studies of MBSR provide similarly complex findings, reporting failure to outperform an active control on primary outcomes but often mixed results on secondary outcomes. Studies of MBSR among patients with chronic pain have reported no significant differences on subjective reports, such as pain intensity, distress, quality of life, and mood, as compared to a multidisciplinary pain intervention (S. Y. S. Wong et al., 2011) or active control or waitlist (Schmidt et al., 2011). A comparison of MBSR and stress management education among patients with generalized anxiety disorder also found no evidence of superiority for MBSR on the primary outcome of anxiety symptom severity, but reported advantage on secondary anxiety outcomes (Hoge et al., 2013). Finally, among nonclinical participants, comparison between MBSR and an active control, the Health Enhancement Program, which was matched to MBSR in elements that were known to reduce stress but were not tied to the practice of mindfulness (e.g. group support, physical activity), indicated no significant benefit associated with MBSR on subjective reports of well being, some benefit on a behavioral pain task (MacCoon et al., 2012), and benefit on biological indices of stress provoked inflammatory response (Rosenkranz et al., 2013).

Interpretation of the mixed findings from studies using active control conditions is complicated even further by the fact that few active controls have been truly matched to MBSR or MBCT on all components except the mindfulness. For example, the degree to which participants in control conditions are provided with equivalent support for home practice is difficult to determine from many published reports; MBSR and MBCT protocols typically include written and audio guide support for daily home practice and it is not clear whether active controls match this element. Moreover, although some active controls carefully match the frequency and duration of sessions (e.g., Philippot et al., 2012), others are structurally different, involving shorter sessions (e.g., Y. W. Kim et al., 2009). Also, few studies have tested the degree to which instructors find the interventions they are delivering to be credible, thus introducing the possibility of allegiance effects contributing to differences in outcomes across groups. Even comprehensive active controls such as the Health Enhancement Program introduce different teachers for each module of the curriculum, unlike MBSR or MBCT in which the same teacher guides the group for the

entire eight sessions (MacCoon et al., 2012). The challenge of developing credible and structurally equivalent psychosocial protocols to control for common factors is not new to psychotherapy research, but it is an important task for the field in order to answer clearly the question of whether mindfulness meditation is an "active ingredient" of MBI. This recommendation is consistent with a recent meta-analysis of the clinical applications of meditation (Goyal et al., 2014), which reported small to moderate effects and little evidence of specific efficacy.

Testing the assumption that mindfulness meditation is specifically efficacious is necessary but not sufficient to advance the field. It is important also to understand more precisely about the importance of mindfulness meditation practice itself. Just how much meditation (if any) is required to achieve clinical benefit? The studies that touch upon this question are mapped currently at Stage I because they rely largely on post hoc analyses of the association between practice time or class attendance and change in symptoms or self-reported mindfulness skill. Findings are mixed, with some studies supporting an association between amount of practice and clinical outcomes (Beddoe & Murphy, 2004; Carmody & Baer, 2008; Collard, Avny, & Boniwell, 2008; del Re, Flückiger, Goldberg, & Hoyt, 2013; Farb, Segal, & Anderson, 2013; Cynthia R. Gross et al., 2004; Rosenzweig et al., 2010; Shapiro, Bootzin, Figueredo, Lopez, & Schwartz, 2003; Shapiro, Jazaieri, & Goldin, 2012), but not all (Carlson, Speca, Patel, & Goodey, 2004; Dobkin & Zhao, 2011; A. Hopkins & Proeve, 2013; MacCoon et al., 2012). The field requires Stage II randomized controlled trials that manipulate dosage or intervention duration as a primary aim. Similarly, basic research studies that examine the validity of methods of assessing practice time and quality are essential. Such findings will bear directly on subsequent stages of research. One can easily imagine patients, referring providers, and health plan administrators asking questions such as, "Can we deliver this in six sessions instead of eight?" or, "Does it really matter if I practice 10 minutes a day rather than 45 minutes?" Stage II studies are well poised to answer such questions.

