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Biopsychosocial Training Programs for the Self-Management of Emotional Stress: A Systematic Review of Randomized Clinical Trials

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Samueli Institute Project Report

Biopsychosocial Training Programs for the Self-Management of Emotional Stress: A Systematic Review of Randomized Clinical Trials

PROJECT SYNOPSIS

Introduction

Multimodal biopsychosocial training programs incorporating complementary and integrative medicine (CIM) techniques have the potential to prevent and reduce stress-related symptoms. Although the inclusion of these therapies into conventional treatment programs has gained acceptance over the years, there are still challenges in their implementation; in particular, a significant shortcoming is the limited availability of evidence based information about the most effective programs. Samueli Institute has rigorously evaluated the scientific literature on multimodal, biopsychosocial training programs for the self-management of emotional stress in order to provide synthesized and clearly organized information to guide researchers, clinicians, and policy-makers as they develop new programs and assess the utility of existing ones.

Objectives

The objectives of this systematic review were to survey these programs across all populations, assess the quantity and quality of the research, and describe the results by type of program and strength of evidence for stress-related outcome measures in order to synthesize the evidence that exists and provide direction for researchers and clinicians, patients and policy for informing decisions toward implementation.

Methods

The authors searched the following databases from database inception through January 2013: PUBMED, EmBase, BIOSIS, CINAHL, the entire Cochrane library as well as the database of abstracts of reviews of effectiveness (DARE), PILOTS, PsycInfo, AMED, ERIC, DoD Biomedical Research, clinicaltrials.gov, NLM catalog, as well as NCCAM Grantee Publications Database. Grey literature was also searched by pearling reference lists and communicating with top experts in the field. 1) Randomized Clinical Studies presented in the English language involving human subjects were included if they (1) investigated self-care, multi-modal, training programs with at least one complementary integrative medicine modality (2) for reducing psychological or emotional stress (3) in healthy or clinical populations (4) that measured stress-related outcomes. Methodological quality was assessed using a modified Scottish Intercollegiate Guidelines Network (SIGN 50) checklist for RTCs. Subject matter experts participated in the synthesis and interpretation of the systematic review's results in order to draw conclusions about the programs that currently exist in the literature base captured.

Results

Over 12,000 articles were screened and 192 were included in the final analysis. Studies were categorized according to type of multi-modal program found in the literature and included cognitive-based, mindfulness-based, relaxation-based, yoga-based as well as 'other' modalities. Studies are groups five sections in this report based on the CIM modalities utilized in the intervention. Results detailed in these sections share the quality of the research available, the current programs captured for reducing emotional stress and the evidence to support the use of these programs.

Impact

The practical implications of this review's findings are that the effective programs have potential benefits in both healthy and clinical populations. They primarily involve self-management skills that empower individuals to gain control over stressors and can be used in any environment with minimal time needed. They offer cost-effective strategies to maintain an inner regulatory balance and combat the effects of stress. Since they are multimodal, they may have greater appeal than programs that offer a singular approach. When properly learned and practiced, there are very few to no adverse effects with these self-management skills. This synthesis provides a comprehensive overview of the types of programs that exist and where research needs to improve to understand the implications of such programs for practice. It is our hope that the results of this work can serve as a practical guide to program managers and clinicians and will ultimately lead to guidelines and recommendations for implementing these types of programs.

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Section 1: Biopsychosocial Training Programs for the Self-Management of Emotional Stress

Introduction

Public health significance of stress and stress disorders

Stress has become a major public health problem in the United States and around the world. The public routinely experiences what they consider to be unhealthy levels of emotional stress, with as many as 22% of Americans reporting extreme levels of stress.[1] Almost half of Americans report that their stress levels have increased in the past five years.[1] While the majority of people recognize that some stress is inevitable - even healthy – stress is also recognized as negatively impacting psychological health, emotional well-being, and overall quality of life. [2,3] Stress is associated with substance abuse, anxiety disorders, depression, suicidality, obesity, cardiovascular disease, chronic pain and a host of other physical and psychological problems[4]) It commonly leads to fatigue and sleep disturbances, and may lower efficiency at work and contribute to increased health care consumption.[4,5]

Current approaches for the treatment of emotional stress-related conditions

There is a substantial need for effective interventions to prevent stress and ameliorate psychological distress. Generally, primary care is the first, and often the only, place that patients suffering from stress seek care.[6-9] Historically, conventional treatments for stress-related conditions have included 'watchful waiting', various forms of individual and group psychotherapy, pharmacological interventions, exercise, nutrition and education about healthy eating choices, communications skills training, anger management training, and sleep hygiene training.[10,11] The effectiveness of many of these approaches is questionable, and varies depending on the level of psychological distress. 'Watchful waiting' along with advice or counsel from a primary care clinician can be recommended for mild cases of emotional stress, but patients frequently find this approach unhelpful and seek more active treatment.[12,13] For moderate-to-severe cases, pharmacologic treatments are often used.[14-16] However, many patients do not want to take psychotropic medications[17] and studies have found that up to 20% do not find it maximally effective.[12] A wide array of psychotherapy techniques have been used to treat emotional stress-related conditions, also with varying degrees of success, with cognitive behavioral therapy (CBT), in particular, showing some evidence of effectiveness.[18]

Interventions aimed at mitigating stress increasingly use complementary and integrative medicine

Over the last 20 years, there has been considerable research on interventions aimed at managing stress-related conditions.[19] Complementary and integrative medicine (CIM) approaches for treating emotional and psychological stress are being increasingly utilized[20]. Mind-body therapies, in particular, are becoming popular adjuncts to conventional interventions for management of such disorders.[21-23] In 2008, 19% of U.S. adults (more than 55 million people) reported using at least one mind-body therapy during the previous 12 months[22] and in 2012, deep-breathing exercises, meditation, yoga, tai chi and qi gong were among the most frequently used techniques. These therapies are based on the ***biopsychosocial model***, a perspective that acknowledges that biological, psychological (e.g., thoughts, emotions, and behaviors), and social factors all play a significant role in human functioning in the

context of wellness and illness. It is often used to describe the concept of the "mind–body connection"[24]. In 2008, 19.2% of U.S. adults (more than 55 million people) reported using at least one mind-body therapy during the previous 12 months.[22]

Desire for CIM self-management approaches

Individuals with emotional and psychological stress are willing to seek CIM modalities to treat their conditions.[13,25] According to the 2008 National Health Statistics Report, persons who choose CIM approaches, such as mind-body therapies, are generally seeking ways to improve their health and well-being or to relieve symptoms associated with chronic illnesses.[22] In addition, CIM users, who spend $33.9 billion a year out of pocket on CIM, want greater control over their own health.[22] Nearly two-thirds ($22.0 billion) of the total out-of-pocket costs that adults spent on CIM in 2007 were for purchases of CIM products, classes, and materials focused on *self-management* of health. This is compared with about one-third spent on visits to CIM practitioners ($11.9 billion)[26]. The increasing use of CIM is not just an American trend but is also a global phenomenon with increasing use reported in the United Kingdom,[27] Canada,[28] and Europe.[29]

The benefit of multi-modal, self-management programs

Multi-modal programs, which by definition incorporate more than one component or modality, have developed as an important model for managing stress-related disorders.[30] Compared to single modality interventions, multi-modal programs address more dimensions of the biopsychosocial paradigm, and have a broader appeal to an individual who may not be interested in or respond well to a particular modality. In group- and population-based applications, multi-modal treatments increase the diversity of modalities to choose from, increasing the chance that an individual patient will find a modality that works for them and achieve favorable outcomes.

A multi-modal biopsychosocial approach to the treatment of stress, used as a complement to conventional care, is by design more holistic than condition-specific treatments with single components. Another characteristic of multi-modal approaches to stress management, such as those that use mind-body modalities, is that they often empower individuals to actively participate in their own treatment and self-care. This active participation, known as self-management, enhances self-care and self-treatment skills that can increase cognitive functioning, physical fitness and psychological resilience.[31] More specifically, self-management is a broad concept including a range of behaviors individuals can apply to improve their quality of life and health. Studies have found that effective self-management can aid in reducing stress by increasing self-awareness, self-actualization, empathy, and adaptability [32,33]. Self-management is in alignment with person-centered care, enabling the individual to feel more in control of their health and facilitating communication with their healthcare providers[34,35]. Because these techniques are easily incorporated into individuals' daily routines, self-management skills may create a greater sense of accomplishment for both patients and healthcare providers[36].

Challenges associated with implementation

In spite of increasing acceptance of CIM practices, healthcare providers, educators, and administrators still struggle with planning, implementing, and evaluating health promotion programs based on these practices. Frequently cited reasons include challenges in CIM research, inadequate time and resources, and insufficient training.[37] Indeed, a recent poll indicated that 61% of healthcare providers discouraged

the use of CIM because they did not feel sufficiently knowledgeable to safely and effectively treat patients with these modalities.[38]

Multi-modal mind-body programs are beneficial in that they can become self-management practices once they are learned. However, the implementation of such programs may be hindered if there is insufficient published research to support their effectiveness since program managers require evidence in order to decide which programs to plan and execute. Unfortunately, establishing the evidence-base is a slow, retrospective process that can miss innovation and market forces - two powerful influences that shape how patients are treated and choose treatment in the United States. To date, there have been no systematic literature reviews conducted on multi-modal biopsychosocial training programs of CIM therapies that are designed as self-management practices to reduce emotional distress. The need for such evidence is vital.

Purpose

In order to define promising future directions for the utility of biopsychosocial programs for managing emotional stress, it is necessary to (1) identify effective interventions for the self-management of emotional stress, (2) describe what they are comprised of, and (3) synthesize the current research findings to assess for effectiveness. This information will guide researchers and clinicians, as well as policy makers, in their efforts to develop new and better treatments options and to expand the CIM evidence base. Therefore, the purpose of this systematic review is to survey the available literature on multi-modal biopsychosocial training programs used for the self-management of emotional stress, describe their components, and assess the quantity and quality of this literature base.

Methodology

Concepts and definitions

The authors used the following definitions to drive this review.

Multi-modal Programs with Self-care CIM Modalities

For purposes of this review, the authors define “multi-modal programs with self-care CIM modalities” as programs that (1) included at least one CIM modality in combination with at least one other self-care technique and (2) required an initial in-person training period in which skills were learned that could then be used independently by an individual without reliance on a trainer or therapist.[31] An example would be an intervention that includes exercise (self-care), nutrition (self-care), and relaxation techniques (self-care, CIM) to reduce stress. See Section 1, Figure 1 for search terms that encompassed “CIM modalities”.

Programs were classified by the authors as those that were either (1) well-established named programs, such as mindfulness-based stress reduction (MBSR) or autogenic training (AT) which met criteria for multi-modal self-care CIM modalities (e.g., relaxation, meditation, yoga, breathing) or; (2) unnamed programs in which modalities were grouped together to form an ad hoc program, (e.g., relaxation training plus guided imagery). Multi-modal programs that included cognitive-behavioral therapy (CBT)

with a CIM modality (e.g., deep breathing and relaxation exercises) were included in this review. The authors chose to include CBT because it requires minimal ongoing dependence on a practitioner and is often paired with CIM modalities and self-management skills.

Psychological or Emotional Stress Outcome

To encompass the construct of "psychological or emotional stress," studies were included that used outcome measures containing one of the following keywords: *stress, anxiety, post-traumatic stress disorder, coping, resilience, hardiness, burnout, distress*, or *relaxation*. Since all healthy and clinical populations experience varying degrees of stress, the authors elected not to exclude any population based on predefined criteria about their conditions or diagnoses. This was consistent with the authors' intent to generalize about the value of programs impacting the symptoms of stress. Thus, all populations, both healthy and clinical (e.g., those with specific conditions or diagnoses), were included as long as the report included a description of emotional stress as defined above.

Study Eligibility Criteria

Authors included articles if they met all of the following criteria: (1) human population; (2) multi-modal program with self-care CIM modalities (as defined above); (3) measured at least one relevant psychological or emotional stress outcome; and (4) any study design published in the English. Authors excluded articles if they met at least one of the following criteria: (1) non-human population; (2) intervention that is either (a) is fully reliant on a practitioner (e.g., acupuncture) and not self-care or (b) not initially taught by a practitioner (e.g., self-taught courses; online materials as the sole sort of training); (3) multi-modal program that either (a) includes a component that is not self-care or (b) is exclusively self-care but does not include at least one CIM practice; (4) no assessment of psychological or emotional stress; (5) compared one self-care CIM modality to another (e.g. meditation and imagery); or (6) published in non-English language.

Data Sources and Search Strategy

The following online databases were searched from their inception through January 2013: MEDLINE/PubMed, Embase, Biosciences Information Services (BIOSIS), Cumulative Index of Nursing and Allied Health Literature (CINAHL), Cochrane, Database of Abstracts of Reviews and Effectiveness (DARE), Published International Literature on Traumatic Stress (PILOTS), PsycInfo, Allied and Complementary Medicine Database (AMED), Education Resource Information Center (ERIC), Department of Defense (DoD) Biomedical Research, clinicaltrials.gov, National Library of Medicine (NLM) catalog, as well as National Center for Complementary and Alternative Medicine (NCCAM) Evidence-based Complementary and Alternative Medicine and Grantee Publications Database.

In additional to searching the aforementioned databases, the authors also searched the gray literature by (1) using identified keywords to search the internet as well as Google Scholar for relevant online dissertations and conference proceeding of meetings; (2) browsing relevant reference lists of identified

articles and related reviews and (3) communicating with experts in the field of stress and CIM to determine if there was any existing literature from our yielded references.

Authors explored MEDLINE Medical Subject Headings (MeSH) terminology and consulted with subject matter experts to build the most robust search (see ***Section 1, Figure 1*** for the PubMed search string). Variations of the search strategy for the remaining databases are available upon request from the primary author. All searches were limited to peer review published articles presented in the English language and involving human subjects. There were no systematic reviews that fit the inclusion criteria upon initial screen. While many types of study designs were captured in the initial search and screen, the authors only included RCT study designs in this analysis due to the breadth of available research.

Section 1, Figure 1. Search terms used according to MeSH strategy

(program OR programme OR training OR taught OR learn* OR skill*) AND (stress OR "Stress, Physiological" [Mesh] OR "Stress Disorders, Post-Traumatic" [Mesh] OR "Stress, Psychological" [Mesh] OR "Stress Disorders, Traumatic" [Mesh]) AND (psychosocial OR integrat* OR "alternative medicine" OR "complementary medicine" OR "alternative therapy" OR "complementary therapy" OR "complementary and alternative medicine" OR "complementary and alternative therapy" OR mind-body OR imagery OR mindfulness OR yoga OR yogic OR biofeedback OR "heart-rate variability" OR "virtual reality" OR breath* OR "cognitive restructuring" OR mantr* OR acupressure OR "body scan" OR "autogenic training" OR self-care OR self-awareness OR self-management OR Reiki OR massage OR "therapeutic touch" OR holistic OR wholistic OR prayer OR writing OR "movement therapy" OR "dance therapy" OR "narrative medicine" OR self-acupuncture OR qigong OR chi OR qi OR "spiritual healing" OR meditat* OR "mental training" OR self-hypnosis OR relax OR EMDR)

Study Selection

Using the predefined study eligibility criteria, nine investigators (CC, SK, RK, DW, SC, JB, LT, MO, AP), trained in systematic review methodology, independently screened titles and abstracts for relevance based on the review's inclusion criteria. All reviewers were fully trained in using a rulebook, which detailed both the screening and review methodology to ensure objectivity and consistency in screening among reviewers. At least two reviewers screened each citation independently. A Cohen's kappa for inter-rater agreement of 0.90 was maintained throughout the screening phase. Disagreements about studies were resolved through discussion and consensus.

All articles marked for inclusion during the initial screen progressed to the review phase, during which full-text articles were obtained and either confirmed as appropriate for inclusion or subsequently excluded based on the pre-defined inclusion criteria.

Data Extraction and Quality Assessment

Studies were grouped according to study design (i.e., RCT, observational study, other). For the purpose of this analysis, the authors only focused on RCT studies due to the vast amount of literature available. All included RCTs were assessed for methodological quality by eight reviewers (CC, RK, DW, SC, JB, LT,

MO, AP) using a modified version of the Scottish Intercollegiate Guidelines Network (SIGN) 50 Checklist for RCTs, a validated and reliable assessment tool widely used in the literature[39] (see **Appendix 1**). Reviewers reviewed an initial selection of articles in pairs until a sufficient kappa (> 90%) was achieved at the review phase, at which point, they reviewed the remaining articles and extracted data independently. All conflicts were resolved through discussion and consensus.

The following descriptive data was extracted during the review phase for all studies included in the review: population description, number enrolled, dropout rates, intervention and control descriptions, intervention dosage, relevant outcomes and results, as well as author's main conclusions.

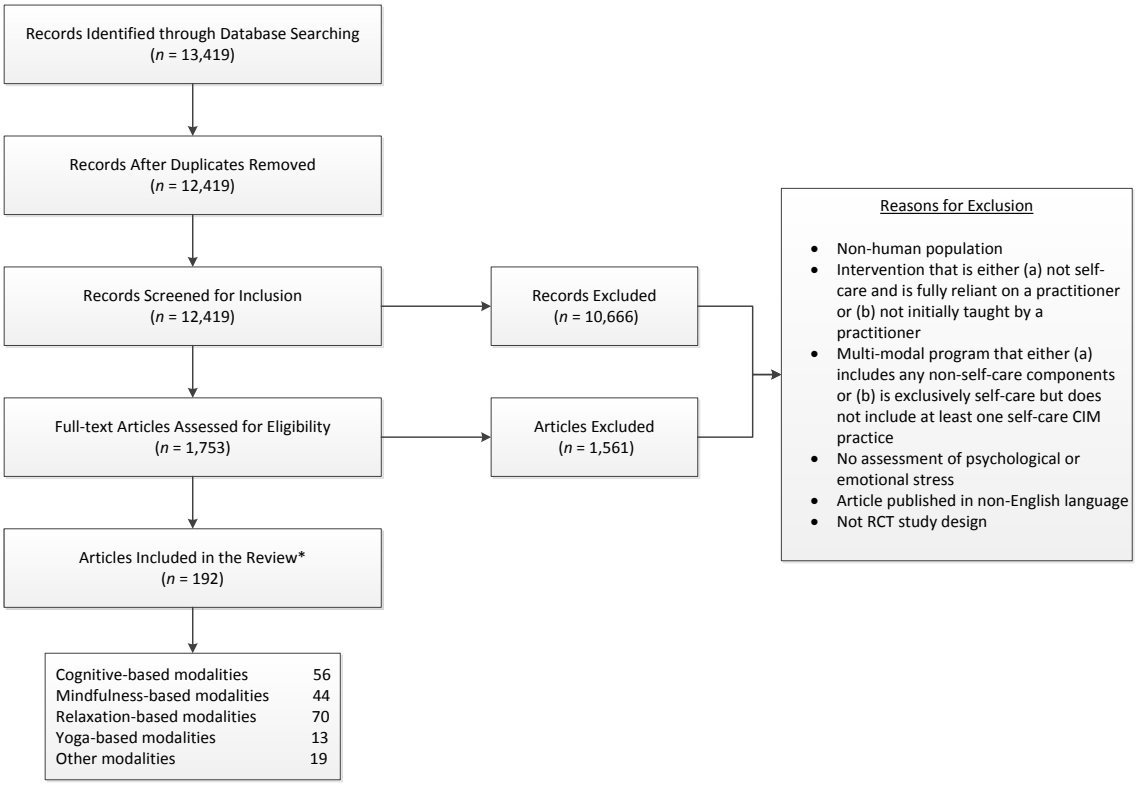
Data Synthesis and Interpretation: Expert Review Process

Subject matter experts convened to review the results from the systematic review and interpret the meaning of the data in order to generate meaningful conclusions from which clinicians, patients and policy makers could use to make practical decisions.

Results

The initial search yielded a total of 12,419 citations, of which 369 studies (i.e., RCTs, controlled clinical trials, observational studies, descriptive studies and mixed-methods study designs) were subsequently included. Of these, 192 RCTs were included in the final review. Because 14 RCTs reported on more than one multi-modal CIM program of interest, a total of 207 programs are described in this review (see ***Section 1, Figure 2*** for Flow Chart of Included Studies). While this systematic review included clinical controlled trials, observational studies, descriptive studies and mixed method study designs (see Figure 2), this current report only reports only on results of RCTs.

Section 1, Figure 2. Flow Chart of Included Studies



*Some articles reported on multiple programs of interest; programs are fully described in their respective chapters.
CIM = complementary and integrative medicine, RCT = randomized controlled trial

For the purposes of structuring this final report, the authors used a taxonomy to categorize programs based on their predominant CIM content. Study results are presented as (1) cognitive-based modalities (see Section 2); (2) mindfulness-based modalities (see Section 3); (3) relaxation-based modalities (see Section 4); (4) yoga-based modalities (see Section 5) and (5) other modalities (see Section 6). Interventions that included meditation *other* than mindfulness-based meditation are included in the relaxation-based modalities section (under the category "relaxation multi-modal"). Unnamed programs (or those that did not have a clear, predominant CIM component) were categorized as: *unnamed programs with CBT* (i.e., intervention was not a previously named multi-modal intervention that incorporated CBT, Section 2); *imagery-based relaxation* (i.e., any relaxation-based program that included guided imagery, Section 4); or *relaxation multi-modal* (i.e. relaxation-based programs with components other than guided imagery, such as progressive muscle relaxation and meditation, Section 4). Articles with more than one intervention of interest are described in all relevant sections (e.g. Warber, 2011[40] which contains modified MBSR and imagery-based relaxation components, is described in both the mindfulness-based and relaxation-based sections).

Appendix 2 details the specific programs found in the literature according to the review's analysis, the number of those reporting statistically significant results for self-management of psychological or emotional stress, and the overall methodological quality assigned using the SIGN 50 criteria for each of the categories of studies collected and assessed.

The remaining sections of this final report detail the full results of the systematic review, describe the characteristics and components of the programs, provide an assessment of the quality of the RCTs, report on the outcomes of emotional stress used, and describe their results.

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Section 2: Cognitive-based modalities for the self-management of emotional stress

Introduction

Cognitive-based modalities focus on the interactive relationship between how one feels, thinks and behaves. The goal of a cognitive-based approach is to change destructive thinking patterns and emotional responses of an individual to ameliorate unhealthy behaviors. These modalities employ psychotherapeutic approaches such as cognitive restructuring, behavioral activation and exposure therapy to address a range of dysfunctions in one's emotional, behavioral, or cognitive state. Cognitive-based modalities can help individuals to learn techniques to cope with anxiety and stress, manage emotions, symptoms of mental illness, overcome trauma, and cope with a medical illness or a chronic condition. Most CBT treatments are widely accepted to be effective treatments for a range of mood anxiety, and personality conditions [1-3].

In this cognitive-based modalities section, the authors have included Cognitive Behavioral Stress Management (CBSM), Stress Inoculation Training (SIT), Coping Skills Training (CST), Anxiety Management Training (AMT), unnamed programs involving CBT plus other self-care therapies, and the FRIENDS program. Programs were included if they were defined by the authors as using cognitive techniques. Many of these cognitive therapies are traditionally delivered in a therapist-based or group setting. With proper training, however, the techniques can eventually be learned for the self-management of emotional stress. This section focuses on evaluating the randomized controlled trials that examined the effectiveness of cognitive-based modalities in reducing emotional stress.

Methods

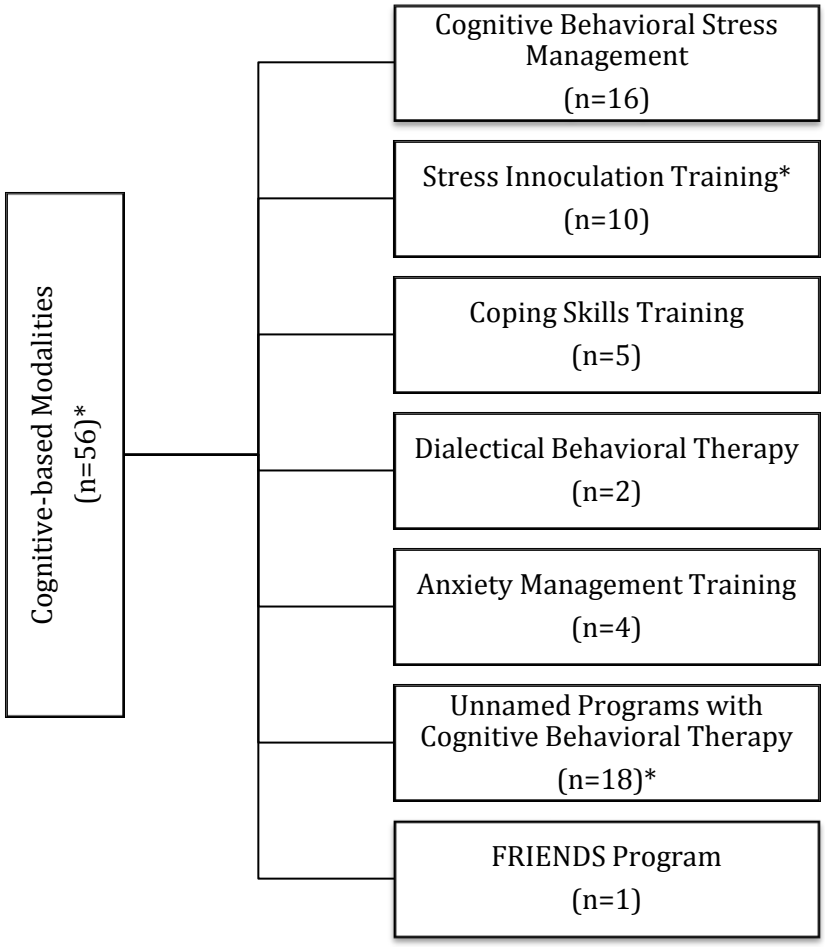
Please refer to Section 1 for a detailed description of the review's methodology.

Results

Study Selection

Of the 192 articles yielded from the database search, 55 randomized control trials (RCTs; see ***Section 2, Figure 1***) met the review's inclusion criteria and were subsequently categorized as cognitive-based modalities. Two[4,5] studies reported more than one intervention of interest. Iglesias et. al. (2012)[4] included both a SIT and an unnamed program involving CBT while Turner et al. (2011)[5] included two unnamed programs involving CBT. Therefore the authors report on 55 randomized controlled trials (RCTs) describing 57 interventions of interest in this section.

Section 2, Figure 1. Flow Chart of Cognitive-based Therapies



*Two articles (i.e., one[4] reporting on both SIT and an unnamed program involving CBT and another[5] reporting on two unnamed programs involving CBT reported on more than one intervention of interest and are subsequently duplicated across intervention categories. Therefore, the authors report on 56 RCTs describing 57 interventions of interest in this section.

Overall Quality Assessment

According to the SIGN 50 criteria used to assess methodological quality, there were four [6-9] high (++) quality studies (7%), 27[5,10-35] adequate (+) quality studies (49%) and 24[4,36-58] (44%) low (0) quality studies. The majority addressed an appropriate and clearly focused research question well and used reliable and valid outcome measures. Limitations were found in randomization procedures, dropout rates, and intention-to-treat analyses, indicating that these processes were either not fully described or successfully achieved. Of the seven [8,15,18,19,33,42,55] multi-site studies, only three [8,18,19] described site similarities adequately or well (see ***Section 2, Table 1***).

Section 2, Table 1. SIGN 50 Quality Assessment for Cognitive-based Modalities

SIGN 50 Criteria	Percentage (n = 55)		
	Well	Adequate	Poor
Appropriate and clearly focused research question	53% (29)	47% (26)	0% (0)
Randomization	20% (11)	18% (10)	62% (34)
Baseline similarities	42% (23)	9% (5)	49% (27)
Outcome reliability/validity	80% (44)	15% (8)	5% (3)
Percentage of dropouts	20% (11)	11% (6)	69% (38)
Intention-to-treat analysis	31% (17)	11% (6)	58% (32)
Multi-site similarities	2% (1)	4% (2)	7% (4)

Cognitive Behavioral Stress Management

CBSM is a skills training program originally developed for use in HIV-positive patients[59], but which has since been adapted and applied to a variety of conditions[60]. With a cognitively oriented theoretical perspective, the program emphasizes the effects of thoughts on emotions and behaviors[61]. The program teaches recovery skills, which are geared towards helping the patient identify irrational cognitions and altering them to effect useful changes in health outcomes. CBSM also teaches some symptom management skills specific to the medical diagnosis being treated, social skills, and general relaxation techniques[62] common to all versions of the program. Typically, the program is delivered in a group setting by mental health professionals. CBSM has been used to treat several health conditions including: HIV, Chronic Fatigue Syndrome, breast cancer, heart disease, diabetes, depression, and anxiety. It has also been used with healthy adult populations to reduce emotional stress and increase quality of life. There is some variability in program length (6-20 weekly sessions) and it is taught in 1-2 hour sessions with the majority of programs at 10-12 weeks.

CBSM Program Results

There were sixteen studies that utilized CBSM as a self-management technique for coping [7,13,31,37,47], emotional stress [6,15,25,39,40,51], distress [14,47], anxiety [12,24,25,37,44,47,59,62], and relaxation [13,37]. A complete description of studies is detailed in ***Appendix 3.***

Ten high (+/++) quality studies[6,7,11-15,24,25,31] compared CBSM to a range of control groups including standard of care[6,15], waitlist condition (WLC)[7,24,25,31], an education/ assessment only group[11-14], and spiritual growth training[7], Tai Chi[7] in HIV-positive individuals[7,15,31], seropositive and seronegative gay men[11], students[24,25], and ischemic heart disease patients[6]. Positive results were found for coping[7,13,31], relaxation[13], distress[14], stress[25] and psychological well-being[6]. Results regarding anxiety were mixed, with three studies[12,14,15] citing improvements in anxiety, and one[11] finding no such change. Doses ranged from 12 to 40 hours over one year. Adverse events were not mentioned or reported by the authors in any of the studies.

Six low (0) quality studies investigated the use of CBSM in healthy[37,40,44] and clinical populations, including those with HIV[39], chronic fatigue syndrome[51], and diabetes[47]. All studies reported that the CBSM intervention favorably impacted stress outcomes including emotional stress[37,39,51], anxiety[40,44,47],

coping[37,47], distress[47], and relaxation[37]. Doses ranged from two to 25 hours over 10 weeks. None of the studies provided information regarding adverse events

Stress Inoculation Training

SIT was developed by Donald Meichenbaum in 1977, and arose from an attempt to integrate cognitive and affective factors in coping processes with the emerging technology of cognitive behavior modification[63]. SIT is a flexible individually tailored multifaceted form of CBT. In order to enhance coping repertoires and to empower individuals to use already existing coping skills, an overlapping three phase intervention is employed: conceptualization phase, skills acquisition and rehearsal phase and application and follow through phase. SIT has been used to help individuals cope with the aftermath of stressful events and on a preventative basis to "inoculate" individuals to future and ongoing stressors. In SIT, the therapist helps the client become more aware of what things are reminders (also referred to as "cues") for fear and anxiety. The program teaches a variety of coping skills that are helpful to manage anxiety, such as deep breathing and relaxation. Individuals learn how to identify cues and triggers so they can utilize their newly learned coping to reduce anxiety. SIT can be delivered in individual or group settings. The sessions range from 20 to 60 minutes in 8 to 15 sessions weekly or biweekly over a three to 12 month period.