Recommendation 5. Consider Skipping to but Not Over Stage III

Stage III has been underemphasized in studies of MBI (and clinical psychological science generally). As defined by Onken et al. (2014), a Stage III study is "a well-controlled, internally valid study in a community setting with community therapists/providers" (page 29). This stage of work has two primary functions in the domain of MBI. First, it is well suited for efficacy tests of the type of self-guided materials that are widely available, including workbooks and audio-guides, and is relevant for testing future applications of MBI using web-based or other technology-based delivery tools. Such interventions do not require clinician training materials because they target the patient directly; thus, it may be warranted, in some cases, for studies to proceed directly from Stage I to Stage III. In such cases, the recommendations regarding appropriate control conditions at Stage II are of particular importance at Stage III. Stage III studies of self-guided materials benefit from comparison to TAU to establish evidence of equivalent or superior benefit to standard of care in various healthcare domains. However, comparisons to active controls are critical to validate the specific efficacy of the mindfulness components over and above expectancies, contact time, and other potentially active ingredients. Although there were insufficient studies at Stage III to allow us to map them at this level of granularity, we think such

distinctions are critical for the future development of the field. Second, tests of efficacy of instructor delivered MBI in the community help to determine whether results from Stage II studies will "hold up" when the MBI is delivered in routine settings by community providers. Thus, researchers are cautioned against "skipping" this stage of work; it is crucial for informing which interventions justify movement to Stage IV.

Of the studies we reviewed, only two were identified that approached the criteria for Stage III. This classification is arguable given the pilot nature of the work and the hybrid use of community and research clinicians; however, both studies provide instructive examples of the ways in which an MBI can be delivered in an innovative manner directly to recipients in the community. N. J. Thompson et al. (2010) compared "distance delivery" of MBCT via telephone or internet for patients with epilepsy and depressive symptoms ($N = 40$), as compared to WLC, and the intervention was co-facilitated by a layperson with epilepsy and a master's of public health student. Similarly, (Niles et al., 2012) conducted a feasibility test ($N = 33$) of a mixed delivery format in which veterans with PTSD were randomized to either an MBSR intervention or a psychoeducation control, both of which included two in person and six telephone-based sessions.

Recommendation 6. Efficacy is Necessary but Not Sufficient for Effectiveness

Only two trials of MBCT and one of MBSR were published prior to 2014 that addressed questions of effectiveness, with two focused specifically on economic outcomes. Specifically, Kuyken et al. (2008) examined the effects of MBCT as compared to maintenance pharmacotherapy among patients treated in primary care, with results suggesting comparable relapse prevention and cost effectiveness as well as advantage to MBCT on indices of reducing residual depressive symptoms, psychiatric comorbidity, and quality of life. van Ravesteijn, Lucassen, Bor, van Weel, and Speckens (2013) examined the cost-effectiveness of MBCT compared with TAU among patients with persistent medically unexplained symptoms, with results indicating lower hospital costs and higher mental health care costs among patients receiving MBCT. Fjorback, Arendt, et al. (2013) also examined economic outcomes of MBSR as compared to care as usual for somatic symptom disorders, and significant benefits for MBSR were reported on disability pension outcomes.

Studies like these make good use of the "care as usual" control groups that can be a progress-limiting factor for earlier stage work. The frequent calls for more rigorous active control groups and caution about care-as-usual comparisons miss the public health relevance of such designs at Stage IV. Care-as-usual comparisons, particularly in the context of healthcare settings in which such care can be precisely described, allow us to determine whether MBI add incremental benefit to what is available. Such studies provide a necessary foundation for Stage IV and V work.

Recommendation 7. Beware of Developing Orphan Innovations, Falling Off the Implementation Cliff, and Getting Caught in "Implementation Limbo"

Only three studies, two of which are purely descriptive, addressed as a primary aim questions relevant to the dissemination or broad implementation of MBI. Specifically, R. S. Crane and Kuyken (2013) conducted a survey with participants in a workshop on

implementation of MBCT and an online national survey of MBCT teachers and stakeholders. Results described a range of barriers and facilitators to MBCT implementation, including structural, political, cultural, educational, emotional and physical or technological factors. Lab and colleagues (2012) examined preferences of employees from large healthcare organizations for MBCT targeting depression relapse prevention delivered by in-person group, online group, in-person individual, and telephone-based individual format. Finally, Patten and Meadows (2009) examined data were from the Canadian Community Health Survey to construct a simulation model that estimated population density required to support sustained delivery of in-person MBCT. Results suggested that implementation of such group-based in-person approaches may be challenging in small population centers.

The lack of attention to Stage V work is a serious gap in an effort to develop a clinical science of MBI. Current estimates suggest that, at best, only one in three people who struggle with mental health problems will receive “at least minimally adequate treatment” (Wang et al., 2005). There is a tremendous unmet need for care. If MBI approaches are to have a meaningful impact, they must overcome not only barriers to dissemination and implementation that are common to other approaches (e.g., service costs, waiting lists, and distance to access intervention), but also unique barriers due to instructor competencies.