SIT Program Results

Ten of the 56 studies categorized as cognitive-based modalities used SIT for the management of a variety of stress related conditions such as post-traumatic stress disorder (PTSD)[28,34], anxiety[4,43,45,46,49,50], distress[42] and emotional stress[52]. See ***Appendix 3*** for a full description of studies.
Neither of the two adequate (+) quality studies determined that a SIT intervention was more effective than no treatment and narrative exposure therapy in treating PTSD symptoms in active duty sailors[34] and PTSD patients[28], respectively. Doses ranged from 1.3 hours to 15 hours over 13 weeks; no authors provided information regarding adverse events.

Eight low (0) quality studies compared the SIT to a variety of controls, including a skills training group[43], combination training group[43], group guidance sessions[49], hand-eye coordination exercises[52], WLC[4,42,45,50], attention-placebo group[50], applied relaxation[46], a relaxation response and guided imagery program[4], as well as an acceptance and commitment therapy group[42]. SIT was also found to reduce stress in both high school students[49] and gymnasts[52] as well as distress in above average distressed patients[42]. Further, although SIT was shown to reduce anxiety in undergraduate students[4], it did not reduce anxiety in students with learning disabilities[43], general anxiety[45] or test anxiety[50] as well as aviophobic patients[46]. Doses ranged from 3.5 hours to 20 hours over 10 weeks. No authors provided information regarding adverse events.

Coping Skills Training

CST includes progressive muscular relaxation according to the method proposed by Bernstein & Borkovec (1973)[64], thought-stopping, cognitive distractions such as reductive techniques on intrusive

thoughts, and instruction in gradual exposure in order for an individual to resume his/her habitual activities [36]. The goal of CST is to increase a sense of competence and mastery by retraining inappropriate or nonconstructive coping styles and forming more positive styles and patterns of behavior. CST may increase the ability to cope with the problems of everyday life. The program can teach problem-solving, social skills training, and cognitive behavior modification. The program may also include other relaxation techniques to control affective arousal, self-encouragement procedures and the use of mental imagery to practice coping responses to anxiety provoking stimuli. CST has been used to treat individuals with alcohol abuse and substance dependence, chronic pain, breast cancer, children with chronic health conditions and healthy populations wanting more efficient skills for stress management. The program is run in a group format and program lengths range from 5-12 weeks with 1-2 hour long sessions. Program content seems to vary depending upon the specific condition addressed.

CST Program Results

All five studies assessing the impact of CST on anxiety[21,23], stress[16] and coping[26,35] outcomes were adequate (+) quality. Studies compared CST to WLC[16,23], education[26,35], and usual care[21]. See ***Appendix 3*** for a full description of studies.

Mixed results were found regarding anxiety as one study reported significant improvement in Type II diabetic patients[21] while another reported no difference in anxiety levels of breast cancer patients[23]. Significant results, moreover, were not found for improving coping in Type I diabetic patients [26,35], stress in mother/child dyads [16] and distress in breast cancer patients[23]. CST dosage ranged from nine hours to 28 hours. None of the studies provided information on adverse events.

Dialectical Behavior Therapy

DBT is a cognitive behavioral treatment developed by Marsha Linehan in the late 1980s. This approach was originally used to treat suicidal individuals with borderline personality disorders (BPD). It has since evolved to combine behavioral problem-solving and acceptance based strategies emphasizing dialectical processes to treat individuals with multiple disorders[65]. DBT is structured as a four-part psychotherapy-based program that includes modules on mindfulness, distress, tolerance, emotion regulations, and interpersonal effectiveness[66]. The mindfulness section teaches skills, divided into "what" and "how" skills for increasing mindfulness and the distress tolerance and emotion regulation section include specific coping skills. The program emphasizes an acceptance and change paradigm in which the patient learns to nonjudgmentally identify maladaptive feelings and behaviors and acquires skills to manage them.

DBT Program Results

One[22] adequate (+) and one[55] low (0) quality study investigated the use of DBT for the management of stress related conditions such as PTSD[22] and coping[55] (see ***Appendix 3*** for a full description of studies).

The adequate (+) quality study[22] reported that 3.5 hours of DBT over 52 weeks did not decrease PTSD symptoms in patients with borderline personality disorders when compared to standard care group[22]. No information regarding adverse events was provided.
The low (0) quality study[55] showed improvement in coping following four hours of DBT over eight weeks when compared to a case-management control group. Authors did not mention or describe adverse events.

Anxiety Management Training

AMT is a conditioning procedure used to reduce anxiety reactions. It involves the arousal of anxiety and training the client to react to anxiety with relaxation or feelings of success. It is based on the theory that anxiety responses can be discriminative stimuli, and that clients can be conditioned to respond to these cues with responses that remove these stimuli through reciprocal inhibition[67]. It does not use anxiety hierarchies. It can also include general psychoeducation and relaxation techniques in the context of understanding physiological arousal. AMT has been used to treat people with physical disabilities and chronic pain, hypertension, severe mental illness, phobias, other stress related conditions and healthy populations. The program ranges in length from a few weeks to 8 weeks with variability between daily and weekly sessions.

AMT Program Results
Four low (0) quality studies compared the use of relaxation training and WLC[56], attention control[54,57], relaxation only and a placebo[48] to AMT for the management of stress related conditions in schizophrenic patients[56] as well as dental[54] and anxious[48,57] students. Studies are fully described in ***Appendix 3***.

AMT was found to reduce anxiety in schizophrenic patients[56] and students[48,57] as well as improve relaxation in dental students during a procedure[54]. Doses ranged from 4.5 to seven hours over six weeks. No information was provided regarding adverse events.

Unnamed Programs with CBT

In addition to CBT-based programs, this section also investigates the use of multi-modal programs that either included CBT or were based on CBT theory, but have not yet been established in the literature as a well-characterized or "named" multi-modal program. For purposes of this review, these studies are referred to as unnamed programs with CBT and include hybrid programs that combine CBT with one or more integrative modality such as AT[9], breathing re-training[4,5,8,30,53] and relaxation[4,5,9,10,17,19,20,27,29,32,33,36,38,41,53,58]. The outcomes of these hybrid programs might be significantly different than traditional CBT programs, such as CBSM or SIT, which use a methodology that is standardized, commonly accepted, and reproducible. Thus, the outcomes for these non-standardized programs are analyzed separately due to the variability in their program components and delivery.

Unnamed Program Results

Eighteen studies used CBT techniques for the self-management of a variety of conditions, such as coping[5,9,36], PTSD[8,33,41], anxiety[4,19,53,58], perceived stress[30], emotional stress[17,32], psychological distress[20], burnout[27], and stress[29,38]. Twelve of these studies were adequate-high (+/++) quality, with two[8,9] high (++) and 10 adequate (+) quality[5,10,17,19,20,27,29,30,32,33] studies; six studies[4,36,38,41,53,58] were considered to be low (0) quality. ***Appendix 3*** describes the studies in full.

The twelve high (+/++) quality studies compared the intervention group to a range of control groups, such as an educational group and mindfulness-based emotional regulation therapeutic program[9], treatment as usual[8,17,27], continuous oral contraceptive therapy[5], no-trauma narrative CBT group[19], WLC[10,20,29,30], information control[32], physical activity[27], cognitive behavioral training self-help[29], and a grief trauma intervention-coping skills group[33].

Nine of the high quality studies showed significant positive results for the CBT-based intervention group, including improvements in coping[5,9], decreased anxiety and PTSD among patients with mental illness[8], improved perceived work related stress[30], improved ability to decrease pain[10], decreased stress levels[17,29], decreased distress[20], and reduced burnout ratings[27]. However, three of the studies reported that the CBT intervention did no show significant effects on anxiety[19], stress or coping[32] or distress[33]. The nine high quality programs had doses that ranged from 1.5 to 60 hours, and no information regarding adverse events was reported.

Six low (0) quality studies compared unnamed programs with CBT to various controls such as WLC[36,41], family or child-focused CBT[58], combination relaxation response[4], guided imagery[4], and CBT groups[4], multi-modal relaxation group[53], and a multiple physical, cognitive, or creativity-based comparison groups[38]. Three studies reported that unnamed programs with CBT showed a decrease in anxiety among patients with PTSD[41] as well as among undergraduates[4], and tension headache sufferers[53] while one[5] found similar improvement in coping among temporomandibular disorder patients. Two studies, however, did not find such improvement among individuals with TBI[36], and children with high anxiety children[58]. Lastly, a combination therapy utilizing cognitive-behavioral approaches did not significantly reduce stress among impoverished persons[38]. Doses were wide ranging, from six to 22 hours over one year. Similar to the majority of other studies in this section, adverse events were not reported by any study.

FRIENDS Program

The FRIENDS Program, founded by Dr. Paula Barrett, is a 10 session community-oriented cognitive-behavioral intervention designed to help children and adolescents with emotional disorders. This treatment and school-based CBT program uses core CBT components (i.e., exposure, relaxation, cognitive strategies, contingency management) and targets the primary components of anxiety (i.e., physiological, cognitive, behavioral) to reduce anxiety and depression and promote emotional resilience[68,69]. FRIENDS is an acronym for the skills it teaches, which stands for the following: (F) feeling worried?; (R) relax and feel good; (I) inner thoughts; (E) explore plans, (N), nice work so reward yourself; (D), don't forget to practice and; (S) stay calm, you know how to cope now.

FRIENDS Program Results

One adequate (+) quality study comparing 13 hours of FRIENDS Program Training over 13 weeks to WLC for the management of anxiety [18] did not show any improvements among African American children. Adverse events were neither mentioned not described (see ***Appendix 3***).

Discussion

The use of cognitive modalities to reduce stress has become one of the most popular methods for individuals to learn the skills for self-management of stress. This systematic review evaluated the quality of the evidence of programs that use cognitive modalities to reduce emotional stress. 55 separate studies were identified and grouped by type of program. Of the 16 studies in CBSM, overall there were positive results within mixed populations. Within the 10 studies of the SIT program, the lower quality studies showed an effect. All 5 studies of the CST program were adequate quality, but the outcomes were mixed. There were also mixed results for the two studies for the DBT program. Significant findings were found for the AMT program. However, the studies were few and they were of lower quality so confidence in these significant findings is questionable. The findings within the unnamed CBT category were mixed. It is difficult to compare programs with such different program structure and focus. While the FRIENDS study was high quality, the single study found it was not beneficial.

Although many of the study results demonstrated mixed outcomes, there is some evidence for the use of cognitive modalities in the reduction of emotional distress and anxiety as well as increased coping skills and well-being within a variety of treatment populations. In particular, the CBSM program showed strong evidence in its ability to help individuals reduce anxiety and increase coping skills. Additionally, several of the unnamed programs that utilized different CBT techniques for the self-management of a variety of conditions showed improvements in coping, decreased stress and decreased pain.

- Cognitive modalities may be effective in the reduction of emotional stress and anxiety within a variety of populations
- More research is needed to determine which program components are most effective for the reduction of emotional stress
- Factors to consider when selecting a program for managing anxiety include: tailoring the program to the target population; dosage of program (length and frequency of sessions; overall length of program); and use of the most evidenced based program for consistency of program delivery

However, the evidence for use of these modalities would be stronger if the studies addressed a few critical issues. For example, some of the conclusions were difficult to decipher due to such extreme variability within the baseline populations of interest. Half of the studies had poor baseline similarities. The type of population being studied has a substantial impact on program outcome and may have different effects within clinical and non-clinical populations. Most of the studies did not demonstrate a long term follow up for the programs. The programs used several different intervention components, making it difficult to

generalize the program effectiveness in a particular setting. Dosage is another important factor in determining effectiveness. Even within the most structured programs there were substantial differences in the number of sessions. It is challenging to define the “ideal dosage” for the desired outcomes in the reduction of emotional stress given the wide range of program length and frequency and number of sessions in this literature pool. The ability to examine these programs with more rigor would allow greater knowledge in understanding which components are essential for positive outcomes and perhaps allow some programs to demonstrate even greater success.

Several different programs demonstrated evidence for the increased ability to manage emotional stress. Yet, there was still changeability depending upon the population studied and the specific components used. Organizations interested in implementing programs for particular populations may want to incorporate the more evidence-based programs which would allow for more uniformity in the program delivery. Clearly, more research is needed on the specific programs in creating consistency to maximize program outcomes. This is especially important with the goal of allowing individual participants the opportunity to continue to use the tools learned outside of the program for their own stress management.

Future studies need to focus on population selection, consistency in length and frequency of program, and a more formal focus on the most integral components to self- management of stress.

Conclusions

Overall, programs that use cognitive modalities have been found to be effective for self-management of stress. However, it would be beneficial to examine more closely what outcomes were found in specific populations in order to determine which programs might be most effective. Additionally, specific research on which program components are most essential in teaching self-management skills would increase the ability for the programs to have maximum impact.

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Section 3: Mindfulness-based modalities for the self-management of emotional stress

Introduction

Mindfulness-based modalities are those that utilize the process of mindfulness as a core component in the self-management of emotional stress. The concept of mindfulness encompasses a mental state of intentionally being present in the moment, with a nonjudgmental attitude and acceptance of one's current thoughts, feelings, and bodily sensations. Mindfulness emphasizes openness, curiosity and acceptance.[1] Through this process, it is believed that the effects of stressors are countered; the depression and anxiety associated with orienting oneself away from the present moment, either in the past or the future, is alleviated as one's attention is focused in the present. Many of the programs included in this section include mindfulness meditation, a practice that often includes regulated breathing and works to balance the sympathetic and parasympathetic nervous systems and alleviate distress[1]. Because mindfulness-based techniques have the capacity to be effective interventions for the self-management of emotional stress, the authors are interested in examining the quality and quantity of research on mindfulness-based modalities. This section includes programs that utilized Mindfulness-based Stress Reduction (MBSR), Mindfulness-based Cognitive Therapy (MBCT), Mind-body Bridging, Vitality Training, and other unnamed multi-modal mindfulness-based programs.[2,3]

Methods

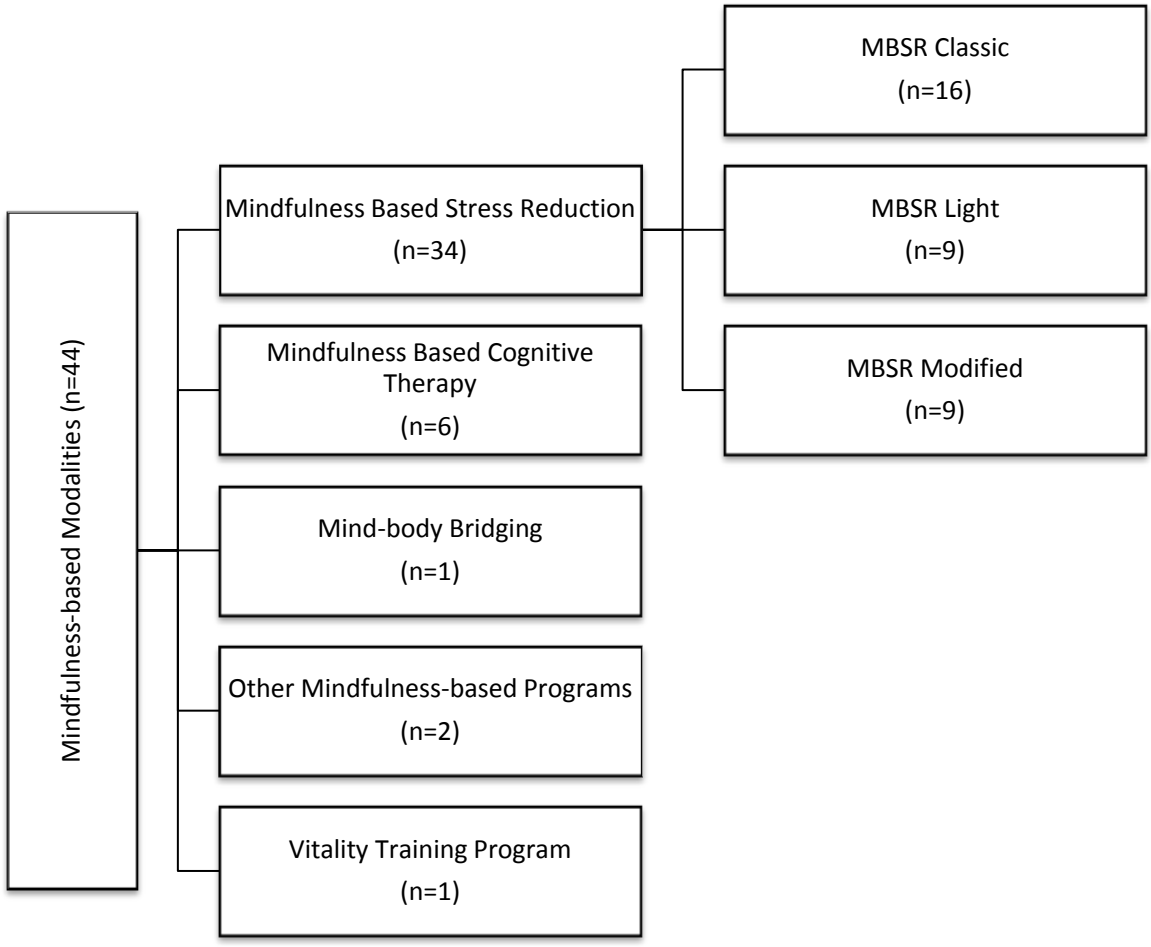
Please refer to Section 1 for a detailed description of the review's methodology.

Results

Study Selection

Of the 192 articles yielded from the database search, 44 randomized controlled trials (RCTs) (see ***Section 3, Figure 1*** for Flow Chart) met the inclusion criteria and were subsequently categorized as mindfulness-based modalities.

Section 3, Figure 1. Flow Chart of Mindfulness-based Modalities



Overall Quality Assessment

According to the SIGN 50 criteria used to assess methodological quality, the majority of the RCTs were high quality, with 21[4-24] (48%) high (++), 15[25-39] (34%) adequate (+) quality studies, and eight[40-47] (18%) low (0) quality studies. Although there were some limitations with adequate reporting of randomization procedures and intention-to-treat analyses, the overall quality literature was high. In fact, the majority of the studies addressed an appropriate and clearly focused research question, dropout rates, and group baseline similarities either well or adequately. Of the four multi-site studies[24,40,41,45], the majority addressed site similarities poorly with only one study[24] doing so well (see ***Section 3, Table 1***).

Section 3, Table 1. SIGN 50 Quality Assessment for Mindfulness-based Modalities

SIGN 50 Criteria	Percentage (n=44)		
	Well	Adequate	Poor
Appropriate and clearly focused research question	73% (32)	27% (12)	0% (0)
Randomization	45% (20)	20% (9)	34% (15)
Baseline similarities	66% (29)	18% (8)	16% (7)
Outcome reliability/validity	75% (33)	23% (10)	2% (1)
Percentage of dropouts	45% (20)	34% (15)	20% (9)
Intention-to-treat analyses	39% (17)	25% (11)	32% (14)
Multi-site similarities	2% (1)	0% (0)	7% (3)

Mindfulness-Based Stress Reduction

MBSR is a well-characterized, structured group program developed by Dr. Jon Kabat-Zinn. With its roots in contemplative Eastern spiritual practices, it uses techniques to cultivate conscious awareness (i.e., mindfulness) and acceptance of moment-to-moment experiences, including thoughts, emotions, and bodily sensations. MBSR teaches a variety of exercises that increase awareness, provide self-regulation, and promote healthy and adaptive responses to stress. Program components include instruction and practice in Hatha yoga and various meditative techniques, such as the body scan, sitting and walking meditations, and loving-kindness meditation. There is also a didactic section and group discussion at each class. Participants are typically asked to practice 45 minutes of mindfulness each day. The training for the standard MBSR program is 30 hours (eight weekly 2.5 hour classes plus one all day retreat)[48] plus daily home practice, however, several variations of the program have been developed, including a more condensed version over a shorter period of time.[48]

Several studies included in the review modified the standard MBSR program. To ensure comparability among groups, the authors categorized MBSR into the following groups based on the content of the interventions utilized: (1) MBSR Classic, which referred to the traditional MBSR program designed by Dr. Kabat-Zinn; (2) MBSR Light, which delivered a shortened variation of the standard program and; (3) MBSR Modified, which featured content inspired by or based on the standard MBSR curriculum, but included modifications (e.g., customizing the content for expectant mothers, tailoring it as a wellness-based program).

MBSR Program Results

Of the 44 RCTs on mindfulness-based modalities, 34 included some form of MBSR, classified as MBSR Classic (n = 16), MBSR Light (n = 9), and MBSR Modified (n = 9) for the treatment of a variety of outcomes including stress, distress, post-traumatic stress disorder (PTSD) symptoms, anxiety, burnout, coping, and resilience (see ***Appendix 4*** for full description of all studies). The methodological quality of these studies was notably high, with over half of the studies being of high (++; n =16) or adequate (+) quality (n = 11); only seven studies were considered low (0) quality.

MBSR Classic

Seven high (++) quality studies compared the effects of a standard MBSR program to different controls including a waitlist control (WLC), [6,8,11,17] health enhancement program,[13] healthy living course[16] and standard care.[20] Studies reported improvements in distress among rheumatoid arthritis[17], arthritis and HIV-positive patients[8]. Improvements in stress were also found in asthma patients[16] and post-menopausal women[6] but not HIV-positive individuals[8]. MBSR was found to be effective at reducing anxiety in breast cancer patients[11] and early post-menopausal women,[4,6] but not chronic pain[20] and healthy adult[13] populations. Despite the standardized nature of the MBSR program, dosage ranged from 19 to 30 hours over a period of 6 to 8 weeks. Two studies[11,17] discussed adverse events, mentioning that none occurred; adverse events were not described in the remaining studies.

Three of the five adequate (+) quality studies comparing MBSR to a WLC found that MBSR significantly reduced anxiety in medical students[36] and heart disease patients[38] but not physiologically distressed individuals[34]. MBSR was also reportedly more effective for reducing stress compared to a WLC[29,35] but not to a non-mindfulness stress reduction intervention.[29] Treatment dosages ranged from 16 to 27 hours over a period of 7 to 8 weeks, with one study[35] not reporting the amount of time spent delivering the intervention. None of these studies provided adverse event information.

Based on the four low (0) quality studies, MBSR significantly improved anxiety in chronic pain patients relative to standard care[46] as well as anxiety in pregnant women[45] and stress, but not burnout[44] in healthcare professionals[44] compared to WLC. Relative to aerobic exercise, no benefit for stress and anxiety reduction was found for generalized social anxiety patients.[41] Intervention dosages in these studies ranged from 16 to 28 hours over 8 weeks, with one study[46] not reporting the amount of time spent on intervention delivery. None of these studies provided adverse event reporting.

MBSR Light

Six of the nine MBSR light studies were high (++) quality and compared the use of shortened MBSR programs to meditation (i.e., Easwarans Eight-Point Program),[15] usual care[4] and a WLC[5,12,15,19,24] in adolescent, student, and cancer patient populations. Overall, results were fairly mixed, with some studies reporting reductions in anxiety,[4,19] stress,[4,5,15] and avoidance[5] and others finding no significant improvements in stress,[12,24] anxiety,[5] coping,[24] PTSD [5] and anxiety-related[4] symptoms. Treatment dosages were lower than for conventional MBSR, ranging from 8 to 16 hours over 7 or 8 weeks. Two studies[5,15] noted that no adverse events occurred, while the remaining articles did not report on adverse events.

The one adequate (+) quality study[28] found that an undescribed dosage of an abbreviated MBSR program significantly reduced distress in health professions students when compared to a wait list condition. No adverse events occurred.

According to one of the low (0) quality studies, a condensed version of MBSR was more effective than WLC in improving relaxation and burnout symptoms in nurses and nurse aids[47]. The second low quality study, however, reported that MBSR did not effectively reduce anxiety in children[43]. Dosages ranged from 2 to 2.5 hours over 2 to 4 weeks. Neither study provided any information on adverse events.

MBSR Modified

Three of the nine RCTs were high (++) quality and compared a modified version of MBSR to imagery-based relaxation program[23], usual care[23], WLC[18] and education controls[10]. MBSR reportedly reduced anxiety in fibromyalgia[18] and transplant[10] patients but did not significantly impact stress in heart attack or angina patients[23]. Intervention dosages ranged from 20 to 28 hours over 8 weeks. One study[10] reported no occurrence of adverse events, while the remaining studies did not address the subject.

Five adequate (+) quality studies compared the use of MBSR to education[39], usual care[26], WLC[26] and advice control[32] groups. Studies described significant improvements in anxiety[27], coping[27] , and distress[31] among cancer patients. Although reductions in stress were also noted for cancer patients[31], no such improvements were found for coronary artery disease[32] and ulcerative colitis[26] patients; similarly, stress was not reduced among stressed individuals[39]. Dosages ranged from 20 to 72 hours over seven to 10 weeks. None of the studies mentioned or described adverse events.

The one low (0) quality study found that 60 hours over 10 weeks of modified MBSR significantly reduced anxiety in ulcerative colitis patients relative to usual care. Adverse events were not addressed.

Mindfulness-Based Cognitive Therapy

MBCT is an adapted version of Jon-Kabat Zinn's MBSR that has been specifically tailored as a psychological treatment program to prevent the relapse of depression and chronic unhappiness. MBCT was developed by Zindel Segal, Mark Williams and John Teasdale, and uses techniques from cognitive therapy, meditative, and mindfulness practice, while focusing on the awareness and restructuring of the relationship one has with the modes of mind that often characterize mood disorders. Like MBSR, MBCT training is typically completed in 30 class hours over eight weeks (eight weekly two hour classes plus one full day retreat), but home-guided meditation practice is essential to familiarize oneself with the workings of the mind.[49]

MBCT Program Results

All six studies investigating the use of MBCT were either high [7,9,14] (++) or adequate [25,30,37] (+) quality. MBCT was delivered to a range of participants including those with depressed mood[7,25,30], caregivers of close relatives with dementia[14], cancer patients[9], and patients with medically unexplained multiple

chemical sensitivities[37]. MCBT was most commonly compared to WLC[9,25,30]; other controls included an education[7,14] and usual care[37]. Overall, results were mixed. In fact, some studies described significant decreases in emotional reactivity[25], emotional stress[9,14] and anxiety[9,25,30] while others reported no reductions in anxiety[7,37] and stress[37]. Dosage for the MBCT interventions ranged from nine to 21 hours over eight weeks, however, one study did not report on the overall dose of the program. None of the authors reported or mentioned adverse events. See ***Appendix 4*** for a complete description of studies.

Mind-body Bridging

Mind-body Bridging is an awareness-training program that teaches skills for mental and physical relaxation and instructs the patient on how to recognize dysfunctional mind-body states[50]. Written free-association exercises are used to identify the patient's expectations for self and for the surrounding world. The program provides a system for identifying and categorizing what are described as resistances to clarity.

Mind-Body Bridging Program Results

Only one adequate (+) quality study [33] investigated the use of mind-body bridging, determining that three hours of the intervention effectively reduced PTSD symptoms among veterans compared to a sleep hygiene intervention. Adverse events were not reported (see ***Appendix 4***).

Vitality Training Program

The Vitality Training Program is a mindfulness-based course that focuses on addressing relationships between thoughts, emotions, and bodily symptoms[51]. It was developed for patients with chronic musculoskeletal pain, but is applicable to other chronic conditions[52]. The program focuses on identifying and using personal resources to increase the patient's overall quality of life.

Vitality Training Program Results

Only one [21] high (++) quality study assessed a Vitality Training Program. Authors noted that the 49.5 hours of the program over 15 weeks significantly improved stress and coping compared to usual care. Authors reported no adverse events occurred (see ***Appendix 4***).

Other Mindfulness-based Programs

Programs that utilize mindfulness as the primary integrative technique, but have not been established in the literature as named programs with standardized methodologies were categorized as other mindfulness-based programs. Two studies evaluated the use of such programs which focus on mindfulness meditation, awareness, and the promotion of emotional clarity and regulation in order to reduce the burden of life's stressful events.

Other Mindfulness-based Program Results

The high (++) quality study [22] determined that a 16 hour mindfulness-based emotion regulation program was more effective than an education control and as effective as a pain-focused CBT intervention in improving coping in rheumatoid arthritis patients. The authors did not provide any adverse event information.

- The quality of evidence on mindfulness-based interventions for emotional stress is high.
- Mindfulness-based modalities are well-suited to self-manage emotional stress.
- Mindfulness interventions are effective among female populations across a variety of conditions, particularly breast cancer.
- Modifications to the classic MBSR program appear to decrease the frequency of positive outcomes but a 'lighter' dosage does not.

The low (0) quality study[40] found that six hours of an acceptance and commitment therapy intervention with a mindfulness component was more effective than WLC and as effective as Stress Inoculation Training (SIT) in significantly improving distress among participants with elevated distress levels. Adverse event information was not reported. See ***Appendix 4*** for a full description of studies.

Discussion

Mindfulness-based modalities are well-suited for use as self-management interventions for emotional stress. They are simple, do not require equipment or outside devices to be practiced, and can be practiced anywhere. Though they require about 8 weeks of initial instruction, they can then be practiced on one's own individually or in groups. The use of mindfulness-based techniques to reduce stress, anxiety and distress is widely used and reported on, as seen by the large number of studies included in this section.

All of the mindfulness-based categories seem to be effective for managing stress in one or more populations. Of 16 MBSR classic studies, 12 (75%) found at least one significant positive outcome related to managing emotional stress. MBSR Light studies found the interventions significantly effective for managing emotional stress in 7 of 9 instances (78%) while MBSR Modified studies found the same in 4 of 9 studies (44%). Thus, in this literature pool, fewer positive outcomes were found in modified MBSR programs than in versions with less dosage.

Results are particularly strong for the effectiveness of all three forms of MBSR in managing emotional stress among female breast cancer patients. Three (9, 10, 25) high or adequate quality studies with a total of 374 participants found MBSR to be effective in this population, even when compared to an active control (25), and no studies found MBSR ineffective with female breast cancer patients. However, effect sizes weren't reported and should be in future studies.

There is also consistent strong evidence that all types of MBSR interventions reduce emotional stress in healthy populations. High and adequate quality studies found MBSR classic, light, and modified all

reduced stress and/or distress in undergraduate and medical students, health professional students, and community volunteers when compared to a wait list control. The one study (26) that reported on effect size found a strong effect size of 1.36 when comparing reductions of distress in an MBSR lite intervention and a wait list control.