Given its early stage of development as a field, researchers and practitioners of MBIs may benefit from lessons learned in the study of efforts to disseminate and implement other psychosocial interventions. Three cautions are particularly salient. First, based on their experience developing and disseminating a method of redistributing “edible but not sellable” fresh produce to low income populations, Evans and Clarke (2011) describe the problem of “orphan innovations,” in which effort is dedicated to the design and initial testing of an intervention but little care is allocated to the task of spreading the intervention to contexts of need. Second, Weisz, Ng, and Bearman (2014) refer to the “implementation cliff” to describe the “voltage drop” that often occurs as interventions move through the clinical science process. As interventions are “scaled up” for dissemination in community settings or are delivered in successive generations following the original intervention developer, outcomes suffer. Third, Weisz (2014) also describe the problem of “implementation limbo” in which resource constraints set the “bar” for training providers at ever lower levels: “If there is no evidence that 4 days of expert-led training, and subsequent individual clinician supervision, are required to maintain fidelity and benefit, then why not reduce cost with a 2-day training and group supervision and have local clinical staff conduct the training and supervision?” (p. 60).

Although it is too early to render definitive judgment on the clinical science of MBI, the saturation of studies at Stage I and Stage II using WLC or TAU controls, and the relative paucity of studies at later stages, highlights the risk of neglecting promising interventions as “orphans” early in the research process. Moreover, the relative lack of attention to studying methods of training instructors that can be broadly implemented may make MBI approaches vulnerable to both the implementation cliff and limbo. Fortunately, the emerging field of MBI also stands to learn from the successes of others. Recent discussions have focused, in particular, on the model of “disruptive innovation” in which new technologies may be integrated in the service of increasing reach and access of MBI. Recommendations within

general psychotherapy domains have included the examination of novel delivery formats such as self-management and self-help formats, brief or more parsimonious adaptations, technology and media driven delivery formats, and integration within broader healthcare packages (Kazdin & Blase, 2011; Rotheram-Borus, Swendeman, & Chorpita, 2012). Such avenues may represent great promise for the dissemination and implementation of MBI; however, they are likely also to raise complex questions that the field must tackle. As Simon and Ludman (2009) note in a discussion of disruptive innovation for cognitive behavioral treatments, “Traditional therapists might be horrified by the prospect of an overseas cognitive behavioural call centre or live-chat centre, available whenever patients choose. But the expectations of health-care providers are not the same as evidence. And the evidence that matters concerns clinical benefit and economic value to patients, rather than appeal or value to providers” (p. 595). It will be essential for clinical innovators and researchers to examine methods of delivery for MBI that will provide such evidence.

Indications of Promise

There are encouraging indications that the field is moving in the directions highlighted in this review. Although our comprehensive mapping was limited to studies published through 2013, the field is advancing rapidly, and an examination of notable studies published since 2014 indicates significant advances in three domains.

First, we find indicators that the field is becoming more programmatic in its approach by anchoring clinical intervention in basic research that specifies clear targets of intervention and by testing proposed mechanisms of change. This is evident, for example, in recent work on substance use disorders that represent novel “next generation” interventions combining elements of MBSR or MBCT, singly, or with other interventions in novel ways. Garland and colleagues (2014) tested both clinical outcomes and mediators of an MBI developed specifically for chronic pain and prescription opioid misuse (mindfulness-oriented recovery enhancement) in the context of a Stage II randomized clinical trial with an active control (supportive group therapy). It may be valuable to use the mapping approach undertaken here to chart the development of these next generation MBIs and the ways in which the structure and content of the interventions are modified to fit the nature of the target problem or population. Moreover, an increased recent emphasis on identifying mediators of change in MBI represents an important step in advancing research in an integrated and systematic manner (Gu, Strauss, Bond, & Cavanagh, 2015; van der Velden et al., 2015).

Second, more studies are incorporating active control conditions that can help to address questions of specific efficacy. J. M. G. Williams et al. (2014) compared MBCT to TAU and to a cognitive psychoeducation program developed to emphasize the didactic elements of relapse prevention without the experiential mindfulness practice. The results indicated no difference in relapse rates over a 1-year follow-up among the three groups—a finding that challenges the specific efficacy of the mindfulness meditation component of MBCT. A subgroup analysis of patients with histories of childhood trauma, however, indicated significant benefit for MBCT. It is possible that MBCT may show specific benefit for more vulnerable individuals, as was the case in the original studies that examined differences by number of prior episodes (Ma & Teasdale, 2004; Teasdale et al., 2000). Although caution

should be exercised in the interpretation of post hoc subgroup analyses, such findings may warrant “returning” to work at Stage 0 to help understand the nature of such vulnerabilities, including mechanisms that might be preferentially addressed through training in mindfulness meditation for such individuals.

Third, given that the stage model was developed to maximize public health impact of psychosocial treatments, it is encouraging that investigators are extending promising work at Stage I and II to examine questions of effectiveness, dissemination, and implementation. The work of Bowen et al. (2014) provides an excellent example of rigorous movement toward Stage III research in which the MBI developed for preventing relapse in substance abuse disorders (mindfulness-based relapse prevention) was tested in a randomized clinical trial with comparison to an active control (cognitive behavioral relapse prevention) and TAU. This study represented a hybrid of Stage II and III research because research clinicians delivered the 8-week intervention in community chemical dependency treatment facilities. Moreover, although TAU comparison groups have been highly heterogeneous in prior studies, this study represents an advance by implementing the study in the context of a specific healthcare setting that allowed, TAU to be clearly defined and measured. The use of comparison conditions that address questions of high relevance to healthcare consumers also signals an important advance. For example, the trial comparing MBCT (with support to discontinue antidepressant medication) to maintenance antidepressant medication (Kuyken et al., 2015) has the potential to address the questions that are at the forefront for many patients seeking care. Specifically, patients and providers want to know how does the MBI compare to other available options. Findings from Kuyken et al. (2015) indicate that relapse rates are statistically equivalent in MBCT and maintenance antidepressant medication, the current standard of care for recurrent depression. Finally, the potential for broad dissemination via web-based delivery also may help to accelerate the pace of Stage III–V research (Boettcher et al., 2014; Dimidjian et al., 2014).

Summary

The science and practice of MBI has reached an important point in its development. The last decade has witnessed an exponential rate of increase in the number of studies and the breadth of clinical problems and populations targeted. We contend that the public health impact of this work is likely to be enhanced by situating work on MBI in a broader framework of clinical psychological science. Doing so highlights important lessons and gaps in our current evidence base. Simply accumulating a greater number of the same types of studies without addressing such gaps is unlikely to advance the field. Although there are indications from recent studies that the field is moving in a positive direction, an integrated and systematic approach to core research questions, to the methodological quality of individual studies at each stage, and to increasing logical links between the stages, will enhance our ability to impact positively the mental health needs of individuals and communities.

Acknowledgments

Dimidjian and Segal receive royalties from Guilford Press for work related to Mindfulness-Based Cognitive Therapy and are on the advisory board of Mindful Noggins, which is part of NogginLabs, a private company specializing in customized web based learning.