The specific aspect of emotional stress that MBSR reduces most consistently is anxiety. Multiple high and adequate quality studies in each category (classic, light, and modified) showed reduced state and/or trait anxiety in a variety of healthy and clinical populations, including medical students, pregnant and menopausal women, distressed and depressed women, female breast cancer patients, female fibromyalgia patients, transplant patients, those with ulcerative colitis, and patients with recurring depression. The measurement tools used to measure anxiety were fairly consistent and valid, most often the STAI and SCL-90 R. Future studies should use the same tools to allow for consistency and future pooling of data.

The overall quality of research on mindfulness-based modalities for self -management of emotional stress is very high, including for classic MBSR, modified MBSR, and MBSR light, as well as MBCT. Of 44 studies, 36 (82%) were of high or adequate quality as assigned by SIGN 50 criteria. Generally, these studies had an appropriate and clearly focused research question and reported on randomization, dropout rates, dosages, and baseline similarities, and used reliable and valid survey instruments. However, there is room for improvement. MBCT and all three types of MBSR studies used a wait list control the majority of the time. In fact, only five studies found MBSR to be effective compared to an active control and only 1 found the same for MBCT. Future studies should use active control groups that more closely match the treatment in order to determine the active components of the treatment.

Dosages were well-reported in almost all of the mindfulness-based studies. However, dosage varied greatly in both duration and frequency, ranging from 2 -74 hours of training over 2-10 weeks. Additionally, the amount of home practice was not recorded in most studies. Because MBSR training programs often include up to 45 minutes a day of home practice, which can greatly alter the dosage intensity, homework should ideally be recorded and reported in future mindfulness-based studies. The dose response relationship was not addressed in any of the studies. This is a question of interest in the field. Future studies should provide more consistent dosing as well as address the dose response relationship and whether a minimum dosage is needed to produce significant results.

Reporting on adverse events is important for well-designed studies as formal recommendations cannot be made without clearly understanding the risks involved with the modality. Of the 44 mindfulness-based studies, only two (5%) reported on adverse events. Both of these studies were high quality, were medium-large in size (total n=292), and reported that no events occurred. This seems to suggest mindfulness-based modalities are safe. However, because adverse events were not explicitly reported in most studies, it is not clear whether there are unreported safety concerns with mindfulness-based modalities. Future studies need to examine, describe, and report on safety and adverse events.

Finally, self-care modalities are often thought to be more cost-effective than pharmacological or clinician-delivered therapies, especially in the case of treating emotional stress which can incur ongoing costs over a long period of time. Typically, an 8-week MBSR class costs $200-$500. MBCT sessions are similar in cost to other forms of psychotherapy. While 18 of the 44 studies (41%) reported effect sizes, none of them conducted cost analyses. Therefore, no evidence-based determinations can be made regarding cost-effectiveness of self-care mindfulness-based modalities for the treatment of emotional stress. Addressing this gap in cost-benefit analyses would be helpful in future studies.

Conclusions

There is high quality evidence showing mindfulness-based interventions are effective at reducing emotional stress in both clinical and healthy populations, particularly in women with a variety of conditions. Programs focused on women, especially breast cancer programs, may want to consider incorporating mindfulness-based components into their interventions. Mindfulness-based interventions also appear to be fairly effective at specifically reducing feelings of anxiety, stress, and distress in populations with emotional stress. Programs for conditions that are associated with anxiousness and stress may want to consider a mindfulness element as part of treatment. Modifications to the classic MBSR program appear to decrease likelihood of positive outcomes in the included studies, but a 'lighter' dosage does not. Future research should focus on questions of dosage and safety and report on adverse events and effect sizes.

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Section 4: Relaxation-based modalities for the self-management of emotional stress

Introduction

Relaxation-based modalities are a variety of techniques that work with the autonomic nervous system to induce physical and psychological relaxation rather than arousal, countering the effects of the "fight-or-flight" stress response. This process can help to cope with emotional distress and decrease the effects of stress on the mind and body. Basic relaxation techniques are fairly simple to learn, often free or low cost, and can be practiced virtually anywhere. The following section describes the quality and quantity of research on relaxation-based modalities for the self-management of emotional stress. Programs included in the relaxation-based modalities section are those that draw on relaxation techniques widely accepted in the literature as effective for mitigating the stress response. These techniques include Benson's Relaxation Response Training (RRT), Easwaran's Eight Point Program of passage meditation, Progressive Muscle Relaxation (PMR), breathing techniques, and guided imagery. These practices represent non-pharmacologic approaches to avoiding stress that have been used for a variety of health conditions and have been shown to be particularly effective for reducing stress and anxiety[1]. Although many of the interventions described in this section include some "named" programs (e.g., RRT), the majority of the programs are categorized as either relaxation multi-modal or imagery-based relaxation. Each of these hybrid programs uses a different combination of relaxation-based integrative skills to consciously elicit the body's relaxation response, which is characterized physically by slower breathing, reduced muscle tension, lower blood pressure and emotionally by a sense of well-being and calm.

Methods

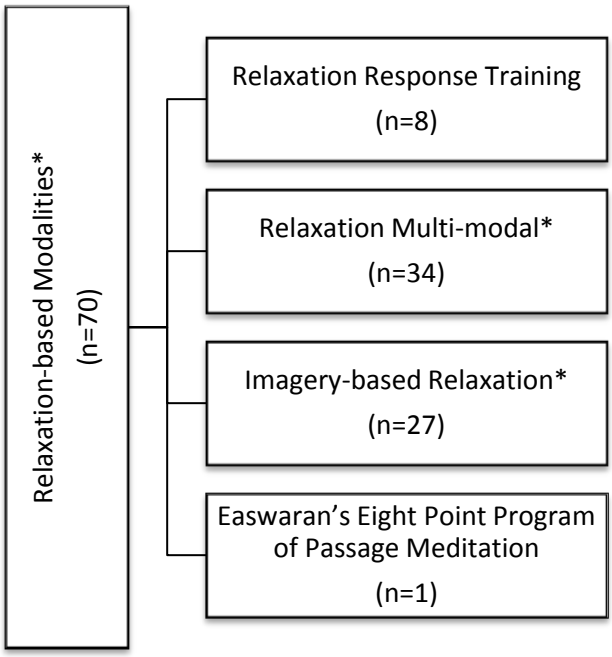
Please refer to Section 1 for a detailed description of the review's methodology.

Results

Study Selection

Of the 192 articles yielded from the database search, 69 unique randomized controlled trials (RCTs; see ***Section 4, Figure 1*** for Flow Chart) met the inclusion criteria and subsequently were categorized as relaxation-based modalities.

Section 4, Figure 1. Flow Chart of Relaxation-based Modalities



*Four[2-5] studies reported on more than one intervention of interest. Both Hellman et al. (1990)[3] and Shaw & Blanchard (1983)[5,6] reported on two RRT interventions of interest. Sallis et al. (1987)[4], moreover, reported on two Relaxation Multi-modal interventions of interest while Bridge et al. (1988)[2] reported on one Relaxation Multimodal and one Imagery-based Relaxation intervention. As such, the authors report on 70 RCTs describing 73 interventions of interest in this section.

Overall Quality Assessment

According to the SIGN 50 criteria used to assess methodological quality, there were eight [7-14] (11%) high (++), 28[2-4,15-38] (40%) adequate (+), and 34[5,39-71] (49%) low (0) quality studies. Appropriate and clearly focused research questions as well as outcome reliability and validity were addressed either well or adequately in nearly all studies. Conversely, randomization procedures, intention-to-treat analyses, and dropout rates were poorly addressed by the majority of studies. Overall, most studies addressed baseline similarities well, though it is interesting to note that nearly almost one third of studies did so inadequately by SIGN criteria. Of the 8 multi-site studies[7,11,15,16,48,55,62,72], 6 did not rigorously identify site similarities (see ***Section 4, Table 1***).

Section 4, Table 1. SIGN 50 Quality Assessment for Relaxation-based Modalities

SIGN 50 Criteria	Percentage (n = 69)		
	Well	Adequate	Poor
Appropriate and clearly focused research question	58% (40)	35% (24)	7% (5)
Randomization	15% (10)	26% (18)	59% (41)
Baseline similarities	43% (30)	12% (8)	45% (31)
Outcome reliability/validity	72% (50)	22% (15)	6% (4)
Percentage of dropouts	27% (19)	25% (17)	48% (33)

Intention-to-treat analysis	22% (15)	3% (2)	75% (52)
Multi-site similarities	3% (2)	0% (0)	8% (6)

Relaxation Response Training

Cardiologist Herbert Benson devised a stress-management approach in the early 1970s, called "relaxation response training" (RRT), in which a form of meditation was used to counter the effects of the sympathetic nervous system and induce a parasympathetic response. The desired outcome of this approach was to achieve the "relaxation response",[73] a term Benson coined to describe the voluntarily elicited physiological state associated with decreases in oxygen consumption, respiratory rate, blood pressure, and an improved sense of well-being. RRT is a concentration meditation technique that includes creating a quiet environment in a comfortable, relaxed posture; focusing on an object of meditation (e.g., a silently repeat word or phrase or prayer); while possessing a passive attitude towards distracting thoughts. There is no well-established "dosage" for relaxation response training to be effective, but it's commonly believed that the more regularly the relaxation response is evoked, the stronger the potential benefits will be.

Relaxation Response Training Results

Eight studies assessed the effectiveness of RRT across outcomes of stress and distress [3,40,43], anxiety[5,20,43,47,53,58], and coping[58]. See ***Appendix 5*** for a full description of studies.

One adequate (+) quality study [3] reported two interventions with RRT components (i.e., Way to Wellness program and a mind/body group) were equally effective in improving stress compared to an information control. A second adequate quality study [20], however, showed that RRT, compared to usual care, did not significantly improve anxiety, though a non-significant positive trend was reported. Total treatment dosages were similar, ranging from 7.5 to nine hours. Neither study addressed adverse events.

Six low (0) quality studies compared RCT to a variety of controls including reading activity[43], non-dieting intervention[53], waitlist condition (WLC)[5], no treatment[40,47] and an unspecified control intervention[58]. Although one study reported RRT improved anxiety, most studies [5,43,47,53,58] did not find such effects. RRT was found to be effective, however, in improving coping[58] and reducing stress[40,43]. Total intervention dosages in these studies ranged widely from 5 to 38 hours over 5 to 10 weeks. None of the studies reported on the topic of adverse events.

Multi-modal Relaxation

The authors used the category "multi-modal relaxation" interventions to refer to any unnamed interventions that had not been standardized or previously described in the literature, but utilized common stress management techniques for relaxation. PMR, a concept introduced by Dr. Edmund Jacobson in 1934[74] is used to monitor and control muscle tension through a series of focused contractions and relaxations of multiple muscle groups. The aim of the exercise is to induce overall relaxation, and it can be taught by a wide range of instructors or done independently for the self-

management of stress. PMR can be carried out in a group or individual setting in 20-30 minutes, although the methods are not standardized and can vary widely[75]. Many of the programs in this section utilize PMR in combination with breathing techniques that emphasize a conscious slowing of the breath.

Multi-modal Relaxation Results

Thirty-four studies were categorized as multi-modal relaxation interventions and studied a range of outcomes including anxiety[2,4,9,19,22,24,28,29,32,33,38,45,46,48,51,52,56,59,60,63,70], stress[4,7,11,18,23,27,28,38,42,49,61,65,66,68], distress[22,25,27,38,69], burnout[18], coping[38], and resilience[28]. One study[4] evaluated two interventions of interest; thus, outcomes from thirty-five programs will be discussed. ***Appendix 5*** details each study in full.

Of the three high (++) quality studies, one [9] found that a multi-modal relaxation intervention significantly reduced anxiety in advanced lung cancer patients, relative to usual care. The remaining studies reported no significant reductions in stress in multiple sclerosis patients[11] or couples expecting children[7] following a relaxation program compared to WLC and standard care conditions, respectively. Total dosages ranged from a single 1.3 hour session to 13 hours over 10 weeks. One study [11] stated no adverse events occurred, while the others did not address the topic.

Fourteen adequate (+) quality studies compared the use of a relaxation program to a no treatment [2,22,24], WLC[18,24,28,29,32,33,38], modified desensitization[24], physical therapy[27], imagery-based relaxation[2], usual care[23], education[4], lifestyle program[19], and minimal treatment[25] in various populations such as parents of handicapped children[33], healthy employees[4,22], students[24,38], medical residents[18], Army employees[32], obese women[19], socially impaired men[25], as well as breast cancer[2,27-29] and irritable bowel syndrome[23] patients. Results regarding anxiety reduction were mixed; although most studies reported significant improvements [2,4,22,28,29,33,38], a few did not find such results [19,25], and others [24,32] reported improvements in some anxiety measures but not others. Relaxation reportedly lessened levels of stress [4,18,23,27,28,38], distress[22,27], coping[38] and resilience[28] but not burnout[18]. Intervention dosages ranged from three to 48 hours. None of these research reports provided adverse event information.

Seventeen low (0) quality studies compared multi-modal relaxation interventions to no treatment[46,48,51,63,70], education[65], cognitive intervention[60,69], relaxation[45,61,68], WLC[45,49,50,52,59,66,68], unspecified control[60], cognitive coping[45], education[70], stress exposure[70], stress inoculation therapy[70], creative activity-based group[42], cognitive approach[42], cognitive and physical approach[42], and social skills program[56] in impoverished persons[42], nurses[70], students[45,50], individuals at high risk for illness[59], police[61,65], heavy drinkers[63], stressed individuals[66,68,69] as well as melanoma[46], anxiety disorder[51], hypertension[48], tension headache[60], HIV-positive[49], myocardial infarction patients[52], and schizophrenic patients[56].

Similar to the adequate quality studies, most low quality studies investigated the effect of relaxation interventions on anxiety; the majority[42,45,46,50,51,56,59,60,63,70] described significant reductions, however a few[48,52,65,69] did not report such benefit. Results regarding stress were mixed with an equal amount of studies reporting significant reductions in stress[61,66] and no such effects[49,68]. No significant results were

reported for measures of distress[69]. Total intervention dosages varied considerably, ranging from 3 hours over two sessions to 44.25 hours over nine weeks. None of the studies provided information on adverse events.

Imagery-based Relaxation

For purposes of this review, the authors grouped relaxation programs that included guided imagery as the dominant modality into category called "imagery-based relaxation". Guided imagery is a technique that focuses and directs the imagination to produce therapeutic change through a variety of techniques such as direct suggestion, metaphor, or storytelling [76]. This technique works to induce psychophysiological relaxation and relieve physical and psychological symptoms; it has been shown to successfully alleviate stress and anxiety[77], improve physical and mental health[78], and relieve suffering associated with chronic pain[79]. Guided imagery practice is delivered either by a practitioner or via audio-recordings and is regarded as safe, with no known associated risks. Many of the programs included in this section utilize guided imagery in combination with breathing, muscular relaxation, and meditation, as these techniques are often combined by imagery practitioners to induce a state of relaxation. The methodology is not standardized and sessions can vary in length.

Imagery-based Program Results

Twenty-seven of the included articles studied imagery-based relaxation. Most commonly, the studies used anxiety outcomes[1,2,8,10,12,15,16,21,31,34,35,39,41,50,54,55,62,64,67,80], as well as stress[13,26,30,31,35,36,55,71], distress[8,39], burnout[17], PTSD symptoms[35] and resilience[57] (see ***Appendix 5*** for a full description of studies).

The four high (++) quality studies reported results that were mixed. One imagery-based stress management program reported significant reductions in anxiety in surgical prostate cancer patients [10] when compared with supportive attention or usual care. One study found no significant reductions in stress among cardiac patients using an imagery-based program compared to lifestyle programs [13]. The two remaining studies had mixed results: distress but not anxiety decreased in ischemic heart patients compared to exercise [8] and anxiety decreased significantly with one measure but not on two other anxiety measures[12] in persons with anxiety disorders. Time spent delivering the intervention varied substantially, ranging from 3-24 hours. None of the studies reported on adverse events.

Twelve adequate (+) quality studies evaluated imagery-based relaxation on stress-related measures. Of these, six studies showed significant improvements, five reported no differences, and one had mixed results. Imagery-based relaxation had significant impacts in reducing burnout in nurses[17], lessening anxiety in rheumatoid arthritis patients [21], stress in persons with emotional pain [26] and coronary artery disease[30], and in cancer patients, decreasing tension/anxiety [34] and anxiety and emotional distress[31]. Five studies documented no anxiety-reducing effects of imagery-based relaxation in persons with multiple sclerosis,[15] hypertension,[16]chronic pain,[37] parents of low birth weight infants,[35] or emotional distress in police officers.[36] Intervention dosage varied considerably, ranging from three to 72 hours. None of the studies described adverse events.

Eleven low (0) quality studies compared the effects of imagery-based relaxation to social support [55], WLC[55,71], relaxation[67], attention[62], no treatment[54,62,64], standard care[41], exercise[64], passive listening[57], usual care[39] as well as an unspecified comparison group[80]. Four studies found significant reductions following imagery-base relaxation in healthy students[67] as well as cancer[80], genital herpes[55], and pediatric[54] patients. However, no beneficial results were found in students[41,64], leukemia[41] and Type I diabetic[39] patients. Positive results were reported in resilience[57] in employee managers, but not stress[71] in healthy populations. Total intervention doses varied between 1.67 over five days to 20 hours over 10 weeks. None of the articles provided adverse event data.

Easwaran's Eight Point Program of Passage Meditation

Easwaran's Eight Point Program of Passage Meditation is a spiritually-derived system which involves selecting a written passage and going through a series of steps focusing on cultivating mindfulness and selflessness[81]. While it emphasizes spirituality, the program is nondenominational and is not predicated on religious belief or adherence.

Easwaran's Eight Point Program Results

One high (++) quality study[14] comparing 12 total hours of Easwaran's Eight Point Program of Passage Meditation to active MBSR and WLC found that the passage meditation and MBSR were equally more effective than a WLC in improving emotional stress. The authors reported that no adverse events occurred (see ***Appendix 5***).

Discussion

Relaxation-based modalities are well-suited as self-management interventions for emotional stress. They are simple, generally do not require equipment or outside devices, and can be practiced virtually anywhere. By inducing the body's own natural relaxation response, they represent non-pharmacological approaches to stress that can change the short- and long-term physical and emotional responses to stress. There are a wide variety of methods to elicit the relaxation response, giving individuals a great deal of choice and making it more likely they find a method that works well for them. Relaxation-based modalities can be easily practiced on one's own, either individually or in groups.
The use of relaxation-based techniques to reduce stress, anxiety and distress is widely used and reported, as evidenced by the relatively large number of studies (n=69) included in this section. The quality of research in this area is moderate with 54% of studies (n=37) designated high or adequate quality. Several (n=7) high/adequate quality studies reported effect sizes; 5 found a medium effect size in reducing at least one outcome related to emotional stress[14,18,26,31,34], one found a small effect,[9] and one found no significant effect[36]. Although these effect sizes are not robustly strong, this represents a sizable literature pool of good quality. Given the low likelihood, but inadequate documentation, of adverse events, it is difficult to fully endorse that relaxation-based skills should be categorically incorporated into programs. The three high/adequate quality studies that did report effect sizes over time[14,26,31] found that results were maintained or increased from post-test to follow-up, suggesting relaxation-based skills can be efficaciously integrated once an intervention is over.

- Overall, the quality of studies for relaxation-based interventions is moderate with over half (53%) of the studies high or adequate quality.
- There are mixed results for multi-modal relaxation-based techniques to self-manage emotional stress.
- There was a lot of variation in the dosages (ranging from 3-72 hours over 1 session-10 weeks), the outcomes measured, and the tools used to measure them in these studies.
- One population that consistently responds well to multi-modal techniques is women with breast cancer. Breast cancer programs may want to consider incorporating multi-modal relaxation interventions to their treatment protocol.
- Few of the relaxation-based intervention studies reported on adverse events or effect sizes. Future studies should focus on questions of safety, total dosage (including homework), and effect sizes.

Relaxation Response Training

Two adequate quality studies reported on the use of Relaxation Response Training to self-manage emotional stress. One showed a non-significant trend toward reducing anxiety with substance abuse patients, but no difference compared to acupuncture control. The second significantly reduced distress in psychosomatic patients. This small number of quality studies is not sufficient to make recommendations for or against Relaxation-Response Training for stress management. Neither study reported on effect sizes or adverse events, which should be addressed in future research.

Relaxation Multi-Modal

Half of the 34 studies in this category were graded high or adequate quality. Results were quite mixed on the effectiveness of multi-modal relaxation techniques for reducing emotional stress. Twelve studies found significant effects amongst clinical and healthy populations and 7 did not. This could be due to a wide range of dosage among studies, which in itself was difficult to determine because the amount of homework included in the interventions was not reported. The mixed results could also be due to heterogeneity in the multimodal interventions themselves, as well as in the outcomes that were measured and the tools used to measure them. Only a single study in this category reported on safety, an adequate quality study that reported no adverse events. Future studies need to report on adverse events, amount of homework given, and effect sizes.

Easwaran's Eight-Point Program

A single high quality study showed the Easwaran's Eight-Point Program significantly reduced emotional stress in undergraduate students compared to a wait list control, but not compared to an active control. This single study is not robust enough to make recommendations about the Easwaran's Eight-Point Program for self-managing emotional stress.

Imagery-Based Relaxation

Imagery-based relaxation studies were of overall fair quality due to shortcomings in study methodology and reporting. The studies included in this review documented mixed findings; nearly equal proportions showed significant improvements in stress-related outcomes or no stress-relieving benefits. This relatively high percentage of non-significant findings, most of which were in anxiety measures, makes

one question whether the imagery intervention itself was not effective or whether the specific imagery content was not appealing or acceptable to study participants. Additionally, most of the significant improvements were found using measures of emotional distress, whereas most of the non-significant studies used anxiety as an outcome measure.

Reporting on adverse events is important for well-designed studies as formal recommendations cannot be made without clearly understanding the risks involved with the modality. Of the 69 relaxation-based studies, only two[11,26] reported on adverse events. Both of these studies were high quality, were moderate in size (total n=168), and reported no events occurred. This seems to suggest relaxation-based modalities are safe. However, because safety was not explicitly addressed in most studies, it remains unknown if relaxation -based modalities are safe. Improving the rigor in both conduct and documentation of adverse events is important for future research.

Dosages were well-reported in almost all of the relaxation-based studies. However, dosage varied greatly in both duration and frequency, ranging from 3 -72 hours of training over a single session to 10 weeks. Additionally, the amount of home practice was not recorded in most studies. Because daily home practice can alter the "dosage" received, homework should ideally be recorded and reported in future relaxation-based studies. The dose response relationship was not addressed in any of the studies. Future studies should provide more consistent dosing as well as address the dose response relationship and whether a minimum dosage is needed to produce significant results.

Conclusions

There are mixed results for the use of relaxation-based techniques to self-manage emotional stress. This is particularly true with multi-modal relaxation interventions, which had significant effects in twelve high/adequate quality studies across multiple populations, but did not in seven. One population that consistently responds well to multi-modal techniques is women with breast cancer, with four high/ adequate quality studies finding significant reductions in emotional distress in this population. Breast cancer programs may want to consider incorporating multi-modal relaxation interventions into their treatment protocols.

There are too few high quality studies to make determinations about the use of Relaxation Response Training or Easwaran's Eight-Point Program for self-management of emotional distress.

Imagery-based relaxation studies in this review were hampered by methodological shortcomings; only 59% received adequate-quality SIGN scores. Similar to the relaxation-based studies, approximately equal proportions of high quality imagery-based studies reported significant impacts versus no significant effects on measures of emotional distress.

Few of the relaxation-based or imagery-based intervention studies reported on adverse events or effect sizes. Future studies should report on safety, number of practice hours beyond the session (which affects dosage), and effect sizes.

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Section 5: Yoga-based modalities for the self-management of emotional stress

Introduction

'Yoga' describes a spiritual discipline originating from ancient India that consists of a number of yogic practices meant to lead to spiritual liberation. The most well-known of these practices in the West is hatha yoga, a multi-modal mind-body practice. A yoga class usually consists of a sequence of physical postures (asanas), breathing methods (pranayama), meditation (dhyana), and relaxation techniques (savasana) and typically lasts 1 to 2 hours.[1-3]

In terms of physical fitness, yoga is effective for increasing muscular strength and endurance, flexibility and pulmonary function[4]. Evidence also indicates yoga is beneficial for the management of certain conditions such as cancer,[5] diabetes[6] and pain-associated disability[7]. Psychological benefits such as decreasing anxiety,[8] depression[9] and increasing a sense of well-being[10] have also been shown. Evidence suggests yoga can be beneficial for stress, with clinical trials demonstrating yoga to be effective for decreasing sympathetic activity,[11] cortisol levels[12-14] and stress.[14,15]

Yoga in practice is a multi-modal approach typically consisting of techniques that include meditation, breathing exercises aimed at regulating respiration, and the practice of various physical postures and exercises with a main focus on stretching and isometric exercise.[16] An inherent feature of yoga is its ability to induce a generalized down-regulation in somatic arousal, the converse of the stress response.[16] This section focuses on evaluating the quantity and quality of randomized controlled trials that examined the effectiveness of yoga for emotional stress.

Methods

Please refer to Section 1 for a detailed description of the review's methodology.

Results

Study Selection

For the purposes of this review, the reviewers considered yoga as single modality if it was simply described as "yoga" in the study since it was uncertain whether this referred solely to yoga poses. The reviewers considered yoga to be multimodal if it was described in the study as

breathing, imagery, chanting, or meditation in addition to postures or if it was a named form of multi-modal yoga (e.g., Hatha Yoga).

Of the 192 randomized controlled trials yielded from database searches, 13 studies were categorized as yoga-based modalities. Most of the interventions involved specific forms of yoga including Viniyoga,[17] Yoga of Awareness,[18] Tibetan Yoga,[19] Iyengar Yoga,[20] Dru Yoga,[21] Kripalu Yoga[22] and Integrated Approach to Yoga Therapy[23] while others did not specify a particular form of yoga.[24-27] Two studies also included additional modalities such as cooking classes[28] and exercise training.[24,28]

Overall Quality Assessment

According to the SIGN 50 criteria used to assess methodological quality, the majority (85%) of the studies were high quality, with four[17-20] high (+) quality studies, seven[21-24,26,27,29] adequate (+) quality studies, and two[25,28] poor (0) quality studies. The majority of the studies addressed an appropriate and clearly focused research question, randomization procedures, baseline similarities between groups, outcome reliability and validity, and dropouts either adequately or well. Most studies did not address intention-to-treat analyses. Two[17,23] of the 13 studies were multi-site studies; only one study adequately reported site similarities[17] (see ***Section 5, Table 1***).

Section 5, Table 1. SIGN 50 Quality Assessment for Yoga-based Modalities

SIGN 50 Criteria	Percentage (n = 13)		
	Well	Adequate	Poor
Appropriate and clearly focused research question	69% (9)	31% (4)	0% (0)
Randomization	54% (7)	15% (2)	31% (4)
Baseline similarities	85% (11)	15% (2)	0% (0)
Outcome reliability/validity	62% (8)	38% (5)	0% (0)
Percentage of dropouts	38% (5)	31% (4)	31% (4)
Intention-to-treat analysis	23% (3)	8% (1)	69% (9)
Multi-site similarities	84% (0)	8% (1)	8% (1)

Yoga-based Interventions

Studies investigated the use of a yoga-based multi-modal interventions for the self-management of a variety of conditions including emotional stress,[17,20,22,29] coping,[18,28] distress,[19,25,27,28] anxiety,[18,19,21,23-27,29] stress[21] and resilience.[22] See ***Appendix 6*** for a complete description of all studies.

The 11 high/adequate quality (++/+) yoga-based studies [17-24,26,27,29] compared the intervention to a range of control groups including standard care,[22,23] waitlist control (WLC),[18,19,21,24] health education class/ supportive therapy,[20,27,29] mindfulness training,[17] no treatment[17] and an unspecified control.[26] Yoga-based multi-modal interventions were found to be effective in

populations with musculoskeletal pain. For instance, yoga improved coping and anxiety in fibromyalgia patients[18], anxiety in chronic low back pain patients[23] and emotional stress in workers.[17] Hatha yoga was found to have no effect on anxiety, however, a positive effect in stroke survivors.[24] Results for cancer survivors were mixed, with two studies [27,29] reducing stress and anxiety, while two studies[19,20] showed no such improvement. Results for healthy populations were also mixed; a multi-modal yoga intervention effectively reduced stress in 4th and 5th graders[26] as well as stress and anxiety in adults,[21] however, no such results were found for stress reduction and improved resilience in healthy adolescents.[22] Dosages for the studies varied. Most interventions ranged from 40 minutes to two hours, one to three times per week for six to 12 weeks with total contact hours ranging from 12 to 56 hours. Three studies acknowledged adverse events, with one reporting a back spasm[20] and two[23,24] citing none occurred; the remaining studies did not mention adverse events.

Two low (0) quality studies investigated the effectiveness of yoga-based multi-modal interventions compared to usual care in clinical populations.[25,28] Results were mixed; one study[28] reported improvements in coping following 60 weeks of four-hour biweekly yoga sessions plus a seven-day retreat, while the second [25] demonstrated no significant improvements in distress or anxiety following 12 weekly one-hour yoga sessions. Only one study mentioned adverse events, reporting that none occurred.[25]

Discussion

Yoga is one of the most prevalent complementary therapies used within the US. The 2012 National Health Interview Survey (NHIS) found 10% of those surveyed reported using yoga within the past year and yoga use significantly increased in all age groups over the three time points in which the survey was administered since 2002. While yoga is used for many reasons, a recent survey found that the majority respondents reported using yoga for stress management.[30] Yoga as a self-management therapy conveys body-based skills that empower an individual to play an active role in their recovery, and maintain or enhance their health.

- Yoga is effective for emotional stress within certain populations.
- Safety is fairly well established.
- Factors to consider when integrating a program of yoga include: tailoring the program to the target population; dosage of yoga (length/ frequency of sessions, duration of program); and the training and experience of the yoga instructor/therapist

Eleven high/adequate quality and two low quality studies were identified in this systematic review. Overall, the majority of studies found yoga to be effective for stress, a finding consistent with previous reports [31,32]. Significant stress reduction was observed in a range of populations, including chronic pain sufferers, cancer patients, healthy children and adults, and stressed workers.

This review also captured information regarding dosing and control groups. Intervention dose was reported consistently; however, there was wide variation in dose in terms of the frequency

of sessions and overall length of the yoga program. Control comparators also varied, with half the studies utilizing a waitlist control or usual care comparator and the other half utilizing an active comparator (health education, mindfulness, exercise, supportive therapy). It was unclear in most of the studies what the rationale was for their chosen comparators. There have been a number of research efforts aimed at standardizing reporting within the yoga research literature as well as trying to pinpoint which factors may play a role in modifying effects. [33-36] A study of yoga teachers and therapists working in the field mental health and well-being came to consensus on the following themes: yoga approaches should be specifically tailored to the target population; breath regulation is very important; yoga is most beneficial when the different techniques are used with an integrated and individualized approach; and yoga teachers should meet specific training and experience requirements with the targeted populations.[35] Future research should focus on understanding the active components of yoga and providing a clear rationale for the choice of active comparison groups.