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Biographies

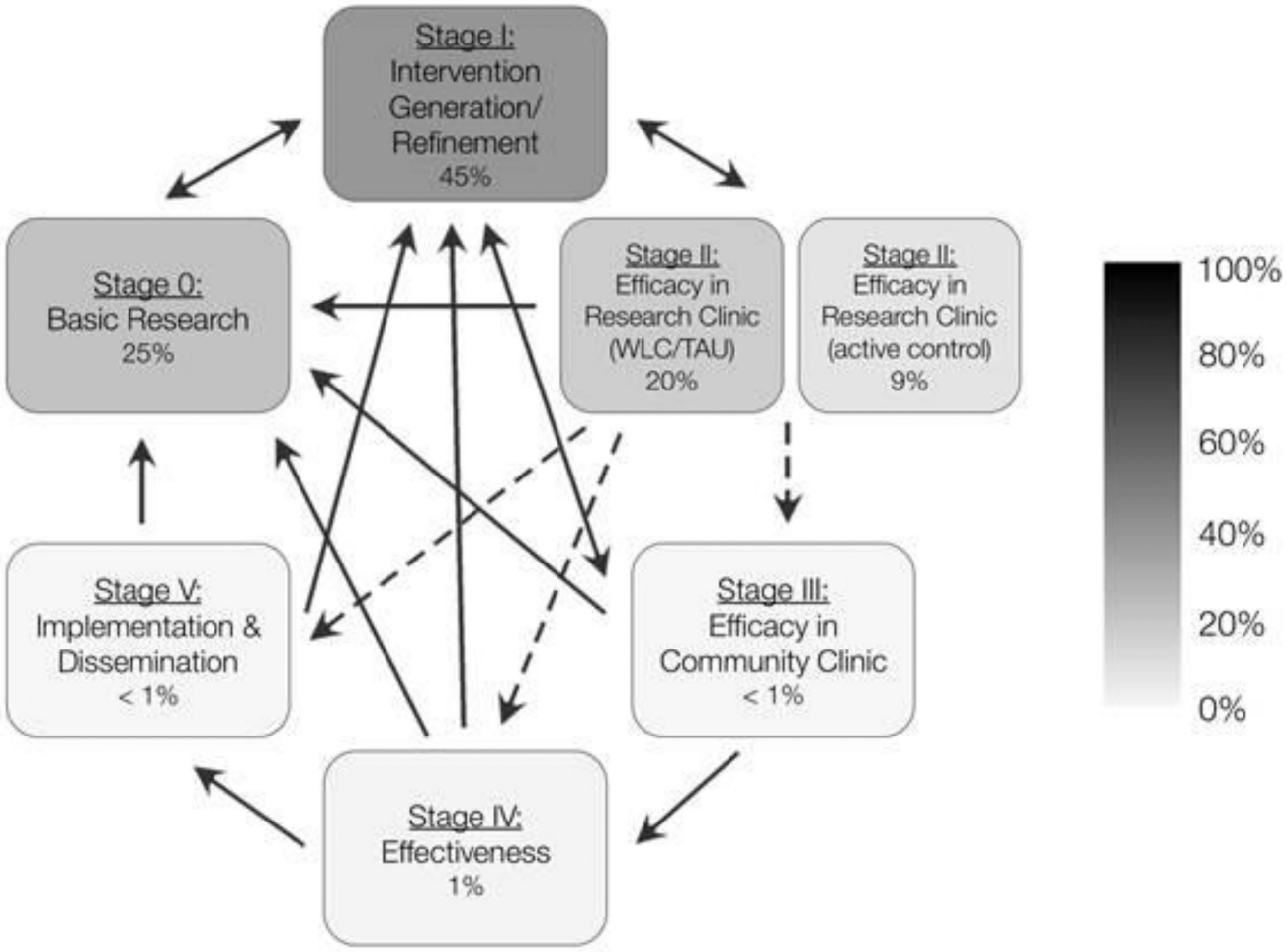

Figure 1.

Evidence base for MBIs (i.e., MBSR and MBCT) mapped according to the adapted NIH Stage Model. Recommended pathways between stages are represented with solid arrows; pathways that should be undertaken with caution are represented with dotted arrows. Color saturation represents the proportion of the total number of published studies of MBIs mapped at a given stage, with the specific percentage indicated at each stage.

Table 1

NIH Stage Model Classification of Mindfulness Based Cognitive Therapy Evidence Base

Stage 0: Basic (Studies that integrate basic research as part of later stage intervention studies are denoted at the relevant later stage with an asterisk).						
Target Problem or Population	**Stage I: Intervention Generation/ Refinement**	**Stage II: Efficacy in Research Clinic**		**Stage III: Efficacy in Community Clinic**	**Stage IV: Effectiveness**	**Stage V: Implementation and Dissemination**
		WLC or TAU control	**Active control**			
Anxiety	○ Cebolla i Martí 2009 ○ Craigie 2008 ○ Evans 2008 ○ Hertenstein 2012 ○ Kim 2009 ○ Kim 2010 ○ King 2013 ○ Lovas 2010	○ McManus 2012* ○ Williams 2011	○ Piet 2010	-	-	-
Bipolar	○ Deckersbach 2012 ○ Howells 2012* ○ Ives-Deliperi 2013* ○ Miklowitz 2009 ○ Perich 2013b ○ Stange 2011 ○ Weber 2010	○ Perich 2013a ○ Williams 2008	-	-	-	-
Borderline Personality Disorder	○ Huss 2007 ○ Sachse 2011	-	-	-	-	-
Care Givers	-	-	○ Oken 2010*	-	-	-

Stage 0: Basic
(Studies that integrate basic research as part of later stage intervention studies are denoted at the relevant later stage with an asterisk).

Target Problem or Population	Stage I: Intervention Generation/ Refinement	Stage II: Efficacy in Research Clinic		Stage III: Efficacy in Community Clinic	Stage IV: Effectiveness	Stage V: Implementation and Dissemination
		WLC or TAU control	Active control			
Child/Family	○ Bailie 2012 ○ Lee 2008	○ Semple 2010	-	-	-	-
Depression (Residual Depressive Symptoms, Acute, and Sub-clinical)	○ Eisendrath 2011 ○ Finucane 2006 ○ Kenny 2007 ○ Kingston 2007 ○ Munshi 2013 ○ Sharma 2013 ○ Williams 2006	○ Barnhorfer 2009 ○ Crane 2012* ○ Geschwind 2011 ○ Geschwind 2012 * ○ Collip 2013 ○ Hargus 2010* ○ Kaviani 2011 ○ Kaviani 2012 ○ Shahar 2010* ○ van Aalderen 2012* ○ van den Hurk 2012	○ Chiesa 2012 ○ Manicavasagar 2011	-	-	-
Depression (Relapse Prevention)	○ Allen 2009 ○ DeRaedt 2012* ○ Hopkins 2012 ○ Mason 2001 ○ Mathew 2010 ○ Michalak 2008* ○ Michalak 2011a* ○ Michalak 2011b* ○ Segal 2002	○ Barnhofer 2007* ○ Bondolfi 2010 ○ Bostanov 2012* ○ Crane 2008 ○ Crane 2010* ○ Gex-Fabry 2012* ○ Godfrin 2010 ○ Hepburn 2009* ○ Jermann 2013* ○ Keune 2011* ○ Ma 2004	○ Segal 2010 ○ Bieling 2012*	-	○ Kuyken 2008 ○ Kuyken 2010* ○ Lau 2012 ○ Patten 2009	○ Crane 2013a

Stage 0: Basic
(Studies that integrate basic research as part of later stage intervention studies are denoted at the relevant later stage with an asterisk).

Target Problem or Population	Stage I: Intervention Generation/ Refinement	Stage II: Efficacy in Research Clinic		Stage III: Efficacy in Community Clinic	Stage IV: Effectiveness	Stage V: Implementation and Dissemination
		WLC or TAU control	Active control			
	○ Worsfold 2013	○ Raes 2009* ○ Teasdale 2000 ○ Teasdale 2002* ○ Williams 2000*				
Disordered Eating	○ Baer 2005a ○ Baer 2005b	○ Alberts 2012	-	-	-	-
Elderly	○ Smith 2007 ○ Splevins 2009	-	-	-	-	-
Healthcare students	○ Collard 2008 ○ Hopkins 2013 ○ Rimes 2011 ○ Ruths 2013	-	-	-	-	-
Heterogeneous/Unspecified	○ Crane 2013b ○ Green 2012 ○ Heeren 2009* ○ Herdt 2012 ○ Langdon 2011 ○ Ree 2007 ○ Schroevers 2010 ○ Troy 2013*	-	-	-	-	-
Medical Comorbidity	○ Chambers 2012 ○ Fitzpatrick 2010	○ Brotto 2012* ○ Foley 2010 ○ Parra-Delgado 2013	○ Philippot 2012	○ Thompson 2010	○ van Ravesteijn 2013	-

Stage 0: Basic (Studies that integrate basic research as part of later stage intervention studies are denoted at the relevant later stage with an asterisk).						
Target Problem or Population	**Stage I: Intervention Generation/ Refinement**	**Stage II: Efficacy in Research Clinic**		**Stage III: Efficacy in Community Clinic**	**Stage IV: Effectiveness**	**Stage V: Implementation and Dissemination**
		WLC or TAU control	**Active control**			
	○ Griffiths 2009 ○ O'Haver 2004 ○ Sharplin 2010	○ Rimes 2013 ○ Skovbjerg 2012 ○ van der Lee 2012 ○ van Son 2013*				
Pregnancy	○ Dunn 2012	-	-	-	-	-
Problem Gambling	○ de Lisle 2011	-	-	-	-	-
Psychosis	-	○ Langer 2012	-	-	-	-
Sleep	○ Yook 2008	○ Britton 2010* ○ Britton 2012a* ○ Britton 2012b*	-	-	-	-

Table 2

NIH Stage Model Classification of Mindfulness Based Stress Reduction Evidence Base