Regarding outcome measures, there were a wide variety of outcome tools utilized to capture changes in stress. However, this could be attributed to the methodology of this review, which employed a broad definition of emotional stress, rather than a systemic lack of consistency in stress outcome measures within yoga research. Finally, yoga appears to be safe with minimal adverse events which is similar to recent findings regarding safety.[37]

Conclusions

Overall, yoga was found to be an effective self-management therapy for emotional stress. However, it appears specific factors may be required to ensure its effectiveness. These factors should be considered when implementing and integrating a program of yoga. Additional research to elucidate which factors modify outcome is needed.

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Section 6: Other modalities for the self-management of emotional stress

Introduction

In the preceding chapters, most of the included studies fit into one the following categories of Cognitive-based, Mindfulness-based, Relaxation-based, and Yoga-based modalities. However, there were 19 studies that did not fit neatly into one of these categories. Because the authors felt that it was important to document these studies, they are included in this chapter of "other modalities" for the self-management of emotional stress.

Methods

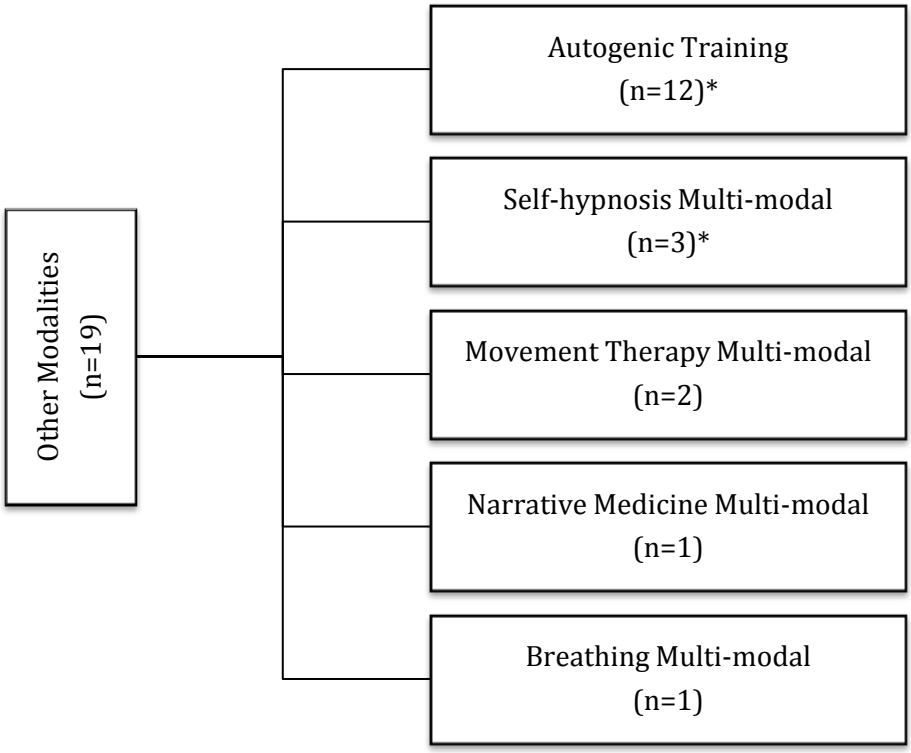
Please refer to Section 1 for a detailed description of the review's methodology.

Results

Study Selection

Of the 192 randomized controlled trials (RCTs) that met the review's inclusion criteria, 18 studies were subsequently categorized as other modalities and included in this section (see ***Section 6, Figure 1*** for Flow Chart). The majority of these studies (64%) used AT as the intervention; the rest of the varied multimodal approaches were in the single digits.

Section 6, Figure 1. Flow Chart of Other Modalities



*One study[1] reported on both AT and self-hypnosis. Therefore, the authors report on18 RCTs describing 19 interventions of interest in this section.

Overall Quality Assessment

SIGN 50 Criteria[2] was used to assess methodological quality. The quality of these studies were fairly equal with nine high quality studies (including three [3-5] high (++), six [1,6-10] adequate (+)) and nine [11-19] low (0) quality studies. The majority of studies addressed a clearly focused research question, baseline similarities between groups, and outcome validity and reliability either adequately or well. Conversely, most studies poorly addressed randomization procedures; dropouts and intention-to-treat analyses indicated that these studies either did not report these procedures or failed to successfully carry them out. The single multi-site study[7] did an inadequate job of addressing similarities between sites (see ***Section 6, Table 1***).

Section 6, Table 1. SIGN 50 Quality Assessment for Other Modalities

SIGN 50 Criteria	Percentage (n = 18)		
	Well	Adequate	Poor
Appropriate and clearly focused research question	61% (11)	33% (6)	6% (1)
Randomization	28% (5)	17% (3)	56% (10)
Baseline similarities	33% (6)	17% (3)	50% (9)
Outcome reliability/validity	78% (14)	17% (3)	6% (1)

Percentage of dropouts	28% (5)	6% (1)	67% (12)
Intention-to-treat analysis	22% (4)	17% (3)	61% (11)
Multi-site similarities	--	--	6% (1)

Autogenic Training

AT is a relaxation technique developed by German psychiatrist Johannes Schultz. Standard AT is a set of self-suggestions to create a sense of heaviness and warmth in the extremities; participants learn to give their bodies mental suggestions to relax and control breathing, blood pressure, heartbeat, and body temperature on their own. It is commonly used to treat sleeping disorders, pain, anxiety, and irritability [10,12,20]. Some of the studies described in this section combine AT with relaxation skills, such as mindfulness, communication skills and progressive muscle relaxation or were a part of a stress management training program. However, since AT includes self-suggestions to calm breathing and induce physical relaxation, it is considered a multimodal CIM technique for the purposes of this review.

AT Results

Twelve studies investigated the use of AT for anxiety[4-6,9,10,12,15,18], distress[1], job stress[7], emotional[16], and emotional stress[17] across a variety of populations including healthy individuals[7,10,11] as well as those with fibromyalgia[4], irritable bowel syndrome[5], tension headache[1], and myocardial infarction[9]. See ***Appendix 7*** for a full description of all studies.

The two high (++) quality studies showed mixed results. One study[4] reported that 18 hours of AT over two months was more effective than usual care in decreasing trait anxiety, while the other study[5] reported that AT (four hours over two months) resulted in no significant improvements in state or trait anxiety when compared to standard care. Neither study mentioned adverse events.

Of the five adequate (+) quality studies, three studies[1,6,9,10] reported that AT effectively reduced anxiety, but only one[10] showed it to be more effective than control conditions (i.e., laughter therapy, no treatment). AT, when compared to a waitlist condition, was found to more effectively reduce distress[1]. Conversely, two studies showed no significant effects: AT did not have an effect on reducing any of four measures of anxiety in cardiac patients[6] nor on perceived job distress in postal workers[7]. Dosages ranged from three to 24 hours over two to three months. There were no reported adverse events in the two studies [7,10] that documented them. Three of the five low quality (0) studies showed that AT was more effective in reducing anxiety than an undescribed control condition[15] or home visits[12] and in lowering emotional stress[16]. No significant reductions in anxiety were found when AT was compared to meditation and an undescribed control[18]. It was also reported to effectively reduce stress[17] but not more than a social activities program. Although one study[18] reported an AT dosage of 10.5 hours over seven weeks, the remaining studies[12,15,17] did not provide adequate dosing information. None of the studies reported on adverse events.

Self-Hypnosis

Hypnosis is an altered state of consciousness in which individuals have heightened focus, absorption, and concentration. Hypnotherapy aims to produce therapeutic change in symptoms, habits, motivations, and lifestyle. It is usually conducted by a trained hypnotherapist with an induction, followed by instructions and suggestions, often incorporating imagery.[21] Hypnosis has been used to reduce symptoms (e.g., pain [22],anxiety[23]), in surgical and dental settings, and to positively change habits (e.g., overeating, smoking). Although typically delivered by a trained practitioner, self-hypnosis can be delivered by repeating a script to oneself or through the use of audio-recordings (i.e., tapes, mp3s or compact discs).[24]

Self-Hypnosis Results

The one adequate (+) quality study[1] reported that a self-hypnosis program was more effective than a WLC and as effective as an AT program in reducing distress of patients with tension headache. Adverse events were not mentioned.

Two low quality (0) studies examined the use of self-hypnosis in healthy populations. The first study[19] reported that 3.5 hours of self-hypnosis, compared to a WLC, significantly reduced stress. The second study[11] reported that self-hypnosis effectively decreased anxiety in medical students but there were no significant differences when compared to a no treatment control group. Dosage was not described, and neither study mentioned adverse events. See ***Appendix 7*** for a complete description of each study.

Movement Therapy Multi-modal

Programs included in this section utilize some form of movement with a CIM technique (e.g., deep breathing, inner quieting, relaxation) to facilitate easier and more efficient movement. Movement therapies such as yoga, tai chi, and Qi Gong are widely used to improve both psychological and physical symptoms such as chronic musculoskeletal pain[25] and physical and/or psychological trauma[26], and are also used for resilience promotion[27] and performance enhancement[28].

Movement Therapy Results

There were two studies that included multi-modal interventions in which movement therapy was the primary modality. The single adequate (+) quality study[8] reported that cognitively-oriented behavioral rehabilitation with Qigong was effective in reducing stress, anxiety, and burnout among individuals on sick leave for burnout; however, when compared with a qi gong only group, there were no differences between groups. The low quality (0) study[14] reported that a multi-modal program including movement therapy, relaxation and meditation was more effective than an unspecified control in reducing anxiety. Neither study made any reference to adverse events (see ***Appendix 7***).

Narrative Medicine Multi-modal

Narrative medicine refers to developing a "sense of story" in practitioners and recognizes that medicine is a story-telling enterprise[29]. Through narrative medicine, patients offer their stories to physicians and practitioners who then reinterpret and try to make sense of these stories. The stories are then presented back to the patient for the purpose of restoring health and wellness[30]. Research has demonstrated that writing about emotionally traumatic experiences is beneficial for improving well-being and healthcare[31].

Narrative Medicine Results

One high (++) quality investigating the use of a multi-modal narrative medicine program did not effectively mitigate stress in healthy students [3]. Adverse events were not mentioned in this study (see ***Appendix 7***).

Breathing Multi-modal

Results

One low quality (0) study[13] showed that both a walking with breathing program and structured bike and strengthening regimen were equally effective in reducing post-surgery anxiety. Adverse events were not mentioned or reported (see ***Appendix 7***).

Discussion

It is challenging to make overarching recommendations for the multimodal relaxation approaches described in this section due to the fact that they represent diverse approaches and represent small numbers of studies. Despite these limitations, the authors decided to include them in the summary of evidence provided in this comprehensive report.

Studies that used AT as an intervention showed mixed results, with fairly equal proportions of reporting significant and non-significant impacts on stress-related outcomes. A possible explanation for these mixed results is that AT has a series of repetitive self-suggestions. Consequently, there are likely some individuals who would be resistant to this directed approach,

Autogenic Training: The results of these 12 studies were mixed: four high quality studies had significant improvements in stress-related outcomes, whereas three had no significant findings. Studies of lower quality were similarly mixed in their results (three significant, two non-significant). Thus, it is challenging to make overall robust conclusions about the overall benefits of AT. Two studies reported no adverse events; thus, there is minimal support for its overall safety.

Self-hypnosis: The single adequate quality study of self-hypnosis showed significant reductions in distress and the two low quality studies also showed significant reductions in anxiety and stress.

Movement therapy: One adequate quality study of a multi-modal qi gong intervention had significant within group reductions in burnout, stress, and anxiety but no between group differences when compared to a qi gong only intervention. In a lower quality study, a multi-modal relaxation program significantly reduced anxiety.

Narrative medicine: One adequate quality study that used a multi-modal narrative medicine intervention showed no significant reductions in stress when compared to a WLC group.

Multi-modal breathing: A single low quality study showed no significant between group differences in anxiety.

whereas others who might be more willing and open to such suggestions and therefore, respond more positively to this modality. The remainder of the studies in this section each had single studies using diverse multi-modal interventions with self-hypnosis, movement therapy, narrative medicine, and breathing techniques. Because of these small numbers, no global recommendations can be made either in favor or against any of these approaches. It's important to keep in mind that this review did not include single modality interventions and these studies are not captured here. They are of value to study when considering possible implementation into such programs for mitigating stress.

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Section 7: Conclusions and Next Steps

Summary

The authors present the analyses of 192 RCTs describing 207 programs with multi-modal self-care CIM modalities to mitigate emotional stress in this comprehensive systematic review. For ease of discussion, we categorized them by their predominant modality: (1) cognitive-based, (2) mindfulness-based, (3) relaxation-based, (4) yoga-based, and (5) other modalities.

The body of literature that was most robust in terms of number of high-quality studies and effectiveness were for two named programs, MBSR and CBSM. Both are well-established programs that require a substantial amount of training before the learned skills can become self-management skills. All types of MBSR (categorized in this review as MBSR classic, MBSR Light, and MBSR Modified) were effective for managing emotional stress and, in particular, anxiety. The scientific rigor of these studies is very high, although the majority of studies compared MBSR to a wait-list control rather than an active comparison group. Similarly, there is strong evidence for CBSM programs in lessening emotional distress. Multi-modal yoga-based studies were of good quality and found to be effective for stress reduction. There were mixed results for relaxation-based techniques, both in terms of quality and effectiveness. AT studies showed moderately good quality, yet mixed effectiveness.

The self-care CIM programs described in this report have potential benefits for both clinical and healthy populations experiencing emotional distress. These self-management skills can help to empower individuals, since they can be practiced in virtually any environment, with minimal time required and at low cost. This may be especially helpful for individuals who are likely to refuse, delay or feel stigmatized by seeking conventional therapies. Such self-management programs are cost-effective strategies to prevent or manage stressors and because they are multi-modal, they may also offer greater appeal than single-modal programs. There are very few to no adverse effects when these self-management skills are properly learned and practiced.

Implications for Program Managers

A fundamental challenge in launching effective programs for program directors and managers in practice is the limited evidence base to guide informed decision-making and implementation. This report describes the spectrum of multi-modal programs with self-care CIM techniques that have been studied to mitigate stress and highlights the strengths and limitations of this literature pool. The authors anticipate that this report will serve as an evidence-based guide to highlight programs where there is reasonably sound evidence to consider implementation. The hope is that this report can serve as a vehicle to stimulate thinking through the required steps

toward the translation of evidence into practice, in order to shape successful programs that can be incorporated into the prevention and treatment of stress-related illness.

Implications for Researchers

The methodological quality of this literature pool suggests that there is room for improvement in future research. Overall, this review included 38 high quality, 81 adequate quality and 72 low quality studies. Because the lowest quality studies have the greatest potential for bias, the reviewers report but do not endorse the results of these studies since their reliability is questionable. Researchers, particularly in the field of CIM research, should consider using CONSORT or STROBE guidelines in the development of their research protocols and in the crafting of their manuscripts to ensure that studies are more methodologically sound and to limit the potential for bias. This would also strengthen the evidence base since adhering to SIGN criteria would also improve the quality of the published literature. The authors hope that stakeholders will critically consider and prioritize the field's research needs to guide the development of a robust future research agenda.

Benefits of this report are two-fold. Not only can stakeholders, vested in research, reflect on the report's content to lay out future research steps but stakeholders, vested in program implementation, can use this content as a foundation for practical decision-making within their own contexts and settings.

Appendix

Appendix 1. Modified SIGN 50 Checklist for Randomized Controlled Trial Study Design

Section 1: Internal validity[1]	
Item[2]	**Criteria**
1.1	The study addresses appropriate and clearly focused question.
1.2	The assignment of subjects to treatment groups is randomized.
1.5	The treatment and control groups are similar at the start of the trial.
1.7	All relevant outcomes are measured in a standard, valid and reliable way.
1.8	What percentage of subjects in each treatment arm dropped out before the study was completed?
1.9	All subjects are analyzed in the groups to which they were randomly allocated (intention-to-treat analysis).
1.10	Where the study is carried out at more than one site, results are comparable for all sites.

Section 2. Overall Assessment

How well was the study done to minimize bias? How valid is the study? Score options: ++, +, and – based on the following

Quality Score	Criteria
High (++)	All or most of the criteria have been fulfilled adequately or well (0 poorly addressed criteria). Where they have not been fulfilled the conclusions of the study are thought *very unlikely* to alter the conclusions.
Acceptable (+)	Some of the criteria have been fulfilled adequately or well (1-2 poorly addressed criteria). Those criteria that have not been fulfilled or not adequately described are thought *unlikely* to alter the conclusions.
Low (0)	Few or no criteria fulfilled adequately or well (3 or more poorly addressed criteria). The conclusions of the study are thought *likely or very likely* to alter.

[1]Each item is evaluated as well covered, adequately addressed or poorly addressed. Item 1.10 can also be marked as not applicable.

[2]Note that items 1.3 (blinding), 1.4 (allocation concealment), and 1.6 (treatment differences) were not assessed as these items were not applicable to our research question/ population. Scoring of SIGN 50 criteria was weighted accordingly because of these modifications.

*Scottish Intercollegiate Guidelines Network (SIGN). SIGN 50: a guideline developer's handbook. Edinburgh: SIGN; 2014.

Appendix 2. Randomized Controlled Trials (n = 192) by SIGN 50[41] score and significance level*

	Significance level						
	P < 0.05			P > 0.05			Total
SIGN Quality Rating:	++	+	-	++	+	-	
Cognitive-based Modalities							
Cognitive Behavioral Stress Management	2	7	6		1		16
Stress Inoculation Training			4		2	4[†]	10
Coping Skills Training		2			3		5
Dialectical Behavior Therapy			1		1		2
Anxiety Management Training			4				4
Unnamed Programs with CBT	2	10	3			3[†]	18
FRIENDS Program					1		1
Mindfulness-based Modalities							
Mindfulness-based Stress Reduction	12	7	5	4	4	2	34
MBCT	2	2		1	1		6
Mind-body Bridging		1					1
Other Mindfulness-based Programs	1		1				2
Vitality Training Program	1						1
Relaxation-based Modalities							
Relaxation Response Training		1	3		1	3	8
Relaxation Multi-modal	1	9[‡]	9	2	6	7	34
Imagery-based Relaxation	4	6[‡]	5		6	6[†]	27
Easwaran's Eight Point Program of Passage Meditation	1						1
Yoga-based Modalities							
Yoga Multi-modal	2	5	1	2	2	1	13
Other Modalities							
Autogenic Training	1	3[§]	3	1	2	2	12
Self-hypnosis		1[§]	1			1	3
Movement Therapy Multi-modal			1		1		2
Narrative Medicine Multi-modal				1			1
Breathing Multi-modal						1	1

*At least one significant between group result reported for a stress-related outcome

[†][42]Iglesias, 2012 low (0) quality score counted three times.

[‡][43]Bridge, 1998 high (+) quality score counted twice.

[§][44]Spinhoven, 1992 high (+) quality score counted twice.

CBT: Cognitive Behavioral Therapy, FRIENDS: (F) feeling worried?; (R) relax and feel good; (I) inner thoughts; (E) explore plans, (N), nice work so reward yourself; (D), don't forget to practice and; (S)

stay calm, you know how to cope now, MBCT: Mindfulness-based Cognitive Therapy.

Appendix 3. Characteristics of cognitive-based modality studies

Citation	Population	Treatment Arms: # Assigned (Drop out %)	Intervention Dose (Total)	Relevant Stress Results	Author's Main Conclusions	Quality
Cognitive Behavioral Stress Management (n = 16)						
Claesson, 2005[6]	198[ab] ischemic heart disease women; mean age = 59.0 (T), 62.0 (C)	*CBSM: 101 (20.8%) UC: 97 (11.3%)	2h x 20/1y (40h)	ELSS (*emotional stress*): significant mean differences between group x time interaction effect, $p = 0.006$ from baseline to FU. **ES** = ND.	A 1y CBSM program is more effective than UC in improving psychological well being in women.	++
McCain, 2008[7]	387[ab] M/F HIV+ individuals; mean age = 42.2	*CB + RLX: ND (ND) TCHI: ND (ND) SPRT: ND (ND) WLC: ND (ND) Overall: 387 (35%)	1.5h x 10/10w (15h + HW ND)	DIS (*coping subscale*): with overall significance of $p < 0.03$ for emotion-focused coping, the RLX and TCHI treatment groups showed significant total treatment effects. **ES =** ND.	Both the RLX group TCHI group were equally more effective than a WLC group in decreasing the use of emotion-focused coping, which suggests that RLX or TCHI are effective for enhancing coping strategies in HIV+ individuals.	++
Antoni, 2009[12]	128 F non-metastatic breast cancer patients; mean age = 50.08 (T), 49.31 (C)	*CBSM: 63 (ND) Condensed educational CBSM: 65 (ND) Overall: 12 (24%)	2h x 10/10w (20h)	HAM-A (*anxiety*): group x time interaction, $p < 0.05$ overall. **ES** = ND.	A 10w CBSM program significantly reduced anxiety in women with breast cancer relative to a condensed education control.	+
Antoni,1991[5] [9]	47[c] healthy gay men; mean age = 32.0 (Seronegative control), 27.5 (Seronegative), 29.2 (Seropositive	*CBSM: ND (ND) Assessment-only: ND (ND)	0.75h x 20/10w (15h)	STAI (*trait anxiety*): no group differences, p = NS at 10w. **ES =** ND. POMS (*anxiety*): no group differences, p = NS at 10w; non-significant group x	A 10w CBSM program did not significantly reduce anxiety in groups of seropositive and seronegative gay men.	+

	control), 33.0 (Seropositive)			serostatus x time interaction. **ES =** ND.		
Antoni, 2006[14]	199[c] F breast cancer patients (Stage III or less); mean age = 50.0	*CBSM + RLX: 92 (22%) Condensed educational CBSM: 107 (19%)	2h x 10/10w (20h + HW ND)	MCOS (*coping*): mean differences between groups in changes from baseline to 10w, $p = 0.06$. **ES**, d = 0.04. MCOS (*relaxation*): mean differences between groups in changes from baseline to 10w, $p = 0.001$. **ES**, d = 0.04.	A mixed CBSM + RLX program covering 10w significantly improved relaxation relative to an education control in female breast cancer patients. The treatment group also showed a NS trend towards improvements in coping.	+
Antoni, 2006[62]	199[c] F non-metastatic breast cancer patients (stage III or below) and surgery within the past 8w; mean age = 50.0	*CBSM + RLX: 92 (19.5%) Condensed educational CBSM: 107 (22.4%)	2h x 10/10w + ND x 1/1y (20h)	HADS (*anxiety*): group effect on slope for anxiety, $p < 0.003$; no significant between group differences at any time. **ES**, d = 0.74. ABS (*emotional distress*): group effect on slope for distress, $p < 0.02$. Group differences, $p < 0.01$ at time 3. **ES,** d = 0.33; 12 mos FU **ES,** d = 0.43.	Relative to an education control, a mixed CBSM + RLX program covering 10w significantly reduced distress, but not anxiety in female breast cancer patients.	+
Berger, 2008[15]	104[ab] M/F HIV-infected persons; mean age = 44.0	*CBSM: 53 (34%) UC: 51 (18%)	2h x 12/12w (24h + HW ND)	HADS (*anxiety*): mean differences between groups, $p = 0.003$, baseline to 12 mos. **ES,** d = 0.52 baseline to 12 mos (moderate).	A 12w CBSM program is more effective than UC in reducing anxiety in HIV+ patients.	+
Gaab, 2003[24]	48[ab] M students; mean age = 24.2 (T), 24.5 (C)	*CBSM: 24 (ND) WLC: 24 (ND)	6h x 2/2d (12h + HW ND)	PSS (*perceived stress*): mean differences between group x time interaction effect, $p < 0.026$ from baseline to post-treatment, with SIT participants showing a reduction in the level of perceived stress. **ES,** f2 = 0.11.	A 2d CBSM program is more effective than WLC in reducing anxiety in healthy college students.	+

Lutgendorf, 1998[31]	52[ac] M HIV+; mean age = 36.75	*GET SMART: 26 (19%) WLC: 26 (30%)	2.25h x 10/10w (22.5h + HW ND)	COPE (*stress coping*): significant group x time interaction for active coping, $p < 0.05$, with the treatment group demonstrating greater improvement in active coping than controls. **ES =** ND.	The GET SMART program significantly improved coping in HIV+ men relative to a WLC with a brief education component.	+
Gaab, 2006[25]	37[ac] M/F healthy 3rd-semester economics students; mean age = ND	*CBSM: 18 (28%) WLC: 19 (22%)	6h x 2/2d (12h + HW ND)	STAI (*anxiety*): between group differences, $p = 0.03$. **ES,** f2 = 0.32.	A 2d CBSM program is more effective than a WLC in reducing state anxiety, but not emotional stress, in healthy college students.	+
Cruess, 2000[39]	62[ac] asymptomatic or early symptomatic HIV-infected gay or bisexual men with a CD4 count 200 cells/mm3 and evidence of comorbid diseases or major psychopathology; mean age = 36.7	*CBSM: 41 (ND) WLC: 21 (ND)	2.5h x 10/10w (25h + HW ND)	POMS (*total mood disturbance-emotional stress*): mean differences between group x time interaction effect, $p < 0.02$ from baseline at 10w. **ES =** ND.	A 10w CBSM intervention significantly reduced emotional stress in HIV+ men relative to WLC.	-
Lopez, 2011[51]	69 (8 M/61 F) chronic fatigue syndrome patients; mean age = 46.0 ± 9.3	*CBSM: 44 (14%) Psychoeducational (PE) seminar: (20%)	2h x 12/12w (24h + HW ND)	PSS (*perceived stress*): significant group x time interaction such that participants in the CBSM condition experienced greater decreases in perceived stress participants in the PE group, $p = 0.028$ baseline to 12w. **ES =** ND.	A 12w CBSM program significantly reduced stress in patients with Chronic Fatigue Syndrome relative to a psychoeducation control.	-
de Anda, 1998[40]	54[c] M/F middle school adolescents; age range = 12 - 14y	*SMT: 36 (ND) Unspecified Control: 18 (ND)	1h x 10/10w (10h + HW ND)	ASCM (*stress*): participants reported a significantly lower degree of stress than controls, $p < 0.05$. **ES =** ND. STAI (*stress*): participants in the SMT	A 10w SMT program significantly reduced anxiety in healthy adolescents when compared to an	-

				group reported a significantly lower degree of state stress than controls, $p <$ 0.05 baseline to post-treatment. **ES =** ND.	undescribed control.	
Hains, 199[44]2	25[a] adolescent boys; age range = 15 - 16y	*CB: 9 (ND) AMT: 8 (ND) WLC: 8 (ND)	40m x 3/3d + ND x 1/ND (2h)	STAI (*anxiety*): significant group differences between intervention vs. control for state anxiety, p = 0.001, and trait anxiety, p = 0.01. **ES =** ND.	A CB intervention program significantly reduced anxiety in healthy male adolescents relative to WLC.	-
Henry, 1997[47]	21 M/F non-insulin dependent diabetic patients; mean age = 59.8	*CBSM: ND WLC: ND	.5h x 6/6w (9h + HW ND)	STAI (*anxiety*): mean differences between group x time interaction effect, p < 0.01 from baseline to post-treatment. **ES =** ND. Hassles Scale (*stress*): group x time interaction, $p <$ 0.01. **ES =** ND. Hassles Scale (*coping*): p = NS. **ES =** ND.	A 6w CBSM program improved anxiety and stress relative to WLC in non-insulin dependent diabetic patients.	-
Berger, 1998[37]	60 M/F university undergraduates; mean age of 19.1 ± .94	*CBSM: ND (ND) Unspecified Control: ND (ND) Overall: 60 (8%)	2h x 2/2w + 1h x 2/2w (6h)	Differential stress inventory (*emotional stress, coping, relaxation*): Significant differences between treatment and control, p = 0.008. **ES =** ND. Undergraduate Student Questionnaire (stress): significant condition x time interaction effect, p = 0.003, as well as a significant main effect for time, $p <$ 0.001. Main effect for condition, p = NS. **ES =** ND.	A 4w CBSM program significantly improved stress in healthy undergraduates relative to an undescribed control. The program did not significantly improve coping or relaxation.	-
Stress Inoculation Training (n = 10)						

Hensel-Dittmann, 2011[28]	28 (gender = ND) patients with post-traumatic stress disorder as a consequence of war and torture; mean age = ND	*SIT: 13 (23%) NET: 15 (27%)	1.5h x 10/13w (15h)	CAPS (*PTSD symptom severity*): CAPS sum score showed a main effect of time, $p = 0.01$, and a significant time-treatment interaction, $p < 0.05$. Symptom reduction appeared in the NET group between pretest and 6 mos FU, **ES,** d = 1.42, and between pretest and 1y FU, **ES,** d = 1.59. For SIT, there was no significant change in the CAPS score; **ES,** d = 0.12 between pretest and the 6 mos FU, d = 0.19 pretest to 1y FU. No between group differences.	The authors did not report any significant findings regarding the effect of SIT on PTSD patients with wartime traumatic experiences. The effect of the treatment and the nature of the control group are unclear.	+
Taylor, 2011[34]	65[a] M, healthy, active duty Navy personnel; mean age = 25.0 ± 0.5	*Psychological skills training: 39 (8%) No treatment: 33 (3%)	40 min x 2/1w (1.3h)	IES-R (*PTSD*): psychological impact decreased from 24h recovery to 1 mos $p < 0.017$, and 3 mos $p < 0.017$. Psychological impact decreased from 1 mos to 3 mos, $p < 0.017$. No interaction or group effects between psychological skills training vs. control relative to this recovery pattern. **ES,** partial $\eta^2 = 0.78$.	Psychological skills training did not reduce PTSD symptomatology relative to a no treatment control in active duty sailors.	+
Mace, 1989[52]	22[c] female gymnasts; age range = 18 - 23 years	*SIT: 11 (18%) Hand-eye coordination exercises control: 11 (18%)	0.5-0.75h x 7/2w (3.5h-5.25h)	Parental Stress Scale (*emotional stress*): Significant difference between SIT and control groups in self-reported stress, $p < 0.01$; group x time interaction significant, $p < 0.05$. SIT group performed better than the control even when accounting for pre-intervention differences, $p < 0.05$ at ground level and $p < 0.01$ at 1.5 meters. **ES** = ND.	SIT significantly reduced stress in female gymnasts relative to an active control.	-
Glanz, 1994[43]	73[c] (gender = ND) university learning-	*SIT: ND (ND)	1.5h x 3/ND (4.5h + HW ND)	SADS (*anxiety*): post-hoc analysis indicated a significant decrease	SIT did not improve test anxiety in learning disabled	-

	disabled students; age range = 18 - 55y	Skills training: ND (ND) Combination training: ND (ND) No training control: ND (ND)		between pretreatment & FU, $p < 0.05$. No between group differences. **ES =** ND.	students more than a skills training, combination training, or no treatment control.	
Haug, 1987[46]	36[c] M/F subjects selected with a phobia for flying; mean age = 42.0	*SIT: 6 (0%) Applied relaxation (AR): 5 (0%) Unspecified control: 25 (0%)	0.75h x 8/4w (6h+ HW ND)	VAS (*anxiety*): mean self-ratings during the pre- and post-treatment revealed a significant main-effect of treatment, $p < 0.01$ with no significant differences between the groups. **ES =** ND.	SIT did not significantly alter anxiety in patients with aviophobia relative to AR or an undescribed control.	-
Kiselica, 1994[49]	48 M/F 9th grade white students from a public high school in a rural community	*SIT: 24 (0%) Group guidance class control: 24 (0%)	1h x 8/8w (8h + HW ND)	STAI (*trait anxiety*): treatment group showed significantly lower scores compared to control, $p < 0.001$. **ES =** ND. Symptoms of Stress Inventory (*stress symptoms*): treatment group showed significantly lower scores compared to control, $p < 0.01$. **ES =** ND.	SIT reduced stress in healthy high school students when compared to regularly scheduled guidance classes.	-
Kooken, 1984[50]	35[c] (gender = ND) students enrolled in degree/non-degree programs at community colleges who have problems with test anxiety; mean age = 57.4	*SIT: 11 (0%) Attention placebo: 15 (40%) WLC: 9 (0%)	ND	STAI (*anxiety*): p = NS Test Anxiety Scale (*test-anxious behaviors*): significant main effects for group, $p < 0.05$, and main effects for time, $p < 0.05$. Substantial yet NS group x time interaction, $p = 0.07$ with declines in SIT and attention placebo groups but not in WLC group. **ES =** ND.	SIT showed a NS trend towards reducing anxiety in students with test anxiety when compared with WLC, but not when compared with an attention control.	-