Stage 0: Basic (Studies that integrate basic research as part of later stage intervention studies are denoted at the relevant later stage with an asterisk).						
Target Problem or Population	**Stage I: Intervention Generation/ Refinement**	**Stage II: Efficacy in Research Clinic**		**Stage III: Efficacy in Community Clinic**	**Stage IV: Effectiveness**	**Stage V: Implementation and Dissemination**
		WLC or TAU control	**Active control**			
Adolescents	○ Jastrowski 2013	○ Biegel 2009	○ Sibinga 2013*	-	-	-
Anxiety	○ Goldin 2009* ○ Goldin 2010* ○ Hazlett-Stevens 2012 ○ Miller 1995 ○ Patel 2007 ○ Rapgay 2011	○ Vøllestad* 2011	○ Arch 2013a* ○ Arch 2013b ○ Goldin 2012* ○ Goldin 2013* ○ Hoge 2013* ○ Jazaieri 2012 ○ Koszycki 2007	-	-	-
Arthritis	-	○ Pradhan 2007*	-	-	-	-
Asthma	-	-	○ Pbert 2012*	-	-	-
Cancer	○ Abercrombie 2007 ○ Altschuler 2012 ○ Birnie 2010a ○ Campbell 2012* ○ Carlson 2003* ○ Carlson 2004* ○ Carlson 2005* ○ Carlson 2007* ○ Degi 2013 ○ Dobkin 2008 ○ Garland 2007 ○ Garland 2013 ○ Hoffman 2012a	○ Andersen 2013 ○ Bränström 2013* ○ Hoffman 2012b ○ Labelle 2010* ○ Lengacher 2009 ○ Lengacher 2012a ○ Lengacher 2013* ○ Lerman 2012 ○ Würtzen 2013a	○ Henderson 2012	-	-	-

Stage 0: Basic (Studies that integrate basic research as part of later stage intervention studies are denoted at the relevant later stage with an asterisk).						
Target Problem or Population	**Stage I: Intervention Generation/ Refinement**	**Stage II: Efficacy in Research Clinic**		**Stage III: Efficacy in Community Clinic**	**Stage IV: Effectiveness**	**Stage V: Implementation and Dissemination**
		WLC or TAU control	**Active control**			
	○ Kieviet-Stijnen 2008 ○ Kvillemo 2011 ○ Lengacher 2011 ○ Lengacher 2012b* ○ Mackenzie 2007 ○ Matchim 2011* ○ Matousek 2011* ○ Saxe 2001* ○ Shapiro 2003 ○ Tacón 2004 ○ Tacón 2011 ○ Tsang 2012 ○ Weitz 2012 ○ Witek-Janusek 2008* ○ Würtzen 2013b*					
Care Givers	○ Epstein-Lubow 2011 ○ Minor 2006	-	○ Whitebird 2013	-	-	-
Chronic Pain	○ Rosenzweig 2010	-	○ Esmer 2010 ○ Plews-Ogan 2005 ○ Wong 2011	-	-	-
Depression History	○ Ramel 2004	-	-	-	-	-
Diabetes	○ Rosenzweig 2007*	○ Hartmann 2012*	-	-	-	-
Disordered Eating	○ Kearney 2012a ○ Smith 2006	-	-	-	-	-

Stage 0: Basic
(Studies that integrate basic research as part of later stage intervention studies are denoted at the relevant later stage with an asterisk).

Target Problem or Population	Stage I: Intervention Generation/ Refinement	Stage II: Efficacy in Research Clinic		Stage III: Efficacy in Community Clinic	Stage IV: Effectiveness	Stage V: Implementation and Dissemination
		WLC or TAU control	Active control			
Fibromyalgia	○ Grossman 2007 ○ Kaplan 1993 ○ Lush 2009* ○ Weissbecker 2002	○ Sephton 2007	○ Schmidt 2011	-	-	-
Healthcare Clinicians or Students	○ Barbosa 2013 ○ Bazarko 2013 ○ Beddoe 2004 ○ Bergen-Cico 2013 ○ Brady 2012 ○ Cohen-Katz 2005a ○ Cohen-Katz 2005b ○ Geary 2011* ○ Martín-Asuero 2010 ○ Rosenzweig 2003 ○ Shapiro 1998 ○ Shapiro 2007 ○ Shapiro 2012 ○ Young 2001	○ Shapiro 2005	○ Shapiro 2008*	-	-	-
Healthy Individuals	○ Naranjo 2012*	○ Anderson 2007* ○ Keng 2012* ○ Kilpatrick 2011* ○ Klatt 2009* ○ Nyklíček 2013b*	○ Jensen 2012*	-	-	-
Heart Disease	○ Tacón 2003	○ Robert-McComb 2004*	○ Palta 2012 *	-	-	-
Heterogeneous or Unspecified	○ Baer 2012	○ Farb 2013*	○ MacCoon 2012*	-	-	-