Hains, 1994[45]	21[a] M/F high school students in Midwestern city; mean age = ND	*SIT: 11 (ND) WLC: 10 (ND)	50 min x 13/ND (10.84h)	STAI (*state and trait anxiety*): borderline significant group x level interactions on trait anxiety, $p = 0.076$. High emotional arousal youths in training group obtained lower trait anxiety scores after training than the WLC high emotional arousal group, $p = 0.033$. No differences between low emotional arousal youths in the training and WLC conditions. Borderline significant group main effects obtained on trait anxiety, $p = 0.089$. Pre-training to FU within group results for the high emotional arousal training group showed borderline significant reductions in state anxiety, $p = 0.088$ and trait anxiety, $p = 0.013$. No statistically significant differences for low emotional arousal training group. **ES =** ND.	SIT showed a NS trend towards reducing anxiety in high school students when compared with WLC.	-
Flaxman, 2010[42]	107 (30 M/77 F) participants with above average levels of distress; mean age = 39 ± 8.1	*SIT: 37 (38%) ACT: 37 (49%) WLC: 33 (27%)	SIT: 3h x 2/2w ACT: 3h x 2/2w (6h)	GHQ (*distress*): $p < 0.01$ at 3 mos (SIT vs. controls). **ES**. SIT, d = 1.21.	SIT program significantly reduced distress relative to a WLC, but did not significantly differ from ACT.	-
Iglesias, 2012**[4]	56[a] (13 M/39 F) undergraduates; mean age = 23.0	RRGI: 14 (14%) CB-SIT: 14 (7%)	RRGI: 1.5-2h/ 10w (15-20h) CB-SIT: 1.5-2h/ 10w (15-20 + HW ND)	STAI (*state/ trait anxiety*): state anxiety was reduced compared to control, $p = 0.024$; trait anxiety within group reduction, $p < 0.013$ at post-intervention, between groups, p = NS. **ES,** state anxiety - partial $\eta^2 = 0.133$, trait anxiety - partial: $\eta^2 = 0.136$.	The CB-SIT program significantly reduced anxiety relative to a WLC, but was not significantly different from the RRGI program or the RRGI + CB program.	-

		RRGICB: 14 (0%) WLC: 14 (7%)	RRGICB: 1.5-2h/ 10w (15-20h)			
Coping Skills Training (n = 5)						
Berry, 2011[16]	56[a] mothers and their 56 (22 M/34 F) children from Mexico; mean age = 29.7 ± 5.3 (mothers), 3.1 ± 1.1 (children)	*CST: ND (ND) WLC: ND (ND)	1h x 12/12w + 1h x 3/ND (15h + HW ND)	The Health Promoting Lifestyle Profile II (*emotional stress*): stress management, *p* = NS at 9 mos. **ES =** ND.	CST did not reduce stress in healthy Mexican mother/child dyads relative to WLC.	+
Grey, 2011[35]	181[a] (53 M/74 F/54 ND) parents of pre-adolescent children with type 1 diabetes; mean age = 8.0 ± 2.8	*CST: 106 (25%) Group education: 75 (33%)	1.5h x 6/ND (9h)	Issues in Coping With IDDM-Parent Scale (*coping*): *p* = NS. **ES =** ND.	CST did not improve coping relative to an education control for parents of pre-adolescent children with type 1 diabetes.	+
Grey, 2009[70]	111[ac] (32 M/50 F) children with type 1 diabetes; mean age = 9.9	*CST: 65 (18%) Group education control: 46 (33%)	1.5h x 6/6w (9h)	Issues in Coping type 1 diabetes-Child Scale how hard to handle subscale (*coping*): *p* = NS at 1y. **ES =** ND. Issues in Coping type 1 diabetes-Child Scale coping upsets me subscale (*coping*): *p* = NS at 1y. **ES,** d = 0.41.	CST did not improve coping relative to an education control for children with type 1 diabetes.	+
D'Eramo Melkus, 2010[21]	109[a] F patients with type 2 diabetes; mean age = 46.0	*CST: 57 (30%) UC: 52 (29%)	2h x 6/ND + 1h x 5/ND (17h)	Crown-Crisp Index (*anxiety*): *p* = 0.001 over time. **ES =** ND.	CST significantly reduced anxiety in patients with type 2 diabetes relative to usual care.	+
Fukui, 2000[23]	50[ac] F breast cancer patients; mean age = 52.6 (T), 54.3 (C)	*CST: 25 (8%) WLC: 25 (8%)	1.5h x 6/6w (9h + HW ND)	POMS (*distress*): *p* = 0.03 between groups. Scores in the experimental group were significantly lower than in the control group both at 6w, *p* < 0.01 and at 6 mos, *p* < 0.009; *p* = NS group x time at baseline, 6w, 6 mos FU. **ES =**	CST significantly reduced distress in female breast cancer patients relative to WLC, but did not reduce anxiety.	+

				ND. HADS (*anxiety*): *p* = NS between groups, *p* = NS group x time baseline, 6w, 6 mos FU. **ES =** ND.		
Dialectical Behavior Therapy (n = 2)						
Feigenbaum, 2012[22]	42[a] (11 M/30 F/1 ND) borderline personality disorder patients; mean age = 35.0 ± 7.6	*DBT: 26 (58%) Standard care control: 16 (12%)	3.5h x 52w (182h)	Modified PTSD scale (*PTSD symptom severity*): PTSD ANOVA, *p* = 0.07, **ES =** ND. Modified PTSD scale (*PTSD symptoms*): *p* = NS. **ES =** ND.	The DBT intervention did not significantly decrease PTSD symptoms severity in patients with borderline personality disorder when compared to treatment as usual.	+
Shelton, 2009[55]	124 (90 M/34 F) prison inmates with impulsive behavior problems; mean age = 28.0 ± 10.2	*DBT: ND (ND) Case management control: ND (ND) Overall: 124 (49%)	0.5h x 8w (4h + HW ND)	WCCL seeking social support subscale (*coping*): *p* = 0.037 at 6 mos. **ES** = ND. WCCL accepting responsibility subscale *(coping*): *p* = 0.024 at 6 mos. **ES =** ND. WCCL planful problem solving subscale (*coping*): *p* = 0.023 at 6 mos. **ES =** ND. WCCL escape-avoidance subscale (*coping*): *p* = 0.039 at 6 mos. **ES =** ND. WCCL confrontational coping subscale (*coping*): *p* = NS at 6 mos. **ES =** ND. WCCL self-control subscale (*coping*): *p* = NS at 6 mos. **ES =** ND.	The DBT intervention was effective in improving some coping skills (seeking social support, accepting responsibility, planful problem solving, escape-avoidance), but not on others (confrontational coping, self-control, distancing, positive reappraisal), when compared with control inmates receiving case management.	-

				WCCL distancing subscale (*coping*): *p* = NS at 6 mos. **ES =** ND. WCCL positive reappraisal subscale (*coping*): *p* = NS at 6 mos. **ES =** ND.		
Anxiety Management Training (n = 4)						
Piazza-Waggoner, 2003[54]	26[ac] M/F second-year dental students; mean age = ND	*AMT: ND Attention control: ND Overall: 26 (ND)	1h x 1/ND (1 h + HW ND)	VAS (*relaxation*): Significant difference between groups, $p < 0.05$ showing attention control rated themselves as better able to relax during the procedure than AMT group. **ES** = ND. STAI (*state anxiety*): between groups, NS, *p* = ND. **ES** = ND.	AMT did not reduce anxiety in dental students compared to an attention control, but did improve their ability to relax during a procedure.	-
Van Hassel, 1982[56]	39[c] (gender = ND) schizophrenic diagnoses (62% chronic undifferentiated subtype, 28% paranoid subtype, 10% other forms of schizophrenia); mean age = 47.5	*AMT: 14 (ND) RLX: 13 (ND) WLC: 12 (ND)	0.75h x 6/6w (4.5h)	STAI (*anxiety*): post-hoc mean anxiety scores for both the AMT and RLX group were significantly less than WLC mean, $p < 0.05$, but did not differ significantly from each other. **ES =** ND.	AMT reduced anxiety in schizophrenic patients relative to WLC, but did not show any benefit over a RLX control.	-
Wilson, 1986[57]	60[ac] (gender = ND) sixth and seventh grade students enrolled in one public middle school who were anxious about tests; mean age = ND	*AMT: 12 (0%) Study skills counseling: 12 (25%) Modified AMT: 12 (8.3%) Attention-placebo	0.75h x 6/3w (4.5h)	TASC (*anxiety*): significant posttest and FU improvements for both modified anxiety management and anxiety management training compared to both control procedures, $p < 0.05$. **ES =** ND.	Both AMT and Modified AMT successfully reduced test anxiety in public school students when compared to placebo, attention, and no contact controls.	-

		control: 12 (16.6%) No-contact control: 12 (0%)				
Hutchings, 1980[48]	70[c] M/F students enrolled in general psychology at the university of Kansas in 1977 who scored highly on anxiety measures; mean age = ND	*AMT: ND (ND) RLX: ND (ND) Placebo: ND (ND)	75m x 6/6w (7.5h + HW ND)	STAI (*anxiety*): AMT scored significantly lower than subjects in the relaxation-only, placebo and untreated control conditions, $p < 0.01$. Applied relaxation scored significantly lower than subjects in the untreated control condition. **ES =** ND. Manifest Anxiety Scale (*anxiety*): AMT group obtained significantly lower scores than subjects in the relaxation-only condition, p = NS. ASQ frequency subscale (anxiety): AMT group had significantly lower scores than untreated control subjects, $p < 0.051$. **ES =** ND ASQ intensity subscale (*anxiety*): subjects in both the AMT and relaxation-only conditions had significantly lower scores than subjects in the untreated control condition, $p < 0.05$. **ES =** ND. ASQ interference subscale (*anxiety*): subjects in the AMT group obtained significantly lower scores than subjects	AMT significantly reduced anxiety in high-anxiety college students, and maintained this favorable comparison relative to placebo and relaxation controls.	-

				in the placebo and untreated control conditions, and subjects in the applied relaxation, $p < 0.01$. **ES =** ND.		
Unnamed Programs (n = 18)						
Mueser, 2008[71]	108[ab] M/F severe mental illness patients; mean age = 44.21	*CBT: 54 (20%) TAU: 54 (0%)	ND	BAI (*anxiety*): between groups analysis CBT vs. TAU $p < 0.03$ baseline vs. post-intervention. **ES =** ND. CAPS (*PTSD*): between groups analysis CBT vs. TAU, $p < 0.05$ baseline vs. post-intervention. For participants with severe PTSD (CAPS > 65), p = NS, and < 65, $p < 0.004$. **ES,** for both CAPS-Total increased, from d = 0.45 to d = 0.59 and in CAPS-diagnosis from d = 0.27 to d = 0.40. Subset with mild- moderate PTSD (CAPS <65) the effect sizes decreased to d = 0.12 and d = 0.10, respectively.	The CBT intervention was more effective than treatment as usual at decreasing anxiety and PTSD in patients with severe mental illness.	++
Zautra, 2008[9]	144[ac] M/F RA patients; mean age = 46.17 ± 12.70 (M), 51.00 ± 10.74 (CBT for pain), 51.43 ± 13.89 (Education)	*CBT for pain: 52 (3.8%) MMER: 48 (8.3%) Education control: 44 (2.3%)	2h x 8w (16h + HW ND)	Coping efficacy (*coping*): significant double interaction, $p < 0.01$, such that participants in both the MMER therapy and CBT for pain conditions experienced greater increases in pain coping efficacy from pre to post than did those in the education-only group condition. **ES** = ND.	The CBT for Pain program was more effective than an education control at increasing coping efficacy for pain, but did not significantly differ from a MMER Program.	++
Andersson, 2012[10]	21 (5 M/16 F) chronic pain patients; mean age = 72 ± 4.6	*CBT: 11 (0%) WLC: 10 (20%)	2h x 6/ 6w (12h + HW ND)	CSQ diverting attention subscale (*coping*): p = NS at 7w. **ES =** ND. CSQ reinterpret pain sensations subscale (*coping*): p = NS at 7w. **ES =**	The CBT-based intervention led to significant improvements in the ability to decrease pain relative to WLC, but failed to impact	+

				ND. CSQ coping self-statements subscale (*coping*): *p* = NS at 7w. **ES =** ND. CSQ ignore pain sensations subscale (*coping*): *p* = NS. **ES =** ND. CSQ praying or hoping subscale (*coping*): *p* = NS. **ES =** ND. CSQ catastrophizing subscale (*coping*): *p* = NS at 7w. **ES =** ND. CSQ increase activity level subscale (*coping*): *p* = NS at 7w. **ES =** ND. CSQ control over pain subscale (*coping*): *p* = NS. **ES =** ND. CSQ ability to decrease pain subscale (coping): *p* < 0.01 at 7w. **ES,** d = 1.7 HADS (*anxiety*): *p* = NS at 7w. **ES =** ND. Anxiety Sensitivity Scale (*anxiety*): *p* = NS at 7w. **ES =** ND.	additional coping measures, distress, or anxiety.	
Blom, 2009[17]	247[a] F patients who were consecutively hospitalized for acute myocardial infarction (AMI), percutaneous	*CBT: 113 (7%) UC: 122 (11%)	2h x 20/ 1yr (40h + HW ND)	Everyday Life Stress Scale (*emotional stress*): *p* = 0.27 at 10w, *p* = 0.05 at 1y, *p* < 0.01 at 1-2y. **ES =** ND.	In the short term, the CBT program was not effective. Long-term daily stress levels were decreased at 1y and 1-2y compared to	+

	transluminal coronary angioplasty, or coronary artery bypass grafting; mean age = 62.0 ± 9.0				controls; however, the intervention group started with higher values at baseline. Due to regression toward the mean, there is no evidence that the intervention decreased daily stress behavior.	
Deckro, 2002[20]	128[ac] (51 M/77 F) students; mean age = 24.0	*RRT + CBT: 63 (13%) WLC: 65 (16%)	1.5h x 6/ND (9h + HW ND)	SCL-90-R GSI (*psychological distress*): between groups from baseline to post-intervention showed significant improvement for intervention vs. control, $p = 0.018$. **ES** = ND. STAI (*state anxiety*): within group differences, $p = 0.001$. **ES =** ND. PSS (*stress*): significant within group difference in pre-post scores for intervention vs. control, $p = 0.008$. **ES =** ND.	RRT + CBT significantly improved distress in healthy college students relative to WLC.	+
Salloum, 2012[33]	72[a] (39 M/31 F) children who experienced different types of potentially traumatic events; mean age = 9.6 ± 1.52	* GTI-CN: 39 (8%) GTI-C: 33 (3%)	ND	UCLA-PTSD RI (*PTSD*): GTI-CN, $p < 0.001$ at 12 mos; GTI-C, $p < 0.016$ at 12 mos. **ES =** ND. Global distress (*distress*): $p < 0.001$ at 12 mos. **ES =** ND.	Despite within group improvements in both groups, the GTI-CN intervention did not lower distress significantly better than the GTI-C group.	+
Turner, 2011**[5]	191[ac] F TMD patients; mean age = 27.7 ± 6.7	*SMT: 60 (23.3%) *Targeted SMT: 57 (17.5%)	SMT/ Targeted SMT: (1.5h x 2/ 4w) + (10m x 6/ 17w) = (4h +	CSQ (*coping*): $p = 0.0004$ at 6 mos. **ES =** ND.	The SMT program and the Targeted SMT program both significantly improved coping relative to a	+

		Continuous oral contraceptive therapy control: 74 (66.2%)	HW ND)		continuous oral contraceptive therapy control, but did not significantly differ from each other.	
O'Leary, 1988[32]	33[c] female RA patients; mean age = 49.3	*CBT: 17 (ND) Education: 16 (ND) Overall: 33 (13%)	2h x 5w (10h)	PSS (*emotional stress, coping*): pre and post differences in the treatment group for stress, $p < 0.05$, and for coping $p < 0.01$; no differences observed between groups. **ES =** ND.	Despite within-group improvements, the CBT intervention was not more effective than an information control at decreasing stress or increasing coping.	+
Lee, 2006[30]	31[ac] (gender =ND) chronic schizophrenia inpatients of a psychiatric center and who engaged in level 4 or 5 of the center's part time paid job program; mean age = 34.9	*Work-related SMT: ND (ND) No treatment: ND (ND) Crossover: 31 (6.5%)	Work-related SMT: 1h x 12w (12h + HW ND)	WSQP (*stress*): between groups analysis baseline to 12w showed a significant and large difference between Groups A and B, $p = 0.0039$. Pooling data from both 12w treatment periods, the results suggested a significant and large treatment effect for the change in total WSQP scores $p = 0.0034$. **ES =** ND.	The work related SMT had significant large positive effects on patients' perceived work related stress.	+
Heiden, 2007[27]	75[ab] M/F patients on sick leave for at least 50% of the time for stress-related diagnoses; mean age = 44.0	*CBT: 28(28%) Physical activity: 23 (4.3%) UC: 24 (8.3%)	3h x 2 x 10w (60h + HW ND)	Shirom-Melamed Burnout Questionnaire (*burnout*): all groups, $p = 0.002$ baseline to FU; CBT group reduced their burnout ratings compared with the control group by end of intervention, $p = 0.024$, $p = 0.062$ at 6 mos. **ES =** ND.	The CBT group significantly reduced their burnout ratings compared with the UC group.	+
Kroener-Herwig, 2002[29]	85[c] M/F pediatric headache patients; mean age = 12.1	*CBT- therapist: 30 (ND) CBT- self-help: 35 (ND)	1.5h x 8w (12h)	The Stress Questionnaire coping with stress subscale (*coping*): statistically significant improvement in both	The CBT therapist administered group format significantly reduced stress	+

		WLC: 20 (ND) Overall: 85 (12%)		therapist-administered and self-help format compared to WLC overall, *p* = 0.032. **ES =** ND.	as compared to the WLC.	
Deblinger, 2011[19]	210[a] (82 M/128 F) child survivors of childhood sexual abuse; mean age = 7.7 ± 2.1	*Trauma narrative trauma-focused CBT, 8w: 52 (25%) *Trauma narrative trauma-focused CBT, 16w: 52 (15%) Without trauma narrative trauma-focused CBT, 8w: 52 (23%) Without trauma narrative trauma-focused CBT, 16 Wks: 54 (35%)	(1.5h x 8w) + (1.5h x 16w) = (36h)	MASC (*anxiety*): 8w trauma narrative vs. 8w without trauma narrative, length x trauma narrative. *p* < 0.001. **ES,** d = 0.55.	Children assigned to the 8w trauma narrative group reported less anxiety at posttreatment when compared to the children assigned to the 8w without trauma condition.	+
Wood, 2006[58]	40[ac] (gender = ND) children with high anxiety living in a major metropolitan area of the western US; mean age = 9.85	*CBT: ND (ND) Family-focused CBT: ND (ND) Child-focused CBT: ND (ND)	60-80m x 12-16 sessions (12-21.3h)	Anxiety Disorders Interview Schedule for DSM-IV Child parent version (*anxiety*): child behavior checklist all *p* < 0.001 on school performance. **ES =** ND. Multidimensional Anxiety Scale for Children (*anxiety*): *p* = ND. **ES** = ND	No between group results reported for anxiety amongst the three CBT interventions in middle school aged children.	-
Fecteau, 1999[41]	24[ac] M/F patients with post-traumatic stress	*CBT: 13 (30%)	2h x 4w (8h + HW ND)	BAI (*anxiety*): score improved significantly more in the intervention	The CBT intervention was more effective than a WLC	-

	disorder following motor vehicle accidents; mean age = 41.3	WLC: 11 (10%)		group as compared to WLC, $p < 0.05$. **ES =** ND.	at decreasing anxiety in patients with PTSD.	
Anson, 2006[36]	33[ac] M/F individuals who had sustained a TBI and who had received outpatient therapy; mean age = ND	*CBT: ND (ND) WLC: ND (ND)	1.5h x 2/ 5w (15h + HW ND)	Coping Scale for Adults (*adaptive coping*): significant time x group interaction effect, $p < 0.01$. Significant main effect of time, $p < 0.001$, but no main effect of group, $p > 0.05$ or a group x time interaction effect, $p > 0.05$, indicating that the effect of treatment was comparable for both groups. Significant decrease in adaptive coping between post-intervention and 5 wk FU, $p < 0.05$. **ES =** ND.	The coping skills group intervention was not more effective than the control group at improving coping.	-
Crouch, 2008[38]	120[ac] M/F impoverished persons in South Africa; age = ND	*Combination approach (P1): 30 (ND) Physical approach (P2): 30 (ND) Cognitive approach (P3): 30 (ND) Creative, activity based program (P4): 30 (ND)	Multimodal Program 1: 1.5h x 4/ 4w (6h)	Questionnaire 1 (*stress*): At post test, the stress levels of the P1 group were significantly lower than P2, $p < 0.001$, P3, $p < 0.001$, and P4, $p < 0.001$. This reduction was maintained at FU only compared to P2, $p < 0.001$. **ES =** ND.	The P1 combination program of practical, physical, and cognitive stress management strategies significantly reduced stress relative to several other groups, including a RLX multi-modal group, a cognitive approach group, and a creative activity-based group.	-
Mosley, 1995[53]	Tension headache sufferers[c] (N = ND) with a 37 year headache chronicity average; age range = 60 - 78y	*RLX + CBT: 13 (15%) RLX: 12 (17%) Headache monitoring WLC: 12 (25%)	RLX + CBT: 1h x 12w (12h + HW ND)	STPI (*anxiety*): RLX + CBT program reduced symptoms of anxiety $p < 0.03$ compared to the HMC control but not compared to the RLX treatment group. **ES =** ND.	The RLX + CBT group program significantly reduced anxiety relative to a WLC, and stressful life events relative to a relaxation group and WLC.	-

				WSI (*stress*): Patients in the RLX + CBT group reported significantly fewer stressful events post-treatment than the RLX group, $p < 0.05$, and HMC group, $p < 0.05$. **ES =** ND.		
Iglesias, 2012**[4]	56[a] (13 M/39 F) undergraduates; mean age = 23.0	RRGICB: 14 (0%) RRGI: 14 (14%) CB-SIT: 14 (7%) WLC: 14 (7%)	RRGICB Group: 1.5-2h/ 10w (15-20h) RRGI Group: 1.5-2h/ 10w (15-20h) CB (SIT) Group: 1.5-2h/ 10w (15-20 + HW ND)	STAI (*state/ trait anxiety*): state anxiety, p = NS; trait anxiety between groups, $p < 0.043$ compared to control. **ES,** state anxiety - partial $\eta^2 = 0.133$, trait anxiety - partial $\eta^2 = 0.136$.	The RRGICB program significantly reduced anxiety relative to a WLC, but did not significantly differ from the CB Program or the RRGICB Program.	-
FRIENDS Program						
Cooley-Strickland, 2011[18]	93 (48 M/45 F) African American public elementary students exposed to community violence; mean age = 9.0 ± 1.08	*FRIENDS CBT: 48 (0%) WLC: 45 (0%)	1h x 13/ 6.5w (13h + HW ND)	Revised Children's Manifest Anxiety Scale (*anxiety*): significant reductions in anxiety for both groups, $p < 0.01$ post-intervention. Group x time interaction, p = NS. **ES =** ND.	Despite within group improvements, the FRIENDS intervention (a cognitive-behavioral anxiety intervention program) was not more effective than a WLC at decreasing anxiety in African American children.	+

*intervention of interest

**reports on multiple cognitive-based interventions of interest

[a]informed consent obtained, [b]authors report power achieved, [c]authors report power not achieved

ABS: Affect Balance Scale, ACT: Acceptance and Commitment Therapy, AMI: Acute Myocardial Infarction, AMT: Anxiety Management Training, ASCM: Adolescent Stress and Coping Measure, ASQ: Anxiety Screening Questionnaire, BAI: Beck Anxiety Inventory, C: Control, CAPS: Clinician Administered PTSD Scale, CB: Cognitive Behavioral, CBT: Cognitive Behavior Therapy, CBSM: Cognitive Behavioral Stress Management, CSQ: Coping Strategies Questionnaire, CST: Coping Skills Training, D: Day(s), DBT: Dialectical Behavioral Therapy, DIS: Dealing with Illness Scale, ELSS: Everyday Life Stress Scale, ES: Effect size, F: Female, FU: Follow-up, FRIENDS: (F) feeling worried?; (R) relax and feel good; (I) inner thoughts; (E) explore plans, (N), nice work so reward yourself; (D), don't forget to practice and; (S) stay calm, you know how to cope now, GET SMART: Group Experienced Therapy for Stress Management and Relaxation Training, GHQ: General Health Questionnaire, GTI-CN: Grief and Trauma Intervention-Coping skills + trauma Narrative processing, GTI-C: Grief and Trauma Intervention-Coping skills only, H: Hour(s), HADS: Hospital Anxiety and Depression Scale, HAM-A: Hamilton Anxiety Rating Scale, HIV: Human Immunodeficiency Virus, IES-R: Impact of Event Scale-Revised, M: Male, MASC: Multidimensional Anxiety Scale for Children, MCOS: Measurement of Current Status, MIN: Minute(s), MMER: Mindfulness Meditation and Emotion Regulation therapy, MOS: Months, ND: Not Described, NET: Narrative Exposure Therapy, POMS: Profile of Mood States, PSS: Perceived Stress Scale, PTSD: Post-traumatic Stress Disorder, RA: Rheumatoid Arthritis, RLX: Relaxation, RRGI: Relaxation Response, meditation, and Guided Imagery techniques, RRGICB: Relaxation Response, Guided imagery and CB techniques, RRT: Relaxation Response Therapy, SADS: Social Avoidance and Distress Scale, SCL-90-R GSI: Symptoms Checklist- 90-Revised Global Severity Index, SIT: Stress Inoculation Training, SMT: Stress Management Training, SPRT: Spiritual Growth, STAI: State Trait Anxiety Inventory, STPI: State-trait Personality Inventory, T: Treatment, TASC: Test Anxiety Scale for Children, TBI: Traumatic Brain Injury, TCHI: focused Tai Chi training, TMD: Temporomandibular Disorder, UC: Usual Care, UCLA-PTSD RI: University of California at Los Angeles Posttraumatic Stress Disorder Reaction Index, VAS: Visual Analog Scale, WCCL: Ways of Coping Checklist, W: Week(s), WLC: Wait List control, WSI: Weekly Stress Inventory, WSQP: Work related Questionnaire for chronic Psychiatric patients, Y: Year(s)

Appendix 4. Characteristics of mindfulness-based therapy studies

Citation	Population	Treatment Arms: # Assigned (Drop out %)	Intervention Dose (Total)	Relevant Stress Results	Author's Main Conclusions	Quality
MBSR Classic (n = 16)						
Carmody, 2011/2012[6,8]	110[a] F patients in late menopausal transition and early post-menopause; mean age = 53.0	*MBSR: 57 (12%) WLC: 53 (6%)	2.5h x 8w (20h + HW ND)	HADS (*anxiety*): $p < 0.005$. **ES =** ND. PSS (*perceived stress*): $p < 0.001$ at 9w. **ES =** ND.	MBSR reduced anxiety and stress in post-menopausal women when compared with WLC.	++
Duncan, 2012[8]	76[a] (64 M/12 F) English-speaking HIV positive adult M/F on ART who reported distress; mean age = 48.0 ± 7.9	*MBSR: 26 (58%) WLC: 16 (12%)	3h x 8/3m + 6h x 1/1d (30h + HW 42h)	AIDS Clinical Trials Group symptom checklist (*distress*): group x time interaction for side effect-related distress $p < 0.0001$; group x time interaction for symptoms and bother attributable to ART $p < 0.023$. **ES =** ND. PSS (*emotional stress*): p = NS at 3 mos. **ES =** ND.	MBSR reduced general distress and symptom-related distress, but not emotional stress, when compared with WLC for HIV+ patients.	++
Hoffman, 2012[11]	229[ab] F breast cancer patients (Stage 0-III); mean age = 49.6	*MBSR: 114 (10%) WLC: 115 (3%)	2.25h x 2/2w + 2h x 6/6w + 6h x 1/1d (22.5h + HW ND)	POMS (*anxiety*): $p < 0.001$ at 8w; $p < 0.001$ at 12w. **ES =** ND.	MBSR reduced anxiety in female breast cancer patients when compared with WLC.	++
MacCoon, 2012[13]	63[ab] (16 M/43 F) healthy adults; mean age = 46.0	*MBSR: 31 (3%) Health enhancement program control: 32 (13%)	3h x 2/2w + 2.5h x 6/6w + 7h x 1/1d (28h + HW ND)	SCL-90-R GSI (*distress*): significant time intervention interaction $p = 0.01$. Significant intervention x time interaction between Time 2 and Time 3, $p = 0.002$, indicating control	MBSR did not reduce general distress or anxiety relative to a health enhancement program in healthy	++

				showed decreasing symptoms of depression from Time 2 to Time 3 relative to MBSR participants who showed increasing depressive symptoms over the same time period. No group differences at any time. **ES,** η2 = 0.09. SCL-90-R (*anxiety*): Significant main effect of time *p* = 0.02, indicating that anxious symptoms decreased over time but no effect of intervention. **ES,** η2 = 0.08.	adults.	
Pbert, 2012[16]	83[ac] (27 M/56 F) asthma patients; mean age = 52.8	*MBSR: 42 (14%) Healthy living course control: 41 (7%)	2.5h x 8/8w + 6h x 1/1d (26h + HW 24h)	PSS (*emotional stress*): *p* = 0.001 at 12 mos. **ES =** ND	MBSR reduced stress more than a healthy living course in asthma patients.	++
Pradhan, 2007[17]	63[ab] M/F RA patients; mean age = 54.0	*MBSR: 31 (7%) WLC: 32 (7%)	2.5h x 8/8w + 8 h x 1/1d (28h + HW ND)	SCL-90-R (*distress*): significant mean differences between groups for intervention, *p* = 0.04 at 6 mos. **ES =** ND.	MBSR reduced distress in RA patients when compared with WLC.	++
Wong, 2011[20]	100[ab] (gender = ND) patients with chronic pain of any etiology; mean age = 47.9 ± 7.8	*MBSR: 51 (19.6%) UC: 49 (10.2%)	2.5h x 8/8w + 7h x 1/1d (19h + HW ND)	POMS (*tension-anxiety*): *p* = NS at completion. **ES =** ND. STAI (*anxiety*): state anxiety *p* = NS at completion; trait anxiety *p* = NS at completion. **ES =** ND.	MBSR did not reduce anxiety relative to standard care in chronic pain patients.	++
Jensen, 2012[29]	60[a] (12 M/48 F) healthy meditation novices; mean age = ND	*MBSR: 16 (6%)	MBSR: 2.5h x 8/8w + 7h x 1/1d (27h + HW ND)	PSS (*emotional stress*): between group post-treatment difference, *p* = NS. After controlling for baseline scores, MBSR decreased significantly	MBSR reduced stress relative to an inactive control but not relative to NMSR in healthy	+

		*NMSR: 16 (6%) CIC: 16 (0%)	NMSR: 2.5h x 8/8w + 7h x 1/1d (27h + HW ND)	more than did CIC, $p < 0.03$, but not more than did NMSR, $p < .07$. Within groups, PSS decreased significantly in MBSR, $p < 0.04$, whereas it increased marginally in CIC and NMSR. **ES** for within group MBSR decrease in PSS, d = 0.61.	meditation novices.	
Robins, 2012[34]	56 (9 M/47 F) participants with physiological distress; mean age = 46.25	*MBSR: 28 (21%) WLC: 28 (0%)	2.5h x 8/8w (20h + HW ND)	Affective Control Scale (*anxiety*): p = NS at post-intervention. **ES =** ND.	MBSR did not affect anxiety in patients with physiological distress when compared to WLC.	+
Shapiro, 2011[35]	32[a] (6 M/26 F) undergraduate students; mean age = 18.73 ± 1.29	*MBSR: 17 (12%) WLC: 15 (0%)	ND	PSS (*emotional stress*): $p < 0.04$ at 12 mos FU. **ES =** ND.	MBSR reduced stress in healthy undergraduates when compared with a WLC.	+
Shapiro, 1998[36]	78[ac] M/F medical students experiencing stress; mean age = ND	*MBSR: 37 (3.0%) WLC: 41 (9.8%)	2.5h x 7/7w (17.5h + HW ND)	SCL-90-R (*distress*): $p < 0.02$. **ES =** ND. STAI (*anxiety*): $p < 0.05$. **ES =** ND.	MBSR reduced distress and anxiety relative to WLC in medical students.	+
Tacon, 2003[38]	20[c] women with heart disease; mean age = 57.3 (T), 63.6 (C)	*MBSR: 10 (10%) WLC: 10 (10%)	2h x 8/8w + ND x ND/ND (16h+ND + HW ND)	STAI (*state anxiety*): significant effects observed, $p < 0.01$ post-treatment. **ES =** ND.	MBSR significantly reduced state anxiety over WLC in women with heart disease.	+
Goldin, 2012[41]	56[a] (27 M/29 F) patients with generalized social anxiety disorder; mean age = 32.8 ± 8.4	*MBSR: 31 (23%) Aerobic exercise program control: 25 (28%)	2.5h x 8/8w + 8 h x 1/1d (28h + HW ND)	LSAS-SR (*anxiety*): between group difference, p = NS at post-intervention and FU. **ES,** d = 0.75 post intervention, **ES,** d = 0.68 at 3 mos FU.	MBSR did not reduce anxiety of emotional stress relative to aerobic exercise in patients with generalized social anxiety.	-
Wong, 2009[46]	100[a] (gender = ND) patients with chronic pain of any etiology; mean age = ND	*MBSR: ND (ND) UC: ND (ND)	ND	STAI (*anxiety*): state anxiety p = 0.027 at 3 mos; state anxiety p = 0.005 at 6 mos. **ES =** ND.	MBSR reduced trait anxiety compared with UC on chronic pain patients.	-

Shapiro, 2005[44]	38[a] Health care professionals from the Palo Alto and Menlo Park Divisions of the Veterans Affairs Palo Alto Health Care System; age range = 18 - 65y	*MBSR: 18 (44%) WLC: 20 (10%)	2h x 8/8w (16h + HW ND)	Burnout scale (*burnout*): NS group differences between MBSR vs. WLC, p = 0.21, **ES =** ND. PSS (*stress*): significant between group differences, p = 0.04. **ES =** ND.	MBSR reduced stress but not burnout in health care professionals (e.g., physicians, nurses, social workers, physical therapists, and psychologists) when compared with a WLC.	-
Vieten, 2008[45]	34[c] pregnant (12-30w) F; mean age = 33.9 ± 3.8	*Mindful Motherhood intervention: 15 (13%) WLC: 19 (5%)	2h x 8/8w (16h + HW ND)	PSS (*stress*): between group differences, p = NS. **ES,** d = 0.39 STAI (*anxiety*): intervention group showed significantly reduced anxiety $p < 0.05$ during the 3rd trimester of pregnancy compared to those who did not receive the intervention. **ES,** d = 0.85.	Mindful Motherhood reduced anxiety but not stress in pregnant women when compared to a WLC.	-
MBSR Lite (n = 9)						
Biegel, 2009[4]	102[ab] (27 M/75 F) adolescents with a history of psychiatric outpatient treatment; mean age = 15.4 ± 1.2	*MBSR condensed: 50 (22%) UC: 52 (12%)	2h x 8/8w (16h + HW ND)	STAI (*state anxiety*): REML, p = 0.005, **ES,** d = 0.70 STAI (*trait anxiety*): REML, p = 0.04 at 3 mos, **ES,** d = 0.79. PSS (*emotional stress*): REML, p = 0.02 at 3 mos. **ES,** d = 0.89. SCL-90-R (*anxiety*): REML, p = NS at 3 mos. **ES,** d = 0.66.	MBSR Condensed reduced stress, trait anxiety, and state anxiety, but not anxiety symptoms in adolescents with a history of psychiatric treatment, when compared with UC.	++
Branstrom, 201[5]0	71[b] (1 M/70 F) patients with a previous cancer	*MBSR condensed: 39 (18%)	2h x 8/8w (16h + HW ND)	PSS (*stress*): p = 0.004 at 3 mos. **ES,** d = 0.63.	Condensed MBSR reduced stress and	++

	diagnosis; mean age = 51.8	WLC: 46 (15%)		HADS (*anxiety*): p = 0.107 at 3 mos. **ES,** d = 0.26. IES-R intrusion subscale (*PTSD stress symptoms*): p = NS at 3 mos. **ES,** d = 0.07. IES-R avoidance subscale (*PTSD stress symptoms*): p = 0.012 at 3 mos. **ES,** d = 0.41. IES-R hyper-arousal subscale (*PTSD stress symptoms*): p = 0.069 at 3 mos. **ES,** d = 0.33.	avoidance, but not anxiety and PTSD symptoms, in cancer patients when compared to a WLC.	
Lengacher, 2009[12]	84[ab] F breast cancer (Stages 0-III) survivors; mean age = 57.5 ± 9.4	*MBSR condensed: 41 (2%) WLC: 43 (2%)	2h x 6/6w (12h + HW ND)	STAI (*state anxiety*): state anxiety, p = 0.03 at 6w; trait anxiety, p = 0.004 at 6w. **ES =** ND. PSS (*stress*): p = NS at 6w. **ES =** ND.	Condensed MBSR reduced state and trait anxiety, but not emotional stress, in female breast cancer survivors when compared with a WLC.	++
White, 2012[24]	169[ab] healthy fourth- and fifth-grade girls attending one of two public schools; mean age = 9.9 ± 0.7	*Mindful awareness for girls through yoga: 74 (5.4%) WLC: 95 (10.5%)	1h x 8/8w (8h + HW ND)	Feel Bad Scale (*emotional stress*): stress, p = 0.06 at 8w. **ES =** ND. Schoolagers Coping Strategies Inventory (*coping*): p = NS at 8w. **ES =** ND.	A yoga-based program showed a NS trend towards reducing emotional stress in healthy schoolgirls. The intervention had no effect on coping.	++
Speca, 2000[19]	109[ac] M/F cancer outpatients with	*MBSR condensed: 61 (13%)	1.5h x 7/7w (10.5 + HW	POMS (*anxiety*): treatment group, p < 0.001 from time 1 to time 2 and p	Condensed MBSR reduced anxiety and	++

	various stages of disease; mean age = 54.9 (T), 48.9 (C)	WLC: 48 (23%)	ND)	< 0.001 between groups. **ES =** ND. SOSI (stress): $p < 0.01$. **ES =** ND.	stress in cancer outpatients compared with WLC.	
Oman, 2008[15]	47[ab] undergraduate students; aged 18 – 24y	*MBSR: 16 (ND) Easwarans Eight-Point Program: 16 (ND) WLC: 15 (ND) Overall: 47 (7%)	1.5h x 8/8w (12h)	PSS (*stress*): treatment groups demonstrated significantly larger decreases compared to controls, $p < 0.05$. At posttest, these changes were not statistically significant. At 8w FU, $p = 0.047$. **ES,** d = 0.45, posttest d = 0.39, 8w FU d = 0.51.	The MBSR significantly reduced emotional stress compared to WLC, but not compared to Easwarans Eight-Point Program.	++
Jain, 2007[28]	104[ab] M/F, full-time medical students, graduate nursing students, and undergraduate students majoring in premedical or prehealth studies; mean age = 25.0	*MBSR condensed: ND (ND) Stress reduction: ND (ND) WLC: ND (ND) Overall: 104 (23%)	1.5h x 4/ND + ND x ND/ND (6h+ND + HW ND)	BSI (*distress*): meditation and relaxation groups experienced significant decreases compared with the WLC, $p < 0.05$ in all cases. No significant differences reported between meditation and relaxation on distress over time. The meditation group also demonstrated significant decreases in both distractive and ruminative thoughts/behaviors compared with the WLC, $p < 0.04$ pre–post in all cases. MBSR vs. WLC, $p < 0.05$ in all cases. **ES**: meditation, d = 1.36; relaxation, d = 0.91.	Condensed MBSR reduced distress in a variety of health professions students when compared to a WLC.	+
Liehr, 2010[43]	18[a] (13 M/5 F) children; mean age = 9.5 ± 1.6	*Mindfulness: ND (ND) Health educational: ND (ND)	15m x 10 over 2w (2.5h)	STAI for Children (*anxiety*): group x time interaction, $p = 0.07$ at post-intervention. **ES =** ND.	The results were not statistically significant despite the Mindfulness Intervention group had greater decreases in	-

		Overall: 18 (6%)			anxiety than the health education intervention.	
MacKenzie, 2006[47]	M/F nurses and nurse aides[c] recruited from long-term and complex continuing care units in a large urban geriatric teaching hospital; mean age = 48.62 ± 6.52 (T), 44.78 ± 8.16 (C)	*MBSR condensed: 16 (ND) WLC: 14 (ND)	0.5h x 4/4w (2h + HW ND)	MBI (*burnout):* significant group x time interactions for two burnout components, emotional exhaustion, $p < 0.05$, **ES**, partial $\eta^2 = 0.16$, and depersonalization $p < 0.05$, **ES**, partial $\eta^2 = 0.16$. Smith Relaxation Dispositions Inventory (relaxation): group x time effect $p < 0.05$. **ES,** d = 0.15.	Condensed MBSR increased relaxation and decreased burnout in nurses and nurse aids when compared with a WLC.	-
MBSR Modified (n = 9)						
Schmidt, 2011[18]	177 F fibromyalgia patients; mean age = 52.5 ± 9.6	*MBSR modified: 53 (10%) *MBSR+ active control: 56 (5%) WLC: 59 (0%)	Both programs: 2.5h x 8/8w + 7h x 1/1d (27h + HW 76h)	STAI (*trait anxiety*): MBSR vs. active control between group differences, p = NS, $p = 0.022$ overall. **ES,** d = 0.41. MBSR and active control vs. WLC, p = 0.04. Over **ES,** d = 0.14.	Both the MBSR group and the MBSR+ active control showed significant improvements in anxiety relative to WLC, but were not significantly different from each other	++
Warber, 2011[23]	58[a] (39 M/19 F) patients with a history of unstable angina or a heart attack; mean age = 60.7	*LCP: 15 (6.6%) Medicine for the Earth: 28 (21.4%) Usual cardiac care control: 15 (33.3%)	5h x 4d (20h + HW ND)	PSS (*stress*): p = NS at 6 mos, significant group x time interaction, $p = 0.049$, the LCP group felt more stressed at the 3 mos FU as they attempted lifestyle changes. **ES =** ND.	The LCP did not significantly reduced stress relative to the Medicine for Earth Program or UC at 3 mos or 6 mos	++
Gross, 2010[10]	138[ab] (76 M/62 F) recipients of kidney, kidney/pancreas, liver, heart, or lung	*MBSR plus: 72 (7%) Health education control: 66 (9%)	2.5h x 8/8w + 8 h x 1/1d (28h + HW ND)	STAI (*anxiety*): $p = 0.02$ overall at 52w. **ES,** d = 0.56.	MBSR plus reduced anxiety in transplant patients when compared with an education	++

	transplants; mean age = 54.0				control.	
Elsenbruch, 2005[26]	30[ac] M/F ulcerative colitis patients in remission or with low disease activity; mean age = 42.9 ± 8.6 (T), 42.4 ± 11.4 (C)	Mind-body therapy: 15 (3%) WLC: 15 (0%)	Mind-body therapy: 6h x 10/10w (60h)	PSS (*stress*): no significant differences between the intervention group and the control group, *p* = ND. **ES =** ND.	Mind body therapy did not reduce emotional stress in ulcerative colitis patients when compared to UC and WLC.	+
Henderson, 2012[27]	180[ab] F breast cancer (Stage I or II) patients; mean age = 49.8 ± 8.4	*MBSR modified: 3 (ND) Nutrition Educational Program: 52 (ND) UC: 58 (ND) Overall: 180 (4%)	2.5-3.5h x 7/7w + 7.5h x 1/1d + 2h x 3/3m (31-38h + HW ND)	DWI active behavioral coping subscale (*coping*): *p* = NS at 4 mos compared to UC, *p* < 0.05 at 1y compared to UC. **ES =** ND. DWI active cognitive coping subscale (*coping*): *p* < 0.05 at 4 mos compared to UC. **ES =** ND. DWI avoidance coping subscale (*coping*): *p* = NS at 4 mos compared to Nutrition Education Program. **ES =** ND. CEC (*anxiety*): *p* < 0.05 at 4 mos compared to UC and Nutrition Education Program; *p* < 0.05 at 2y compared to UC. **ES =** ND.	MBSR increased coping and reduced anxiety in female breast cancer patients when compared with both an education control and UC.	+
Lerman, 2012[31]	77[ab] F cancer patients; mean age = 57.0	*MBSR plus: 53 (9%) WLC: 24 (17%)	2h x 8/8w + 4h x 1/1d (20h + HW ND)	SCL-90-R GSI (*distress*): within group improvements for the treatment group, *p* < 0.023, but not the control group. Between group statistics ND. **ES,** d = 0.373.	The authors did not report any significant findings regarding the effect of mindfulness-based stress reduction	+

				SCL-90-R (*positive symptoms distress*): within group improvements for the treatment group, $p < 0.023$, but not the control group. Between group statistics ND. **ES,** d = 0.340	MBSR plus on distress in cancer patients. A conclusion cannot be determined.	
Michalsen, 2005[32]	105[ab] M/F coronary artery disease patients; mean age = 59.0 ± 8.7 (T), 59.8 ± 8.6 (C)	*Comprehensive lifestyle modification and stress reduction program: ND (ND) Advice only control: ND (ND) Overall: 105 (4%)	3h x 10/10w + 2h x 21/21w + ND x ND/3d (72h + ND)	STAI (*trait anxiety*): both groups improved significantly during the 1y for trait anxiety, p = ND. Between group analysis, p = NS. State anxiety was not significantly more reduced in the written-advice-only group. **ES =** ND. PSS (*stress*): between group, p = NS. **ES** = ND	The Comprehensive Lifestyle Modification and Stress Reduction Program did not significantly change anxiety or stress in patients with coronary artery disease when compared with an advice only control.	+
Williams, 2001[39]	103[ab] M/F community volunteers with high perceived stress; mean age = 49.2	*Wellness based stress reduction: 59 (45%) Education control: 44 (41%)	2.5h x 8/8w + 8h x 1/1day (28h)	DSI (*distress*): between group results showed the decrease in effects of daily hassles in the intervention group was significantly larger than in the control group, p = 0.01 and at 3 mos FU, p = 0.045. **ES =** ND. SCL-90-R GSI (*distress*): within group decrease in the intervention group pre to post-intervention and 3 mos FU, $p < 0.05$. Between group reductions for the intervention vs. control group was borderline significant, p = 0.057 at post-intervention and significant at 3 mos FU, p = 0.049. **ES =** ND	Wellness Based Mindfulness Stress Reduction showed a NS trend towards reduced distress in high stress volunteers when compared with an education control.	+

Langhorst, 2007[42]	30[ac] M/F ulcerative colitis patients (in remission); mean age = 41.2 ± 9.9 (T), 47.3 ± 13.1 (C)	*MBSR plus: 15 (13%) UC: 15 (13%)	6h x 10/10w (60h)	BSI (*anxiety*): significant decrease in anxiety in the treatment group as compared to the control group, p = 0.029 at 3 mos. No significant between group differences at 12 mos. **ES =** ND.	MBSR plus significantly reduced anxiety in ulcerative colitis patients relative to UC.	-
MBCT (n = 6)						
Chiesa, 2012[7]	18[a] (4 M/12 F/2 ND) participants with major depression; mean age = ND	*MBCT: 9 (0%) Psycho-education control: 9 (22%)	2h x 8w (16h + HW ND)	BAI (*anxiety*): between group differences, p = NS. **ES =** ND.	The MBCT intervention was not effective at reducing anxiety in participants with major depression.	++
Foley, 2010[9]	115[ab] (26 M/89 F) cancer patients; mean age = 55.2 ± 10.6	*MBCT: 55 (4%) WLC: 60 (10%)	(2h x 8/ 8w) + (5h x 1d) = (21h + HW ND)	HAM-A (*anxiety*): p = 0.002 at post-intervention. **ES,** d = 1.14. Depression Anxiety Stress Scale-Short Form (*distress*): p < 0.001 at post-intervention. **ES,** d = 0.60.	Participants in the MBCT group showed statistically significant improvements in anxiety and distress than then a WLC.	++
Oken, 2010[14]	31 (6 M/25 F) caregivers of close relatives with dementia; mean age = 64.46	*Meditation: 10 (20%) Active Education: 11 (0%) Respite only control: 9 (10%)	1.5h x 6/ 6w (9h + HW ND)	Revised Memory and Behavior Problems Checklist (*emotional stress*): caregiver stress for all three groups: p = 0.030 post-intervention, respite vs. meditation p = 0.041 post-intervention, meditation vs. education p = NS post-intervention. **ES =** ND. PSS (*emotional stress*): all three groups p = NS post-intervention. **ES =** ND.	The meditation intervention significantly lowered emotional stress in caregivers compared to a respite only group.	++
Britton, 2012[25]	52[ab] (11 M/41 F) patients with recurrent depression; mean age	*MBCT: 29 (10%) WLC: 23 (18%)	8w (time ND)	STAI (*anxiety*): p < 0.05 post-induced stress. **ES,** partial η^2 = 0.13.	MBCT was associated with an overall decrease in emotional reactivity.	+

	= 47.0				Overall anxiety levels decreased significantly for the MBCT group, but not controls, when compared to pre-treatment levels.	
Lee, 2010[30]	75[a] middle-aged women with depressive mood; mean age = 41.0	*MBCT: 33 (29%) WLC: 42 (9%)	2.5h x 8w (20h)	SCL-90-R (*anxiety*): $p < 0.01$ at 8w. **ES,** d = 0.441.	The MBCT intervention effectively decreased anxiety in middle-aged women with depressive mood compared to a WLC.	+
Skovbjerg, 2012[37]	37[ac] (2 M/35 F) patients with multiple chemical sensitivities; mean age = 51.6 ± 9.2	*MBCT: 17 (47%) TAU control: 20 (15%)	2.5h x 8/ 8w (12h + HW)	SCL-92 (*emotional stress, anxiety*): stress p = NS at 20w, anxiety, p = NS at 20w. **ES =** ND.	Patients with multiple chemical sensitivities who received MBCT did not differ from no treatment controls on measures of stress and anxiety.	+
Mind-body Bridging (n = 1)						
Nakamura, 2011[33]	63 (60 M/3 F) veterans with self-reported sleep disturbance; mean age = 51.85	*MBB: 35 (6%) Sleep hygiene control: 28 (11%)	MBB: 1.5h x 2w (3h)	PCL-M (*PTSD*): p = 0.029 at post-intervention. **ES,** d = 0.32.	Sleep-focused MBB in two sessions greatly reduced PTSD symptoms.	+
Other Mindfulness-based Program (n = 2)						
Zautra, 2008[22]	144[ac] M/F RA patients; mean age = 46.17 ± 12.70 (M), 51.00 ± 10.74 (P), 51.43 ± 13.89 (E)	*MBERTP: 48 (8.3%) CBT: 2 (3.8%) Education: 44 (2.3%)	MBERTP: 2h x 8w (16h + HW)	Coping efficacy (*coping*): pain coping efficacy increased across participants from pre to post, $p < 0.001$. A significant double interaction emerged, $p < 0.01$, such that participants in both the emotion regulation therapy and CBT for pain conditions experienced greater	The MBERTP was more effective than an education control at increasing coping efficacy for pain, but did not significantly differ from a CBT for Pain program.	++

				increases in pain coping efficacy from pre-to post than did those in the education-only group condition. **ES** = ND.		
Flaxman, 2010[53]	107 (30 M/77 F) participants with above average levels of distress; mean age = 39 ± 8.1	*ACT: 37 (49%) SIT: 37 (38%) WLC: 33 ()	ACT: 3h x 2/2w (6h) SIT: 3h x 2/2w (6h)	GHQ (*distress*): $p < 0.001$ at 3 mos (ACT vs. Controls). **ES**, d = 1.31.	The ACT program significantly reduced distress relative to a WLC, but did not significantly differ from the SIT group.	-
Vitality Training (n = 1)						
Zangi, 2012[54]	71[ac] (15 M/56 F) patients with an inflammatory rheumatic joint disease; mean age = 53.9 ± 9.1	*Vitality Training Program: 36 (8.1%) UC: 35 (5.6%)	(4.5h x 10 over 15w) + (4.5h x 1) = (49.5h + HW ND)	GHQ, 20-item version (*distress*): p = 0.002 at 12 mos. **ES =** ND. EAC processing and expression subscales (*coping*): processing subscale, $p < 0.001$ at 12 mos. Expression subscale, p = NS at 12 mos. **ES,** processing subscale d = 0.43, expression subscale d = 0.0.	After receiving the Vitality Training Program, patients with inflammatory rheumatic joint disease significantly improved distress measure, relative to UC controls. Participants receiving the intervention also improved significantly on a coping-processing scale, but did not show improvement on a coping-expression scale.	++

*intervention of interest

[a]informed consent obtained, [b]authors report power achieved, [c]authors report power not achieved

ACT: Acceptance and Commitment Therapy, AIDS: Acquired Immune Deficiency Syndrome, ART: Anti-retroviral Treatment, BAI: Beck Anxiety Inventory, BSI: Brief Symptom Inventory, CBT: Cognitive Behavioral Therapy, CEC: Courtauld Emotional Control Scale, CIC: Collapsed Inactive Control, D: Day(s), DSI: Daily

Stress Inventory, DWI: Dealing With Illness scale, EAC: Emotional Approach Coping Scale, ES: Effect size, F: Female, FU: Follow-up, GHQ: General Health Questionnaire, H: Hour(s), HADS: Hospital Anxiety and Depression Scale, HAM-A: Hamilton Anxiety Rating Scale, HIV: Human Immunodeficiency Virus, HW: Homework, IES-R: Impact of Events Scale- Revised, LCP: Lifestyle Change Program, LSAS-SR: Liebowitz Social Anxiety Scale-Self-report version, M: Male, MBB: Mind-body Bridging, MBCT: Mindfulness-based Cognitive Therapy, MBERTP: Mindfulness-based Emotion Regulation Therapeutic Program, MBSR: Mindfulness-based Stress Reduction, ND: Not Described, NMSR: Non-mindfulness Stress Reduction, NS: Non-significant, PCL-M: Post-Traumatic Stress Checklist for Military, POMS: Profile of Mood States, PSS: Perceived Stress Scale, PTSD: Post-traumatic Stress disorder, RA: Rheumatoid Arthritis, SCL-90/92-R GSI: Symptoms Checklist-90-Revised Global Severity Index, SIT: Stress Inoculation Training, SOSI: Symptoms of Stress Inventory, STAI: State Trait Anxiety Inventory, UC: Usual Care, WLC: Wait List Control, W: Week(s), Y: Year(s)

Appendix 5. Characteristics of relaxation-based modality studies

Citation	Population	Treatment Arms: # Assigned (Drop out %)	Intervention Dose (Total)	Relevant Stress Results	Author's Main Conclusions	Quality
Relaxation Response Training (n = 8)						
Chang, 2010[82]	67[a] M residents with a substance abuse/dependence problem enrolled in a VA Domiciliary rehabilitation program; mean age = 48.0	*RRT: 23 (39%) Acupuncture 23 (30%) UC: 21 (19%)	0.75 x 10/10w (7.5h)	STAI (*anxiety*): relaxation vs. UC, $p = 0.06$, anxiety between acupuncture vs. relaxation response, p = NS. **ES =** ND.	RRT showed a NS trend towards improving anxiety in substance abuse inpatients compared to UC, and no difference compared to acupuncture.	+
Hellman, 1990**[3]	80[ac] M/F patients with psychosomatic complaints; mean age = 37.0	* WTW: 28 (ND) *Mind-body program 27 (ND) Stress management information: 25 (ND) Overall: 80 (11%)	Both Programs: 1.5h x 6/6w (9h + HW ND)	Bipolar profile of mood states (*psychological distress*): between groups analysis showed a significant decline vs. control in psychological distress for both WTW and MB groups, $p < 0.05$. The lower-levels of distress at FU were somewhat greater for the mind-body group than for WTW group, but no statistically significant differences. **ES =** ND.	Both the WTW program and the mind-body program significantly reduced distress compared to an information control, but did not significantly differ from each other.	+
Galvin, 2006[47]	15[a] M/F aging adults; mean age = 71.3	*RRT: 8 (0%) No treatment: 7 (0%)	1.5h x 5/5w (7.5h + HW ND)	STAI (*state anxiety*): state anxiety levels showed a marginally significant reduction $p < 0.066$ in the RRT group as compared to the control group. The RRT group was significantly more anxious at pre-assessment as compared to the	In healthy adults, RRT caused a NS trend towards reduced anxiety relative to a no treatment control.	-

				control group $p < 0.046$. **ES** = ND.		
Katzer, 2008[53]	225[ac] overweight women; mean age = 46.1	*RRT (P1): 60 (60%) Group non-dieting program (P2): 62 (61%) Mail-delivered non-dieting program (P3): 101 (62%)	RRT: 2h x 10/10w + 2h x 1/2w + 2h x 8/8 mos (38h)	SCL-90-R GSI (*anxiety*): within group analysis showed all treatment groups (P1, P2, P3) experienced significant improvements in scores, $p < 0.0001$. Scores for P1, $p = 0.004$, P2, $p < 0.0001$, P3, $p = 0.002$ between baseline and 12 mos. **ES,** P1 = 0.63, P2 = 0.54, P3 = 0.36; anxiety P1 = 0.40, P2 = 0.40, P3 = 0.23.	A series of mind-body interventions with and without dietary changes improved anxiety in overweight patients, but the effects of the groups did not differ.	-
Mancini, 1983[58]	30[c] M/F nursing students; age range = 25 - 43y	*SMT: 15 (46%) Unspecified control: 15 (60%)	1h x 8 (8h)	A-State Anxiety Inventory (*anxiety, coping*): results between experimental and control, p > 0.05 pre/post. **ES =** ND. Weekly self-report measures (*stress*): control group experienced more stressors over the 8w, $p < 0.01$ as well as less coping strategies and techniques, $p < 0.001$. **ES =** ND.	The 8w stress management group had significantly fewer stressors and more coping strategies compared to the control group	-
Shaw, 1983**[5]	22[ac] M/F volunteers; age range = 20 – 60y	*SMT - positive set: 8 (ND) *SMT - neutral set: 8 (ND) WLC: 6 (ND)	SMT: 1.5h x 5/5w (7.5h)	STAI (*anxiety*): failed to show any significant effects; statistics = ND. **ES =** ND.	Multicomponent stress management training did not significantly alter anxiety in self-referred healthy volunteers when compared to WLC.	-
Day, 1982[43]	62[c] M/F Lebanese 5th	*RRT: ND (ND)	10m x 30/6w	General Anxiety Scale for Children	RRT significantly	-

	grade students; age range = 10 - 12y	Special reading activity: ND (ND)	(5h)	(*stress, anxiety*): significant treatment effect was found within groups for general stress $p < 0.01$. Students who practiced relaxation response reported a lower level of stress and anxiety. Pre/FU after 3w, p = NS. **ES =** ND TASC (*anxiety*): treatment effect, $p < 0.01$.Students who practiced relaxation response reported a lower level of stress and anxiety. **ES =** ND. Pre/FU after 3w, p = NS. **ES =** ND.	reduced general stress and test anxiety in healthy Lebanese 5th graders when compared to a reading activity control.	
Bertoch, 1989[40]	30[c] M/F public school teachers (middle and high school) in northern Utah; mean age = 38.1 ± 8.28 (T), 38.1 ± 6.99 (C)	*Holistic treatment program: 15 (ND) No treatment: 15 (ND)	Holistic treatment program: 2h x 12/ND (24h)	Structured Clinical Stress Intervention (*stress*): control group pre/post, p = 0.04, treatment group pre/post, p = 0.001, between groups treatment vs. control posttest, p = 0.004. **ES =** d, 1.22. Derogatis Stress Profile (*stress*): control group pre/post, p = 0.04, treatment group pre/post, p = 0.001, between groups treatment vs. control posttest, p = 0.021. **ES,** d = 1.00. Occupational Stress Inventory (*stress*): control group pre/post p = 0.80, treatment group pre/post	A holistic treatment program significantly reduced stress in healthy public school teachers relative to a no treatment control.	-

				p = 0.001, between groups treatment vs. control posttest, *p* = 0.008. **ES,** d = 0.75. Teacher Stress Measure (*stress*): control group pre/post, *p* = NS, treatment group pre/post *p* = 0.001, between groups treatment vs. control posttest *p* = 0.001. **ES,** d = 1.10.		
Relaxation Multi-modal (n = 34)						
Chan, 2010[83]	140[ac] (123 M/17 F) lung cancer patients (stage 3 or 4) receiving palliative radiotherapy; mean age = ND	*MM relaxation: 40 (3%) UC: 40 (16%)	1.3h x 1(1.3h + HW ND)	STAI (*state anxiety*): *p* < 0.001 at 6w. **ES,** partial η^2 = 0.051.	Psycho-educational intervention was effective for relieving anxiety in patients with lung cancer, compared to control.	++
Mohr, 2012[11]	121[a] (20 M/121 F) patients with relapsing forms of MS; mean age = 42.7 ± 9.8	*MM relaxation program: 60 (22%) WLC: 61 (9%)	50m x 16/ 20-24w (13.3h)	Life Events Scale (*stress*): *p* = NS at post-intervention. **ES =** ND. Brief Inventory of Perceived Stress (*stress*): *p* = NS at post-intervention. **ES =** ND.	The SMT failed to significantly reduce stress in patients with multiple sclerosis.	++
Bergstrom, 2009[7]	2151[b] (1064 M/ 1087 F) nulliparous F and their partners; mean age = 30.05	*Natural group: 1073 (15%) UC: 1078 (14%)	2h x 4 over 10w (8h) + FU session + HW ND	Swedish Parenthood Stress Questionnaire (*parental stress*): *p* = NS for men or women at 3 mos after childbirth. **ES =** ND.	There were no statistically significant differences in parental stress between the Natural Group and UC	++
Bragard, 2010[18]	113 (35 F/61 M/17 ND) medical residents; mean age = 28.2 ± 2.6	SMT + communication training: 4 (ND)	SMT + communication training: 40h	MBI emotional exhaustion subscale (*burnout*): *p* = NS. **ES,** d = 0.12.	The SMT and communication training was effective at	+