Stage 0: Basic (Studies that integrate basic research as part of later stage intervention studies are denoted at the relevant later stage with an asterisk).						
Target Problem or Population	**Stage I: Intervention Generation/ Refinement**	**Stage II: Efficacy in Research Clinic**		**Stage III: Efficacy in Community Clinic**	**Stage IV: Effectiveness**	**Stage V: Implementation and Dissemination**
		WLC or TAU control	**Active control**			
	○ Birnie 2010b ○ Carmody 2008a ○ Carmody 2008b ○ Carmody 2009a ○ Carmody 2009b* ○ Chang 2004 ○ Cordon 2009* ○ del Re 2013 ○ Deyo 2009 ○ Dobkin 2011 ○ Evans 2011 ○ Fang 2010* ○ Flugel 2010 ○ Frisvold 2012 ○ Greeson 2011* ○ Hawtin 2011 ○ Hölzel 2011* ○ Imel 2008* ○ Jha 2007* ○ Kerr 2011 ○ Kerrigan 2011 ○ Melloni 2013* ○ Morone 2012 ○ Reibel 2001 ○ Roth 1997a ○ Roth 1997b ○ Roth 2002 ○ Roth 2004	○ Nyklíček 2008* ○ Robins 2012 ○ Shapiro 2011* ○ Simpson 2011	○ Oman 2008 ○ Rosenkranz 2013* ○ Smith 2008			

Stage 0: Basic
(Studies that integrate basic research as part of later stage intervention studies are denoted at the relevant later stage with an asterisk).

Target Problem or Population	Stage I: Intervention Generation/ Refinement	Stage II: Efficacy in Research Clinic		Stage III: Efficacy in Community Clinic	Stage IV: Effectiveness	Stage V: Implementation and Dissemination
		WLC or TAU control	Active control			
	○ Salmoirago-Blotcher 2013 ○ Thompson 2009 ○ Weiss 2005					
HIV	○ Jam 2010* ○ Robinson 2003* ○ Sibinga 2008 ○ Sibinga 2011	○ Duncan 2012 ○ Gayner 2012	○ Creswell 2009* ○ SeyedAlinaghi 2012*	-	-	-
Hot Flashes	○ Carmody 2006	○ Carmody 2011	-	-	-	-
IBS	○ Kearney 2011	○ Zernicke 2013	○ Garland 2012*			
Insomnia	-	-	○ Gross 2011*	-	-	-
Intimate Partner Violence / Abuse	○ Bermudez 2013 ○ Dutton 2013 ○ Kimbrough 2010	-	-	-	-	-
Older Adults	○ Ernst 2008 ○ Gallegos 2013a* ○ Szanton 2011 ○ Young 2010	○ Creswell 2012* ○ Gallegos 2013b* ○ Moynihan 2013*	-	-	-	-
Personality Disorder Symptoms	-	○ Nyklíček 2013a*	-	-	-	-
Pregnant Women	-	○ Vieten 2008	-	-	-	-
Prisoners	○ Samuelson 2007	-	-	-	-	-
Psoriasis	-	-	○ Kabat-Zinn 1998*	-	-	-

Stage 0: Basic
(Studies that integrate basic research as part of later stage intervention studies are denoted at the relevant later stage with an asterisk).

Target Problem or Population	Stage I: Intervention Generation/ Refinement	Stage II: Efficacy in Research Clinic		Stage III: Efficacy in Community Clinic	Stage IV: Effectiveness	Stage V: Implementation and Dissemination
		WLC or TAU control	Active control			
PTSD / trauma (among veterans)	-	○ Kearney 2012b ○ Kearney 2013	-	○ Niles 2012	-	-
Smoking	○ Davis 2007*	-	-	-	-	-
Somatization	-	-	○ Fjorback 2013a	-	○ Fjorback 2013b	-
Stress	○ Hölzel 2010* ○ Walach 2007	-	-	-	-	-
Stroke / TBI	○ Azulay 2013* ○ Bédard 2003 ○ Bédard 2005	○ Johansson 2012*	-	-	-	-
Substance Abuse	○ Carroll 2008 ○ Lange 2011 ○ Marcus 2003* ○ Vallejo 2009	-	-	-	-	-
Teachers	○ Gold 2010	-	-	-	-	-
Tinnitus	○ Gans 2013	-	-	-	-	-
Transplant	○ Gross 2004 ○ Kreitzer 2005	-	○ Gross 2010	-	-	-