		WLC: 47 (ND) Overall: 113 (15%)	over 2 mos (40h)	 MBI depersonalization subscale (*burnout*): *p* = NS. **ES,** d = 0.02 MBI personal accomplishment subscale (*burnout*): *p* = NS. **ES,** d = 0.14 VAS (*stress to communicate*): *p* = 0.003. **ES =** d, 0.6	reducing physician stress to communicate with patients, compared to control, but failed to impact burnout in physicians.	
Deechakawan 2010[23]	188[ac] (24 M/152 F/12 ND) adults with irritable bowel syndrome; mean age = 44.0 ± 14.0	*Comprehensive self-management program, in-person: 62 (13%) Comprehensive self-management program, telephone: 64 UC: 62 (0%)	ND x 9/3m (ND + HW ND)	Daily Stress Level 5-point Likert (*emotional stress*): moderate-to-severe stress levels, *p* = 0.034. **ES =** ND.	The Comprehensive Self-Management intervention was more effective than the control condition at decreasing daily stress in patients with irritable bowel syndrome.	+
Carels, 2004[19]	44[ac] obese, sedentary, postmenopausal women; mean age = 54.7 ± 7.9	*Lifestyle change intervention + self-control skills: 23 (17.4%) Lifestyle change intervention: 21 (14.2%)	Lifestyle change + self Control: 1.5-2h x 24w (36h-48h)	STAI (*anxiety*): No significant differences between groups. Significant within-subject effects for anxiety, *p* < 0.05 at 1y post-treatment. **ES =** ND.	The lifestyle change + self-control skills intervention failed to decrease anxiety compared to the control group in obese, sedentary, postmenopausal women.	+
Kovačič, 2011[27]	32[a] F patients with primary diagnosis of breast cancer (stages I	*MM relaxation program: 16 (0%)	0.75h x 7d (5.25h + 1w standard	PSS (*stress*): *p* < 0.0005 at 4w. **ES =** ND.	The standard physiotherapy plus relaxation training	+

	or II); mean age = ND	Standard physiotherapy: 16 (0%)	physiotherapy program + HW ND)	GHQ-12 (*distress*): $p < 0.0005$ at 4w. **ES =** ND. Rotterdam Symptom Checklist (*distress*): $p < 0.0005$ at 4w. **ES =** ND.	significantly decreased perceived stress and distress in patients with breast cancer, compared to the control condition.	
Loprinzi, 2011[28]	24[a] F breast cancer patients; mean age = 61.0	*MM relaxation program: 12 (0%) WLC: 12 (0%)	(1.5h x 2) + (0.5-1h x 1d [optional]) = (3-4h)	Connor-Davidson Resilience Scale (*resilience*): $p = 0.010$ at 12w. **ES =** ND. PSS (*stress*): $p = 0.003$ at 12w. **ES =** ND. Smith Anxiety Scale (*anxiety*): $p = 0.002$ at 12w. **ES =** ND.	The SMART intervention improved self-reported measures of resilience, stress, and anxiety in patients with breast cancer, compared to controls.	+
Mehnert, 2011[29]	63[a] F non-metastatic breast cancer patients; mean age = 51.88 ± 8.46	MM relaxation program: 35 (14%) WLC: 28 (0%)	1.5h x 20/10w (30h)	HADS (*anxiety*): $p = 0.03$ at FU. **ES =** ND.	The physical exercise rehabilitation program led to a decline in anxiety in breast cancer patients, compared to controls.	+
Jones, 1996[52]	2328[c] M/F patients with confirmed myocardial infarction (MI); mean age = ND	*MM relaxation program: 1168 (8%) UC: 1160 (7%)	2h x 7 (14h + HW ND)	STAI (*anxiety*): No difference between groups. **ES =** ND.	The rehabilitation program did not lower anxiety in patients with a myocardial infarction.	+
Pruitt, 1992[32]	81[ac] M/F US army employees stationed at the Pentagon; age range = 21 - 65y	*MM relaxation program: 31 (ND) WLC: 33 (ND)	ND	STAI (*anxiety*): pre to posttest between groups, p = NS. **ES =** ND. SCL-90-R GSI (*anxiety*): pre to posttest between groups, $p = 0.026$. **ES =** ND.	The stress management intervention did not decrease anxiety better than the control group, but was more effective at significantly	+

					improving stress-related physical symptoms and the perception of anxiety.	
Deffenbacher, 1979[24]	69[c] M/F students who scored in the upper 15% percentile on the Debilitating Scale of the Achievement Anxiety Scale; mean age = ND	*MM relaxation program: 17 (0%) Modified desensitization: 17 (12%) No treatment: 17 (17%) WLC: 18 (0%)	50m x 7 (5.83h + HW ND)	Achievement Anxiety Test (*debilitating anxiety*): posttest and FU between groups and 2 control groups, $p < 0.00$. **ES =** ND. Achievement Anxiety Test (*facilitating anxiety*): posttest and FU between groups and 2 control groups, $p < 0.00$. **ES =** ND. STAI (*trait anxiety*): between groups at post test, $p < 0.05$, at FU $p < 0.001$. **ES =** ND.	The relaxation as self-control intervention successfully decreased debilitating test anxiety and increased facilitating test anxiety, and led to reduction and maintenance on both measures of non-targeted anxiety relative to the controls.	+
Frisch, 1982[25]	34[c] M hospital patients with impaired interpersonal functioning; mean age = 46.7 (combined training), 48.4 (social skills training), 53.4 (minimal treatment control)	*MM relaxation program: 12 (9%) Social skills training: 12 (0%) Minimal treatment: 10 (10%)	9 sessions (ND)	The Social Avoidance and Distress Scale (*anxiety*): p = ND. No significant differences between conditions. **ES =** ND.	The combined social-skills training and stress-management training failed to significantly impact anxiety in men with impaired social functioning.	+
Singer, 1988[33]	36[ac] M/F parents of children with severe handicaps; mean age = ND	*MM relaxation program: 18 (ND WLC: 18 (ND)	2h x 8w (16h)	STAI (*anxiety*): After controlling pre-intervention scores there were significant reductions in the treatment group for both state and trait anxiety, $p = 0.02$. **ES =**	The stress management intervention was effective at significantly decreasing anxiety, compared to controls.	+

				ND.		
de Jong, 2000[22]	155[c] M/F recruited through employers; mean age = 38.0	*SMT + paraprofessional: 51 (14%) SMT + psychologist: 53 (11%) Assessment- only control: 51 (20%)	SMT: 2.5h x 8w (20h + HW ND)	GHQ (*general distress*): difference between the intervention and control, $p < 0.05$, **ES =** ND. STAI (*trait anxiety*): difference between the intervention and control, $p < 0.05$. **ES =** ND.	The stress management intervention decreased stress and anxiety in employees compared to a control group.	+
Bridge, 1988[2]	161[ac] F breast cancer patients (stage I or II) after first session of six wk course of radiotherapy; mean age = 53.0 (Relaxation + Imagery), 51.0 (Relaxation), 54.0 (C)	*Relaxation program: ND (ND) Relaxation + Imagery: ND (ND) No treatment: ND (ND) Overall: 161 (13%)	Relaxation Program: 0.5h x 6/ 6w (3h + HW ND)	POMS (*tension*): women trained in relaxation plus imagery were more relaxed than those trained in relaxation only, who in turn were more relaxed than the controls, $p < 0.025$. **ES =** ND. Leeds General Scales for anxiety and depression (*anxiety)*: p = NS over the 6w of treatment. **ES =** ND.	The Relaxation program showed significantly reduced anxiety compared to a no treatment control, but did not significantly differ from a Relaxation + Imagery program.	+
Sallis, 1987**[4]	76[c] healthy M/F employees of 2 high tech corporations; mean age = 36.0	*Relaxation training: 26 (ND) *Multi-component stress management: 26 (ND) Education/support: 24 (ND)	Both programs: 1h x 8-10w (8-10h)	STAI (*anxiety*): anxiety decreased in all groups from baseline to FU, $F(1, 61) = 5.99$, $p < 0.017$. **ES =** ND. Withdrawal Symptom Scale (*emotional stress*): total work stress self-efficacy decreased significantly in all groups between	The Relaxation training and Multicomponent stress management intervention program did not significantly differ from each other or from an education/support control group on a	+

		Overall: 76 (7%)		baseline and FU, $F(1, 59) = 6.36$, $p < 0.014$. There were no significant changes in perceived work stress. **ES =** ND.	measure of stress or on a measure of anxiety.	
Jones, 2000[38]	79[b] M/F nursing students who were distressed; mean age = 27.3 ± 7.6	*Worksite stress management program: 40 (ND) WLC: 39 (ND)	2h x 6/ ND (12h)	GHQ (*distress*): $p < 0.0005$ post and FU. **ES =** ND. STAI (*anxiety*): between groups pre vs. post $p < 0.0005$, and FU, $p < 0.002$. **ES =** ND. Derogatis Stress Profile (*stress*): between groups pre vs. post $p < 0.0005$. **ES =** ND. Beck and Srivastava Stress Inventory (*stress*): within groups, pre vs. post $p = 0.008$, post vs. FU $p < 0.0005$. **ES** = ND. WCQ (*coping*): direct coping $p < 0.04$. **ES =** ND.	Worksite stress management program was significantly more effective than the control group at decreasing anxiety and distress, and increasing active coping in distressed nursing students.	+
Fawzy, 1995[46]	65[ac] M/F stage I-II malignant melanoma patients; mean age = 42.41 (T), 46.28 (C)	*MM relaxation program: 29 (34%) No treatment: 33 (33%)	3h x 2 (6h + HW ND)	POMS (*anxiety*): within group reductions, $p < 0.05$, between group interactions approached significance, $p = 0.09$ **ES =** ND. BSI (*distress*): between group interactions approached significance, $p = 0.09$ **ES =** ND.	The despite within group reductions the intervention group was not significantly better at decreasing anxiety and total mood disturbance compared to the control group.	-

Janbozorgi, 2009[51]	35[a] (4 M/28 F) anxiety disorder patients; mean age =24.6 ± 3.8	*Integrative relaxation training program: 18 (17%) No treatment: 17 (0%)	1.5-2h x ND/12w (18-24h + HW ND)	STAI (*state anxiety*): $p < 0.0001$ at post-test. **ES =** ND. STAI (*trait anxiety*): $p < 0.0001$ at post-test. **ES =** ND.	The integrative relaxation training effectively decreased anxiety in patients with anxiety disorder compared to controls.	-
Garcia-Vera, 1998[48]	43[ac] M diagnosed with essential hypertension; mean age = 45.5 ± 10.1 (T), 45.4 ± 7.8 (C)	*SMT: 22 (5%) No treatment: 21 (0%)	SMT: ND	STAI (*anxiety*): between group interactions, p = NS. **ES =** NR.	The SMT program was not effective at changing psychological variables in men with hypertension.	-
Gifford, 1998[49]	71[a] M only HIV-positive adults with at least one AIDS (CDC category C) or AIDS-related complex (CDC category B) diagnosis and enrolled in continuing HIV care with a primary provider; mean age = 45.2 (T), 45.3 (C)	*Positive self-management program: 34 (25%) WLC: 37 (11%)	ND x 16h/ 7w (16h)	PSS (*emotional stress*): pre/post scores between experimental vs. control groups, $p = 0.20$. **ES =** ND.	The positive self-management program was not more effective than the control group at decreasing perceived stress in male HIV-positive adults.	-
McGrady, 2009[84]	Study 1: 33[a](6 M/17 F) individuals who were considered at risk for illness due to a high number of life events in the previous 6 mos; mean age = 53.0 Study 2: 28[a] (4 M/11 F) family practice patient;	Study 1 *MM relaxation program: 17(12%) WLC: 16(50%) Study 2: *MM relaxation program: 14 (36%)	Study 1:1.5h x 2/ ND (3h + homework) Study 2: 1h x ND/ 8w (8h + HW ND)	BAI (*anxiety*): $p < 0.03$ at 3 mos (Study 1), **ES =** ND; $p < 0.04$ at 3 mos (Study 2), **ES =** ND.	The intervention group demonstrated significant reductions in anxiety scores in comparison to a WLC.	-

	mean age = 51.0	WLC: 14 (57%)				
Rohsenow, 1985[63]	40[c] heavy social drinking M college students; age range = 20 - 24y	*Cognitive-affective SMT: 15 (27%) No treatment: 21 (20%)	1h x 6/ 2w (6h + HW ND)	STAI (*trait anxiety*): group differences approached significance, $p < 0.055$ at 2w post-treatment, and reached significance, $p < 0.046$ at 4w following treatment. No significant differences at 2.5 and 5.5 mos FU. Trained group reported significantly lower intensity of daily anxiety, $p < 0.034$ during the 2w post-treatment, but did not differ significantly in the frequency of anxiety during each day. **ES =** ND.	The cognitive-affective SMT effectively lowered mean anxiety and decreased the intensity of daily anxiety of participants compared to controls.	-
Sarason, 1979[65]	18[c] M/F police trainees; mean age = 25.9	*MM relaxation program: ND (ND) Education: ND (ND)	2h x 6 (12h)	STAI (*state/ trait anxiety*): no differences between groups in either state or trait anxiety. Relative to controls, the treatment group displayed a significantly higher level of test anxiety as a function of treatment, $p < 0.05$. **ES =** ND.	The SMT was not effective at decreasing anxiety compared to controls.	-
Tallant, 1989[66]	32[c] volunteers (8 M/ 24 F) who completed the pre-group assessment and were experiencing symptoms of stress; mean age = 37.7 ±	*MM relaxation program: ND (ND) WLC: ND (ND)	2h x 8w (16h + HW ND)	SCL-90-R GSI (*distress*): significant changes pre/post for stress management group $p < 0.05$ relative to controls, control group, p = NS. **ES =** ND. POMS (*tension- anxiety*): $p < 0.05$	Treatment was more effective at decreasing distress and anxiety than the WLC.	-

	10.7			between groups. **ES =** ND.		
Van Rhenen, 2005[69]	130[ac] employees (117 M/ 13 F) working in a telecommunications company in the Netherlands who were considered stressed; mean age = 44.2 ± 7.4	*Physical and relaxation exercises: 71 (45%) Cognitive intervention: 59 (39%)	1h x 4/ 8w (4h)	<u>Four-Dimensional Symptom Questionnaire (*distress, anxiety*)</u>: group x time short term, *p* = NS, follow up *p* = NS, anxiety *p* = NS at either time point. **ES,** distress overall (T1-T3) for the cognitive group, d = 0.96 (large) and relaxation intervention d = 0.90; anxiety d = 0.25 for cognitive group (small) and relaxation intervention, d = 0.57 (medium). **ES =** ND. <u>Maslach Burnout Inventory–General Survey, Dutch Version (*burnout*):</u> group x time interactions, *p* = NS at all time points. **ES** for burnout/ exhaustion, short-term cognitive group d = 0.11 and relaxation group d = 0.24; Overall cognitive group d = -0.13 and relaxation group, d = 0.20.	The relaxation intervention was not significantly more effective for significantly decreasing anxiety, distress or burnout in employees, compared to a cognitive intervention.	-
Deffenbacher, 1981[45]	47[c] M/F anxious students; mean age = ND	*C + RCS: 13 (ND) CCS: 13 (ND) RCS: 10 (ND)	C + RCS: 50m x 4/ 2w (3.3h)	<u>Achievement anxiety test (*debilitating anxiety*)</u>: Between groups analysis, pre vs. immediately post-treatment, active treatment groups reported significantly lower scores than	The combined C+RCS group significantly lowered debilitating test anxiety and significantly increased facilitating anxiety	-

		WLC: 11 (ND)		WLC, $p < 0.05$. At FU, treated subjects had lower scores vs. WLC group, $p < 0.01$, but the C + RCS group reported lower scores than either CCS or RCS groups, $p < 0.05$. **ES =** ND. <u>Achievement anxiety test – (*facilitating anxiety*)</u>: Between group pre vs. immediately post-treatment, C + RCS group reported higher scores than other groups, $p < 0.05$. At FU, the C+RCS group improved more than WLC or RCS groups, $p < 0.05$, and the CCS group had higher scores than WLC, group $p < 0.05$. STA: Between groups analysis, pre vs. immediately post-treatment, active treatment groups were less worried $p < 0.05$ and state anxious $p < 0.01$ than controls and did not differ significantly among themselves. **ES =** ND.	compared to all groups.	
Ranta, 2008[61]	80[c] (gender = ND) volunteer police personnel; mean age = ND	*MM relaxation program: 40 (ND) Relaxation control: 40 (ND)	1h x 3 (3h + HW ND)	<u>PSS (*stress*)</u>: between group differences pre/post-intervention, $p < 0.001$. Post-hoc comparison of multidimensional intervention vs. relaxation only group was significant, $p < 0.01$. Significant trial x treatment interaction $p < 0.001$. **ES =** ND.	The multidimensional intervention was more effective than the control group at reducing job stress in volunteer police personnel.	-

Tolman, 1990[68]	41[c] (12 M/ 29 F) subjects having difficulties dealing with stress; mean age = 36.3	*Multi-method SMT: 13 (ND) Relaxation-only: 14 (ND) WLC: 14 (ND) Overall: 41 (9%)	2h x 8w (16h)	SCL-90-R GSI (*distress*): multi-method and WLC significantly improved by posttest $p < 0.05$, and multi-method and relaxation only at follow up $p < 0.05$. **ES =** ND. POMS (*tension- anxiety*): between group interactions, p = NS. **ES =** ND.	Despite within-group improvements, the multi-method SMT program was not significantly more effective than the control group at decreasing stress or anxiety.	-
West, 1984[70]	60 registered F nurses; mean age = 33.8	*Coping Skills (CS): 12 (0%) *Stress inoculation: 12 (0%) Exposure to simulated stressors (Ex): 12 (0%) Education only (Ed): 12 (0%); No treatment: 12 (0%);	Coping Skills: 1h x 4/4w (4h) Stress Inoculation: 1hr x 8/4w (8h) Exposure to Simulated Stressors: 1h x 4/4w (4h) Education: 0.5h x 4/4w (2h)	STAI (*anxiety*): there was an overall effect for the four active treatments versus no treatment, $p < 0.001$. MBI (*burnout*): an overall between groups effect for the four active treatments versus no treatment, $p < 0.001$. **ES =** ND.	The CS program and the SI program, when combined as one group, showed significantly reduced anxiety relative to other groups, including an education group, a stress exposure group, and a no treatment control.	-
Lukoff, 1986[56]	28[c] M Schizophrenia patients; mean age = ND	*Holistic health sessions: 14 (ND) Social skills training-family therapy: 12 (ND)	295 min/w x 9w (44.25h)	SCL-90-R GSI (*anxiety subscale*): within group analysis pre/post-intervention holistic treatment group $p < 0.01$, social skills group $p < 0.01$. **ES =** ND. Psychiatric Assessment Scale	Despite within group improvements in both groups, the holistic health sessions were not more effective than social skills training at decreasing anxiety.	-

				(*anxiety*): holistic treatment group $p <$ NS, social skills group- not significant. **ES =** ND.		
Crouch, 2008[42]	120[ac] M/F impoverished persons in South Africa; age = ND	*Physical approach (P2): 30 (ND) Combination approach (P1): 30 (ND) Cognitive approach (P3): 30 (ND) Creative, activity based program (P4): 30 (ND)	MM Program 1: 1.5h x 4/ 4w (6h)	Questionnaire 1 (*stress*): At posttest, the stress levels of the P2 group were significantly lower than P3, $p < 0.001$ and P4, $p < 0.001$. This reduction was maintained at FU only compared to P3, $p < 0.001$ and P4, $p < 0.001$. **ES =** ND.	The P2 physical program with diet, relaxation, and exercise techniques was significantly more effective at reducing stress relative to several other groups, including a combination stress management group, a cognitive approach group, and a creative activity-based group.	-
Mosley, 1995[60]	Tension headache sufferers[c] (N = unclear) with a 37y headache chronicity average; age range = 60 - 78y	*Relaxation training (RXL): 12 (17%) Relaxation training + CBT (RXL + CBT): 13 (15%) WLC: 12 (25%)	Relaxation training: 1h x 12w (12h + HW ND)	STPI (*trait anxiety*): Relaxation group reduced anxiety compared to a control, $p < 0.01$, but not compared to the RLX + CBT group. **ES** = ND. WSI (*stress*): Relaxation group did not significantly decrease the frequency of minor stressful compared to the RLX + CB group or HMC group. **ES =** ND.	The RXL program significantly reduced anxiety relative to a WLC, but was not significantly different from the relaxation + CBT group.	-
Imagery-based Relaxation (n = 27)						
Cohen, 2011[10]	159[ab] M patients with early-stage prostate cancer who were	*SMT: 53 (28%) Supportive attention:	1.5h x 2 (3h)	POMS (*anxiety*): $p = 0.006$ pre-surgery. **ES =** ND.	The stress management group had significantly lower pre-surgery	++

	undergoing radical prostatectomy; mean age = 60.0 ± 6.6	54 (17%) UC: 52 (15%)			anxiety scores than the standard care group, with no other group differences between supportive attention and UC groups.	
Blumenthal, 2005[8]	134[ab] IHD patients; mean age = 63.0	*SMT: 44 (5%) Exercise: 48 (8%) UC: 42 (9.5%)	1.5h x 16w (24h)	STAI (*anxiety*): exercise and SMT program vs. UC *p* = NS posttreatment. **ES =** ND. 24 item General Health Questionnaire (*distress*): exercise and stress management vs. UC *p* = 0.02 posttreatment. **ES =** ND.	For patients with stable IHD, SMT training reduced emotional distress more than UC alone.	++
Norton, 2012[12]	87[a] (33 M/54 F) anxiety disorder patients; mean age = 32.98	*MM relaxation program: 65 (2%) CBT: 22 (5%)	2h x 12/12w (24h)	STAI (*anxiety*): decreasing scores were observed throughout treatment for CBT, $p < 0.001$ and relaxation, $p < 0.001$. **ES =** ND. ADDQ (*anxiety*): *p* = NS. **ES =** ND. BAI (anxiety): *p* = NS. **ES =** ND.	Both MM relaxation and CBT group showed significantly decreased anxiety, but in only one of the three self-report measures.	++
Warber, 2011[13]	58[a] (39 M/19 F) patients with a history of unstable angina or a heart attack; mean age = 60.7	*Medicine for the Earth: 28 (21.4%) LCP: 15 (6.6%) Usual cardiac care control: 15 (33.3%)	5h x 4d (20h + HW ND)	PSS (*stress*): *p* = NS at 6 mos, significant group x time interaction, $p = 0.0488$, the LCP group felt more stressed at the 3 mos FU as they attempted lifestyle changes. **ES =** ND.	The Medicine for Earth program significantly reduced stress relative to a LCP at 3 mos, but did not differ from UC. No significant differences at 6 mos.	++
Arnetz, 2009[36]	18[a] healthy M police officers with 1y of	*MM relaxation program: 9 (0%)	2h x 10/10w (20h + HW ND)	VAS (*emotional stress*): *p* = NS at post-stimulation stress. **ES,** d = -	The police imagery and skills training program	+

	experience; mean age = ND	Police training as usual control: 9 (0%)		0.80.	did not decrease emotional stress in healthy young police officers.	
Barlow, 2009[15]	142[a] (41 M/101 F) multiple sclerosis patients; mean age = 49.5	*Chronic disease self-management course: 78 (28%) WLC: 64 (23%)	Chronic disease self-management course: 2h x 6/ 6w (12h)	HADS (*anxiety*): p = NS at 4 mos and 12 mos. **ES,** d = 0.16 at 12 mos.	There were no statistically significant differences in anxiety between the intervention group and WLC group.	+
Berger, 2011[17]	80[a] Jewish and Arab baby clinic F nurses; mean age = 48.0	*MM relaxation program: 42 (ND) WLC: 38 (ND) Overall: 80 (12%)	MM relaxation program: 6h x 12/ 12w (72h HW ND)	Professional Quality of Life Scale (*burnout*): $p < 0.001$. **ES,** d = 0.22.	The stress management intervention was more effective than a WLC at reducing burnout in well-baby clinic nurses.	+
Batey, 2000[16]	562[c] M/F hypertensive patients; age range = 30 – 54y	*SMT: 242 (8%) No treatment: 320 (23%)	37h/ 18m (37h)	PGWB (*anxiety*): NS reductions at 18 mos in the stress management intervention compared to the no treatment group, p = ND. **ES =** ND.	The SMT intervention did not lower the measures of stress relative to the control group.	+
Chen, 2010[37]	19[a] (6 M/13 F) participants with current chronic pain; mean age = 39.0	*ARPT: 11 (64%) WLC: 8 (12%)	0.75h x 6w (4.5h + HW ND)	Depression Anxiety and Stress 21 Scale (*anxiety*): p = NS at post-intervention. **ES =** ND.	There is no evidence for the effectiveness of the ARPT program in reducing anxiety in participants with chronic pain.	+
de Brouwer, 2011[21]	96[ab] (31 M/43 F/12 ND) rheumatoid arthritis patients; mean age = 59.0 ± 10.5	*SMT: 49 (18%) Unspecified control: 47 (27%)	1h x 4/2w (4h + HW ND)	Dutch State Anxiety Scale (*anxiety*): $p < 0.01$ at post-intervention. **ES =** ND.	Results indicated lower anxiety after the training in the SMT than in the control group.	+

Harris, 2006[26]	259[ac] M/F participants who had experienced a hurtful interpersonal experience from which they still felt negative emotional consequences; mean age = 41.8	*Group forgiveness: 134 (14%) No treatment: 125 (18%)	1.5h x 6w (9h)	PSS (*stress*): treatment group experienced greater decreases, $p < 0.001$ compared to the control. **ES**, post-test, d = 0.66; FU, d = 0.54.	The group forgiveness intervention was significantly more effective at decreasing perceived stress than the control group.	+
Neves, 2009[30]	81[a] (69 M/12 F) coronary artery disease patients; mean age = 59.6	*Cardiac rehabilitation + Relaxation: 40 (0%) Cardiac rehabilitation control: 41 (2%)	1h x 36/12w (36 h + exercise training)	PSS (*stress*): $p \leq 0.001$ post-intervention. **ES =** ND.	The cardiac and relaxation therapy intervention decreased stress in patients with coronary artery disease.	+
Yang, 2010[85]	90[a] (61 M/29 F) nasopharyngeal cancer patients; mean age = 49.6 ± 10.8	*MM relaxation program: 30 (13.3%) Calligraphy: 30 (20.0%) No treatment: 60 (3.3%)	0.5h x 28/4w (14h)	POMS-SF Chinese version (*tension-anxiety*): $p = 0.021$ at 4w**ES,** partial $\eta^2 = 0.108$.	The mixed-modality relaxation training significantly lowered tension-anxiety scores of nasopharyngeal carcinoma patients relative to a no-treatment control.	+
Zelkowitz, 2011[35]	121[ac] new mothers of very low birth weight infants; mean age = 30.9 ± 5.7	*MM relaxation program: 60 (16.6%) Attention control: 61 (16.4%)	1.5h x 6/ND (9h + HW ND)	STAI (*state anxiety*): p = NS at 6-8w. **ES =** ND. Parental Stress Scale infant appearance/behavior subscale and role restriction subscale (*stress*): p = NS. Role restriction subscale, p = NS at 6-8w. **ES =** ND. Perinatal PTSD Questionnaire	The relaxation program was not effective in lowering anxiety or PTSD in new mothers receiving the intervention compared to control mothers who received an attention control.	+

				(*PTSD*): *p* = NS at 6-8w. **ES =** ND.		
Nunes, 2007[31]	34[ac] F breast cancer patients; mean age = 54.2 (T), 50.07 (C)	*Relaxation and visualization therapy: ND (ND) No treatment: ND (ND)	0.5h x 24 (12h + HW ND)	ISSL (*emotional stress*): within groups pre vs. post, experimental group for experiencing stress in the last 24h, $p < 0.01$, in the last week, $p < 0.05$, and in the last mos $p < 0.001$. ES: 24h, d = 0.72; last week, d = 0.64; last mos, d = 0.70. STAI (*state/ trait anxiety*): state anxiety within group pre vs. post experimental group $p < 0.05$, trait $p < 0.001$. No change over time in the control group, all $p > 0.05$. **ES**, state, d = 0.52; trait, d = 0.79.	Within-group improvements showed that RVT is more effective for reducing stress and anxiety of cancer patients undergoing radiotherapy, compared to a no-treatment control, but no between group significant results.	+
Bridge, 1988[2]	161[ac] F breast cancer patients (stage I or II) after first session of 6w course of radiotherapy; mean age = 53.0 (Relaxation + Imagery), 51.0 (Relaxation), 54.0 (C)	*Relaxation + Imagery: ND (ND) Relaxation Program: ND (ND) No treatment: ND (ND) Overall: 161 (13%)	Relaxation Program: 0.5h x 6/6w (3h + HW ND)	POMS (*tension*): women trained in relaxation plus imagery were more relaxed than those trained in relaxation only, who in turn were more relaxed than the controls, $p < 0.025$. **ES** = ND. Leeds General Scales (*anxiety*): no significant changes over the 6w of treatment. **ES =** ND.	The relaxation + imagery program showed significantly reduced anxiety compared to a no treatment control, but did not significantly differ from a Relaxation program.	+
Aikens, 1997[39]	22[c] M/F non-insulin dependent diabetes mellitus patient; mean age = 61.0 ± 10.2	*MM relaxation program: ND (ND) UC: ND (ND)	MM relaxation program - Behavioral sessions: 1h x	SCL-90-R GSI (*distress*): decreased significantly within treated subject between 1 and 9w, $p <$ 0.05.	The relaxation training was not effective at decreasing distress or anxiety in non-insulin	-

			6/ND (6h + 25-30 min relaxation sessions for 9w + HW ND)	Between groups, *p* = NS. **ES =** ND SCL-90-R GSI (*anxiety*): *p* = NS. **ES =** ND. STAI (*trait anxiety*): *p* = NS. **ES =** ND.	dependent diabetes mellitus patients compared to a UC group.	
Burns, 2008[41]	49[a] adults with acute leukemia; mean age = 52.47 ± 15.36 (T), 55.53 ± 15.88 (C)	*MM relaxation program: 25 (40%) UC: 24 (37.5%)	MM relaxation program: 0.75h x 8/4w (6h + HW ND)	STAI (*anxiety*): both groups improved in terms of greater positive affect, less negative affect, less fatigue, and less anxiety, all *p* < 0.001. **ES =** ND.	Despite within-group improvements in both groups, the music imagery intervention did not decrease anxiety more than the control group in adults with acute leukemia.	-
Decker, 1992[44]	82[ac] (30 M/52 F) newly diagnosed cancer patients undergoing radiation treatment; mean age = 61.0	*MM relaxation program: 34 (ND) Unspecified control: 29 (ND)	1h x 6 (6h + HW ND)	POMS (*anxiety/ tension*): pretest/ posttest between groups *p* < 0.001. **ES =** ND.	The relaxation training substantially improved anxiety in ambulatory patients undergoing radiation therapy.	-
Roth, 1987[64]	65[ac] M/F college students enrolled in General Psychology classes at the University of Kansas; mean age = 18.9 ± 1.3	*Relaxation training: 21 (9.5%) Aerobic exercise training: 23 (22%) No treatment: 21 (14.3%)	0.5h x 33/11w (16.5h + HW ND)	STAI (*anxiety*): between group results, *p* = NS. Results for the 3 conditions over time, *p* = 0.003. **ES =** ND. SCL-90-R GSI (*distress*): between group results, *p* = NS. Results for the 3 conditions over time *p* = 0.008. **ES =** ND.	Despite within-group improvements in all groups, the relaxation intervention did not significantly decrease anxiety when compared to the aerobic exercise training or control.	-
Tang, 2007[67]	80[ac] Dalian University of Technology undergraduates	*Integrative body-mind training: 40 (ND)	20m x 5/ 5d (1.67h)	POMS (*tension-anxiety*): Post training results indicated there were significant differences in the	The IBMT reduce tension-anxiety better than a relaxation only	-

	(gender = ND) who are healthy and without any training experiences; mean age = ND	Relaxation training control: 40 (ND)		experimental group but not the control, $p < 0.01$. **ES =** ND.	control.	
Lizasoain, 1995[54]	40[c] M/F children admitted to the pediatric ward of Clinica Universitaria of Navarra, Spain; age range = 8 – 12y	*Psychopedagogical program: 20 (ND) No treatment: 20 (ND)	ND	State Trait Anxiety in Children (*anxiety)*: Significant group effect with statistically significant differences between the experimental group and the control group, $p \leq 0.01$. **ES =** ND.	The children who received the psychopedagogial intervention had lower rates of anxiety symptomatology than the children who did not receive such a program.	-
Longo, 1988[55]	31[c] (gender = ND) people with recurrent genital herpes rates of four or more per year; mean age = 26.2 ± SD 6.41	*Psychosocial intervention: 10 (0%) Social support: 10 (0%) WLC: 11 (18%)	1.5h x 6/ 6w (9h + HW ND)	POMS (*tension-anxiety*): significant treatment x phase of treatment interaction, $p < 0.05$. Psychosocial group had significantly less tension and anxiety than WLC at 6 mos FU, $p < 0.001$. **ES =** ND. Hassles Scale (*stress*): no significant results between groups. **ES =** ND.	That psychosocial intervention reduced tension-anxiety more than placebo effects (social support) or WLC at 6 mos FU.	-
Maddi, 1998[57]	54[c] M/F managers in a utilities company; mean age = ND	*Relaxation/meditation training: 18 (33%) Hardiness training: 18 (0%)	1.5h x 10w (15h)	Personal Views Survey (*hardiness*): treatment conditions appear to have affected hardiness scores differentially, $p < 0.01$. Between group analysis showed hardiness level increased more in	The relaxation/ meditation intervention was more effective at significantly increasing hardiness than the passive listening	-

		Passive listening control: 18 (11%)		the hardiness training group than in relaxation/meditation $p <$ 0.0001 or passive listening $p <$ 0.0001. Hardiness increased more in relaxation/meditation group compared with passive listening group, $p <$ 0.0001. **ES =** ND.	condition.	
Rasmussen, 1998[62]	58[ac] M/F nursing students enrolled in graduate and undergraduate nursing courses; mean age = 30.51 ± 7.49	MM relaxation: ND Attention placebo: ND No treatment: ND Overall: 58 (17.2%)	MM Relaxation Program: 1.5h x 4/4w (6h)	Death Anxiety Scale (*anxiety*): overall decrease, $p < 0.05$ within groups, but no significant changes as a function of treatment groups. **ES =** ND. STAI (*anxiety*): overall decrease, $p < 0.05$ within groups, but no significant changes as a function of treatment groups. **ES =** ND.	Despite within group improvements, the experimental group was not successful in reducing death anxiety in nursing students compared to the control group.	-
Whitney,1989[71]	68[c] subjects (gender = ND) recruited from medium sized mid-western community; mean age = ND	*Combined process and structure 16 (12.5%) High involvement: 16 (31.3%) High structure group: 16 (6.2%) WLC: 20 (30%)	Combined Condition: 2h x 9w (18h)	POMS (*stress)*: within group analysis, pre to post for the combined condition group, $p =$ 0.011, high structure group, $p =$ 0.029, high involvement group p = 0.033, WLC, $p =$ 0.033. Between group analysis of WLC vs. all treatment groups, $p =$ NS. **ES =** ND.	Despite within-group improvements, the combined condition stress management training did not affect stress related outcomes better than WLC.	-
Iglesias, 2012[50]	56[a] (13 M/39 F) undergraduates; mean age = 23.0	RRGI: 14 (14%)	RRGI: 1.5-2h/ 10w (15-20h)	STAI (*state/ trait anxiety*): state anxiety was reduced compared to control, $p =$ 0.024; trait anxiety	The CB-SIT program significantly reduced anxiety relative to a	-

		CB-SIT: 14 (7%) RRGICB: 14 (0%) WLC: 14 (7%)	CB-SIT: 1.5-2h/ 10w (15-20 + HW ND) RRGICB: 1.5-2h/ 10w (15-20h)	within group reduction, $p < 0.013$ at post-intervention, between groups, p = NS. **ES,** state anxiety - partial $\eta^2 = 0.133$, trait anxiety - partial: $\eta^2 = 0.136$.	WLC, but was not significantly different from the RRGI program or the RRGI + CB program.	
Easwarans Eight-Point Program (n = 1)						
Oman, 2008[14]	47[ab] undergraduate students; aged 18 - 24y	*Easwarans Eight-Point Program: 16 (ND) MBSR: 16 (ND) WLC: 15 (ND) Overall: 47 (7%)	Easwarans Eight-Point Program: 1.5h x 8/8w (12h)	PSS (*emotional stress*): treatment group demonstrated significantly larger decreases in perceived stress compared to controls, $p < 0.05$. At posttest, these changes were not statistically significant. At 8w FU, $p = 0.047$. **ES,** d = 0.45, posttest d = 0.39, 8w FU d = 0.51.	The Easwarans Eight-Point Program significantly reduced emotional stress compared to WLC, but not compared to MBSR Lite.	++

*intervention of interest

**reports on multiple relaxation-based interventions of interest

[a]informed consent obtained, [b]authors report power achieved, [c]authors report power not achieved

AIDS: Acquired Immune Deficiency Syndrome, ARPT: Abbreviated Progressive Relaxation Technique , BAI: Beck Anxiety Inventory, C: Control, C+RCS : Cognitive + Relaxation Coping Skills, CB: Cognitive Behavioral, CBT: Cognitive Behavioral Therapy, CCS: Cognitive coping skills, CS: Coping Skills, D: Day(s), ADDQ: The Anxiety Disorder Diagnostic Questionnaire, ES: Effect size, F: Female, FU: Follow-up, GHQ: General Health Questionnaire, H: Hour(s), HIV: Human Immunodeficiency Virus, HW: Homework, HADS: Hospital Anxiety and Depression Scale, IBMT: Integrative Body-mind Training, IHD: Ischemic Heart Disease, LCP: Lifestyle Change Program, M: Male, MBI: Maslach Burnout Inventory, MBSR: Mindfulness-based Stress Reduction, MIN: Minute(s), MM: Multi-modal, MOS: Months, ND: Not Described, NS: Non-significant, POMS: Profile of Mood States, PSS: Perceived Stress Scale, PTSD: Post-traumatic Stress Disorder, RCS: Relaxation Coping Skills, RRGI: Relaxation Response and Guided Imagery, RRGICB: Relaxation Response and Guided Imagery Cognitive Behavioral, RRT: Relaxation Response Therapy, RVT: Relaxation and Visualization Therapy, RXL: Relaxation, SCL-90-R GSI: Symptoms Checklist- 90-Revised Global Severity Index, SMART: Stress Management and Resiliency Training, SMT: Stress Management Training, STAI: State Trait Anxiety Inventory, T: Treatment, TASC: Test

Anxiety Scale for Children, UC: Usual Care, VAS: Visual Analog Scale, W: Week(s), WCQ: Ways of Coping Questionnaire, WSI: Weekly Stress inventory, WLC: Wait List Control, WSI: Weekly Stress Inventory, WTW: Ways to Wellness, Y: Year(s)

Appendix 6. Characteristics of yoga-based modality studies

Citation	Population	Treatment Arms: # Assigned (Drop out %)	Intervention Dose (Total)	Relevant Stress Results	Author's Main Conclusions	Quality
Yoga Multi-modal (n = 13)						
Bower, 2012[20]	31[ab] F breast cancer survivors with persistent post-treatment fatigue; mean age = 53 ± 5.3	*MM yoga program: 16 (6%) Health education: 15 (13%)	1.5h x 24/12w (36h)	PSS (*emotional stress*): *p* = NS at post-intervention and at 3 mos. **ES =** ND.	A MM yoga intervention did not significantly improve emotional stress in female breast cancer survivors relative to an education control.	++
Carson, 2010[18]	53[ab] F patients diagnosed with fibromyalgia by American College of Rheumatology; mean age = 53.0	*Yoga of awareness: 25 (12%) WLC: 28 (7%)	2h x 8/8w (16h + HW ND)	Coping Strategies Questionnaire catastrophizing Subscale (*coping*): *p* = 0.0154. **ES =** ND. Fibromyalgia Impact Questionnaire Revised (*anxiety*): *p* = 0.0407 at post-intervention. **ES =** ND.	The Yoga of Awareness program significantly improved coping and anxiety in fibromyalgia patients relative to WLC.	++
Cohen, 2004[19]	39[ab] M/F lymphoma patients either receiving chemotherapy or had received it within the past 12 mos; mean age = 51.0	*Tibetan yoga program: 20 (5%) WLC: 19 (0%)	ND x 7/ND (ND)	IES (*distress*): between groups, *p* = NS pre vs. FU. **ES =** ND. Speilberger State Anxiety Inventory (*anxiety*): between groups, *p* = NS pre vs. FU. **ES =** ND.	The Tibetan Yoga Program did not improve anxiety over WLC in lymphoma patients.	++
Wolever, 2012[17]	239 (56 M/183 F) healthy workers with clinically significant stress; mean age = 42.9	*Viniyoga stress reduction program: 90 (15.5%)	1h x 12/12w (12h + HW ND)	PSS (emotional stress): stress group, $p < 0.01$ at 2w post-completion. **ES,** $\eta^2 = 0.06$.	A viniyoga stress reduction program significantly reduced stress in healthy workers	++

	± 9.7	Mindfulness at work: 96 (14.6%) No treatment: 149 (11.3%)			compared to Mindfulness at Work intervention and a no treatment control.	
Chan, 2012[24]	17[a] (12 M/2 F/3 ND) stroke survivors with chronic hemiparesis; mean age = 67.0	*MM yoga program: 9 (11%) WLC: 8 (25%)	1.5h x 6/6w + 50m x 6/6w = (14h + HW ND)	STAI (*state anxiety*): group x time interaction, *p* = NS at post-intervention. **ES =** ND. STAI (*trait anxiety*): group x time interaction, *p* = NS at post-intervention. **ES =** ND.	A MM yoga intervention did not change state anxiety in stroke survivors when compared to WLC.	+
Hartfiel, 2011[21]	48 (4 M/36 F) University Staff Members; mean age = 59.3	*MM yoga program: 24 (17%) WLC: 24 (17%)	MM Yoga Program: 1h x 6-18/6w (6-18h)	POMS- Bipolar (*anxious subscale*): *p* = 0.005. **ES,** η2 = 0.19 Inventory of Positive Psychological Attitudes (*self-confidence during stress*): *p* = 0.001. **ES,** η^2 = 0.25.	A MM yoga intervention significantly reduced anxiety and stress in healthy university staff compared to WLC.	+
Mendelson, 2010[26]	97[a] (38 M/59 F) fourth and fifth grade students; mean age = 10.15	*MM yoga program: 51 (6%) Unspecified control: 46 (4%)	0.75h x 48/12w (36h)	Responses to Stress Questionnaire (*stress*): *p* < 0.001. **ES,** d = 0.83.	A MM yoga intervention significantly reduced stress in healthy children relative to an undescribed control.	+
Noggle, 2012[22]	51[a] (22 M/29 F) grade 11 or 12 students; mean age = 17.2 ± 0.7	*MM yoga program: 36 (3%) UC: 15 (0%)	40m x 28/10w (18.7h)	PSS (*emotional stress*): *p* = NS at post-intervention. **ES =** ND. Resilience Scale (*resilience*): *p* = NS, at post-intervention. **ES =** ND.	A MM yoga intervention did not provide and improvements in stress or resilience in healthy adolescents relative to UC.	+
Vadiraja, 2009[38]	88[a] F breast cancer patients (stage II and	*MM yoga program: T 44 (5%)	1h x 18/6w (18h)	HADS (*anxiety*): *p* < 0.001. **ES,** Cohen's *f* = 0.31.	A MM yoga intervention significantly reduced	+

	III); mean age = 47.2	Supportive therapy: 44 (25%)		PSS (*emotional stress*): $p < 0.001$. **ES,** Cohen's $f = 0.36$.	anxiety and emotional stress in breast cancer patients when compared to supportive therapy.	
Tekur, 2012[23]	80[ab] (44 M/46 F) chronic low back pain patients; mean age = 49.0 ± 3.8	*MM yoga program: 40 (0%) UC: 40 (0%)	8h x 7/7d (56h + HW ND)	STAI (*state anxiety*): $p < 0.001$ at completion. **ES,** d = 1.14. STAI (*trait anxiety*): $p < 0.001$ at completion. **ES,** d = 0.94.	A MM yoga intervention significantly reduced state and trait anxiety in chronic low-back pain patients relative to UC.	+
Raghavendra, 2007[27]	98[ac] F breast cancer outpatients; mean age = ND	MM yoga program: ND (ND) Psychodynamic supportive expressive therapy: ND (ND) Overall: 98 (37%)	MM Yoga Program: 2h x 1/1d (2h)	STAI (*state anxiety*): between groups, $p < 0.001$. Subjective questionnaires (*distress*): number of distressful symptoms, $p = 0.002$, symptom distress, $p < 0.002$. **ES =** ND.	A MM yoga intervention significantly reduced anxiety and symptom distress in breast cancer patients relative to psychodynamic therapy.	+
Donesky-Cuenco, 2009[25]	41[a] (8 M/21 F) COPD patients; mean age = 70.0 ± 9.0	*MM yoga program: 20 (30%) UC: 21 (28%)	1h x 24/12w (24h + HW ND)	Modified Borg Scale (*dyspnea related distress):* $p = 0.08$ post 6m walk, p = NS post-cycle ergometry. **ES,** dyspnea-related distress end 6 min walk, d = 0.67, dyspnea-related distress end cycle, d = 0.28. STAI (*anxiety*): p = NS at 3 mos. **ES,** d = 0.39.	A MM yoga intervention did not alter distress or anxiety in COPD patients' when compared to UC.	-
Toobert, 1998[28]	28[ac] post-menopausal women with CHD; mean age = 64.0 ± 9.0 (T), 62.0 ± 11.0 (C)	*PrimeTime: ND (ND) UC: ND (ND)	4h x 2 x 60w (480h + 7d retreat + HW ND)	PSS Stress Scale (*stress*): p = NS at 4 and 12 mos. **ES =** ND. Ways of Coping Questionnaire (*coping*): scores were NS, $p = 0.07$,	The PRIME TIME intervention was successful overall at increasing coping with stress compared to a	-

				at the 4 mos assessment, however a significant overall effect $p = 0.012$ was found at 12 mos. **ES =** ND.	usual care group.	

*intervention of interest

[a]informed consent obtained, [b]authors report power achieved, [c]authors report power not achieved

C: Control, CHD: Coronary Heart Disease, COPD: Chronic Obstructive Pulmonary Disease, D: Day(s), ES: Effect Size, F: Female, FU: Follow-up, HADS: Hospital Anxiety and Depression Scale, H: Hour(s), HW: Homework, IES: Impact of Events Scale, M: Male, MIN: Minute(s), MM: Multi-modal, MOS: Months, ND: Not Described, NS: Not significant, PSS: Perceived Stress Scale, STAI: State Trait Anxiety Inventory, T: Treatment, UC: Usual Care, W: Week(s), WLC: Wait List Control

Appendix 7. Characteristics of other modality studies

Citation	Population	Treatment Arms: # Assigned (Drop out %)	Intervention Dose (Total)	Relevant Stress Results	Author's Main Conclusions	Quality
Autogenic Training (n = 12)						
Luciano, 2011[4]	216[a] (5 M/211 F) fibromyalgia patients; mean age = 55.3 ± 8.6	*AT: 108 (6.5%) UC: 108 (14%)	2h x 9/2 mos (18h + HW ND)	STAI - Spanish version (*trait anxiety*): p = 0.001 at post-intervention. **ES,** partial η^2 = 0.09.	The combination of UC with a psycho-educational program was significantly more effective at decreasing anxiety than UC alone.	++
Shinozaki, 2010[5]	21[ab] (10 M/11 F) patients with IBD which was unresponsive to pharmacotherapy; mean age = 31.6 ± 11.1	*AT: 11 (0%) UC: 10 (0%)	0.5h x 8/8w (4h + HW ND)	STAI (*state anxiety*): p = NS at undescribed time point. **ES =** ND. STAI (*trait anxiety*): p = NS at undescribed time point. **ES =** ND.	Patients with IBD did not significantly improve on an anxiety measure after completing AT when compared to a UC.	++
Asbury, 2009[6]	53[ac] F cardiac syndrome X patients; mean age = 57.1	*AT: 27 (15%) Symptom monitoring control: 26 (4%)	1.5h x 8/8w (12h + HW ND)	HADS (*anxiety*): NS. **ES =** ND. Cardiac Anxiety Questionnaire (*anxiety*): NS at post-monitoring. **ES =** ND. STAI (*trait anxiety*): NS. **ES =** ND. STAI (*state anxiety*): NS. **ES =** ND.	Despite within group improvements, the AT group was not more effective than the control at reducing anxiety.	+
Eriksen, 2002[7]	1059[ab] M/F employees in Norwegian post offices; mean age = 38.2 (PE), 38.2 (IHP), 38.9 (SMT), 37.0 (C)	*SMT: 162 (20%) PE: 189 (24%) IHP: 165 (25%)	2h x 12w (24h + HW ND)	CJSQ (*perceived job stress*): no significant effect of interventions, p = NS. **ES =** ND.	The SMT intervention had no effects on subjective job stress.	+

		Unspecified control: 344 (33%)				
Kanji, 2006[10]	93[ab] M/F nursing students; age range = 19 - 49y	*AT: 32 (34%) Attention Control (laughter therapy): 30 (20%) No treatment: 31 (16%)	1h x 8w (8h + HW ND)	STAI (*anxiety*): statistically significant difference in state anxiety between the treatment group A and the time control, $p < 0.001$, and between the treatment group and the attention control, $p < 0.005$, but not between the 2 control groups, $p < 0.595$. For trait anxiety, statistically significant difference between the treatment and time control groups $p < 0.001$, but not between the treatment and attention control group, $p < 0.084$. **ES =** ND.	AT was significantly more effective in reduction of state and trait anxiety than both other groups immediately after treatment.	+
Trzcieniecka-Green, 1996[9]	100[a] (87 M/13 F) admitted to hospitals for acute myocardial infarction (WHO criteria) or coronary artery bypass surgery; mean age < 70	*AT: 50 (ND) WLC: 50 (ND)	10 sessions (ND)	HADS (*anxiety*): significant group x time interactions were observed for anxiety $p < 0.01$, and at FU, $p < 0.05$. **ES =** ND.	The intervention significantly decreased anxiety in patients with myocardial infarction when compared to the control group.	+
Spinhoven, 1992[1]	56[c] M/F tension headache patients; mean age = 36.0	*AT: 28 (18%) Self-hypnosis: 28 (18%) Overall: 56 (18%)	AT: 0.75h x 4 (3h + HW ND + 3 boosters)	SCL-90 (*distress*): compared to a waiting list period, $p < 0.05$. FU measurements indicated that therapeutic improvement was maintained, $p < 0.05$. **ES =** ND.	The AT program showed statistically significant reductions in distress compared to a waiting list period.	+
Hidderley, 2004[12]	31[a] F having had early stage breast cancer (T1,	*AT: 16 (ND)	Weekly sessions over	HADS (*anxiety*): AT group showed a strong statistical improvement in	The AT intervention was more effective at	-

	T2, no nodes or metastases); age range = 16 - 65y	Home visit only: 15 (ND)	2 mos	their scores compared to controls, p = 0.0027. **ES =** ND.	decreasing anxiety than a home visit control group.	
Milne, 1986[16]	80 M/F IBD patients; age = ND	*AT: 40 (ND) Unspecified control: 40 (ND)	3h x 6 (18h)	IBD Stress index (*emotional stress*): Significant reduction in stress index scores from baseline levels in the treatment group only, $p < 0.001$. Significant reduction in scores in the treatment group, $p < 0.01$ from baseline to 8 mos. No significant change in the scores of the control group. **ES =** ND.	The intervention was more effective at lowering emotional stress in patients with IBD than the control	-
Solberg, 2000[18]	31[a] adult M runners; mean age = 39.0	*AT: 10 (ND) Meditation: 11 (ND) No treatment: 10 (ND)	AT: 1.5h x 7/ 7w (10.5h + HW ND) Meditation: 2.5h x7/7w (17.5h + HW MD)	STAI (*anxiety*): No significant differences across the groups. **ES =** ND.	The AT intervention was not effective for reducing anxiety in adult male runners	-
Migdał, 1989[15]	96[c] cadets in the Janek Krasicki Air Force Academy, Deblin, Poland; age range = 20 - 24y	*AT: 40 (ND) Unspecified control: 45 (ND)	ND	STAI (*anxiety*): Significant changes appeared by the end of the relaxation training both for state and trait anxiety at $p < 0.01$ in favor of the experimental group. **ES =** ND.	AT was effective for reducing anxiety in Air Force cadets, when compared to the control group.	-
Norman, 2002[17]	130[c] M/F clients of the Community Treatment and Re-integration Program for Psychotic	*SMT program: 64 (6.3%) Non-specific social	12w + HW ND	PSS (*emotional stress*): treatment x time, p = NS. **ES =** ND.	Despite within group improvements, the SMT was not more effective than the control group at	-

	Disorders situated in London, Ontario; mean age = 34.6 ± 8.04 (T), 33.4 ± 9.39 (C)	activities control: 66 (7.6%)			reducing stress.	
Self-Hypnosis Multi-modal (n = 3)						
Spinhoven, 1992[1]	56[c] M/F tension headache patients; mean age = 36.0	*Self-hypnosis: 28 (18%) AT: 28 (18%) Overall: 56 (18%)	Self-hypnosis: 0.75h x 4 (3h + HW ND + 3 boosters)	SCL-90 (*distress*): $p < 0.01$ at post-treatment, and $p < 0.05$ compared to a waiting list period. FU measurements indicated that therapeutic improvement was maintained, $p < 0.05$. **ES =** ND.	The self-hypnosis program showed statistically significant reductions in distress compared to a waiting-list period.	+
Gruzelier, 2001[11]	28[ac] M/F pre-clinical medical students; mean age = 20.1	*MM self-hypnosis program: 16 (ND) No treatment:12 (ND)	MM Self-Hypnosis Program: ND	STAI (*anxiety*): scores increased, $p < 0.001$. No between group differences. **ES =** ND.	Self-hypnosis was not effective at decreasing anxiety in pre-clinical medical students when compared to controls.	-
Stanton, 1988[19]	40[c] trained F nurses who have been employed in hospitals for at least 2 years; mean age = ND	*MM self-hypnosis program: ND (ND) WLC: ND (ND)	MM Self-Hypnosis Program: 70 min x 3 (1h 50 min)	Stress Profile (*stress*): Between groups treatment vs. control group, $p < 0.001$ at 9 mos FU, $p < 0.0001$ pre to post treatment for experimental group, $p < 0.0001$ at 9 mos FU. **ES =** ND.	The experimental group was able to significantly reduce their stress level and maintain this at FU compared to controls	-
Movement Therapy (n = 2)						
Stenlund, 2009[8]	136[b] (40 M/96 F) patients on sick leave for burnout; mean age = 41.6 ± 7.4	CBR + MM Qigong program: 67 (13.4%) Qi Gong: 69 (27.5%)	CBR: (3h x 30 over 1y) + MM Qigong Program: (1h x 52w) = (142h + HW ND)	SMBQ (*burnout*): within group improvements, $p < 0.001$ at 12 mos **ES,** d = 1.9. ELSS (*stress*): within group improvements, $p < 0.001$ at 12 mos. **ES,** d = 1.0.	No differences between groups for burnout, stress, or anxiety comparing a CBR + Qigong group compared with Qigong only group	+

				CPRS-S-A (*anxiety*): within group improvements $p < 0.001$ at 12 mos. **ES,** d = 0.7.		
McComb, 2003[14]	12[c] bulimic women; age range = 18 - 22 years	MM relaxation program: 6 (ND) Unspecified control: 6 (ND)	MM Relaxation Program: 1.5h x 8w (12h)	STAI (*state/ trait anxiety*): Decreased significantly in the treatment group, but not the control group, $p < 0.05$. **ES,** trait anxiety $f = 0.86$, state anxiety f = 0.71	The intervention group demonstrated a significant reduction in anxiety compared to an undescribed control group.	-
Narrative Medicine Multi-modal (n = 1)						
Tavakoli, 2009[3]	118[a] (71 M/47 F) international university students; mean age = 25.0	Combination condition (assertiveness training and expressive writing): 29 (17%) Assertiveness training condition: 30 (7%) Expressive writing condition: 29 (10%) WLC: 30 (0%)	Assertiveness: 1.5h x 2w (3h) + Expressive writing: 20 min x 3 over 1w (1h) = 4h total	Acculturative Stress Scale for International Students (*emotional stress): p* = NS at FU. **ES =** ND.	A MM narrative medicine program with combined assertiveness training and expressive writing intervention did not significantly change participants' total scores on a population-specific stress measure compared to a WLC.	++
Breathing Multi-modal (n = 1)						
Mayo, 2011[13]	133 (gender = ND) adults scheduled for resection of benign or malignant colorectal lesions or for colon reconstruction of non-active IBD; mean age = 60.0	*Prehabilitation walk/breath: ND (ND) Structured bike and strengthening regimen: ND (ND) Overall: 133 (29%)	Prehabilitation walk/breath group: ND	HADS (*anxiety*): *p* = NS 3-4w post-operation. **ES =** ND.	Anxiety was considerably reduced after surgery in both groups, but results between groups were not statistically significant.	-

*intervention of interest

[a]informed consent obtained, [b]authors report power achieved, [c]authors report power not achieved

AT: Autogenic Training, C: Control, CBR: Cognitively oriented Behavioral Rehabilitation, CPRS-S-A: Comprehensive Psychopathological Self-rating Scale for Affective syndromes, ELSS: Everyday Life Stress Scale, ES: Effect Size, FU: Follow-up, H: Hour(s), HADS: Hospital Anxiety and Depression Scale, HW: Homework, IBD: Inflammatory Bowel Disease, IHP: Integrated Health Program, MIN: Minutes, MOS: Months, MM: Multi-modal, ND: Not Described, NS: Not Significant, PE: Physical Exercise, PSS: Perceived Stress Scale, SCL-90: Symptoms Checklist- 90, SMBQ: Shirom Melamed Burnout Questionnaire, SMT: Stress Management Training, STAI: State Trait Anxiety Inventory, T: Treatment, UC: Usual Care, W: Week(s), WHO: World Health Organization ,WLC: Wait List control, Y: Year(s)

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