THE CAMPBELL COLLABORATION

Protocol:
Mindfulness-Based Interventions for Improving Academic Achievement, Behavior and Socio-Emotional Functioning of Primary and Secondary Students: A Systematic Review

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BACKGROUND

1.1.1.1 The Problem, Condition, or Issue

Over the past two decades, increased attention on improving academic outcomes of students to compete in a global environment has led to significant changes in education policy, with greater emphasis placed on academic versus other competencies (i.e., social, emotional, behavioural). An increased focus on improving academic rigor and the use of and emphasis on high stakes testing have been two of the more significant factors affecting education, particularly in the U.S. but also in other countries (Gregor, 2005; Von Der Embse, Barterian, & Segool, 2013). Recent policy initiatives in the U.S. (e.g., No Child Left Behind Act, 2001; Race to the Top, 2009) have emphasized school accountability for educational programming and outcomes to facilitate students developing academic proficiency. In short, present-day U.S. education policy has narrowly focused on ensuring high levels of academic achievement, a departure from a broader mission of schools to support vocational education, physical and mental health, all of which had been promoted in the past (Kataoka, Rowan, & Hoagwood, 2009). Despite increased emphasis on academic rigor and high stakes testing, findings from the National Assessment of Educational Progress (NAEP) continue to indicate poor performance for many children in the U.S. Indeed, the U.S. continues to lag behind most Organization for Economic Co-operation and Development (OECD) countries (National Center for Education Statistics, 2012; OECD, 2008), suggesting that existing educational programming is currently not meeting the needs of many students.

In addition to changes in education policy requiring an increased emphasis on academic standards and accountability, schools are increasingly expected to attend to the social, emotional, and behavioral needs and problems of students. Although schools have long functioned as a context for improving youth developmental outcomes, the myriad issues that negatively impact students' social, emotional, and behavioral functioning in schools serve as the impetus to revive schools' focus on non-academic issues (Greenberg Domitrovich, & Bumbarger, 2001; Schonert-Reichl & Lawlor, 2010). Moreover, a substantial body of evidence linking social, emotional, and behavioral factors to learning and academic achievement continues to expand, pointing to the critical need for schools to attend to these factors to enhance academic achievement (Denham & Brown, 2010; Eisenberg et al., 2010). Evidence suggests that students today are experiencing high levels of stress as well as other emotional and developmental challenges that may impede their ability to learn and succeed in school (APA, 2009; Merikangas et al., 2010; Pope, 2010). Approximately 13%-20% of children in the U.S. experience at least one mental disorder, and these rates have been on the rise since 2005 (Centers for Disease Control and Prevention, 2013). The increased prevalence of stress and anxiety, and at earlier ages than prior generations, has been at least partially attributed to school-related stress—particularly, high stakes testing, increased academic pressure, and the overscheduling of students in multiple extracurricular activities (APA, 2009; Gregor, 2005; Pope, 2010; Suldo, Shaunessy, Thalji, Michalowski, & Shaffer, 2009). Indeed, students report school-related stress as being their greatest source of stress (APA, 2009), and teachers rate behaviors associated with anxiety as some of the most

common problems that children and adolescents face (Harrison, Vannest, Davis, & Reynolds, 2012). The prevalence and levels of student stress and anxiety have become a concern for schools as emerging evidence suggests strong links between stress and academic performance as well as with emotion regulation, behavioral functioning, and brain and cognitive development, which are also strongly linked to academic performance (Anderson, 2003; Anderson & Teicher, 2009; Sandler, Braver, & Gensheimer, 2000; Shonkoff, Boyce, & McEwen, 2009; Suldo et al., 2009; Teicher, Andersen, Polcari, Anderson, & Navalta, 2002; Wolchik, Coxe, Tein, Sandler, & Ayers, 2006).

Social-emotional development and competencies have also been linked to learning and academic achievement and increasingly viewed as a target for school-based interventions (Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011; Eisenberg, Spinrad, & Eggum, 2010; Zins & Elias, 2006;). A growing body of evidence has found numerous social and emotional factors, including emotion regulation, effortful control, social and self-awareness, self-management, relationships skills and decision-making, to be directly and indirectly related to academic performance, school engagement, and externalizing and internalizing behaviors (Brackett & Rivers, 2014; Denham & Brown, 2010; Eisenberg et al., 2010; National Center for Educational Statistics, 2002; Wang Haertel, & Walberg, 1997). For example, an inverse relationship between emotion regulation and effortful control has been found with externalizing behavior problems in pre-school age children through adolescence (Eiden, Edwards, & Leonard, 2007, Eisenberg et al., 2010; Gardner, Dishion, & Connell. 2008). Conversely, students with greater ability to self-regulate are more likely to demonstrate better ability to concentrate and pay attention in school and exhibit better impulse control and fewer externalizing behaviors, leading to improved functioning and success in school (Eigsti et al, 2006; Eisenberg et al., 2010; McClelland et al., 2007; Mischel, Shoda, & Rodriguez, 1989).

The increased prevalence of stress, anxiety, mental health problems and other social, emotional, and behavioral risk factors, along with the increase in knowledge of the impact of these factors on learning and achievement, has prompted schools and policy-makers to begin to more explicitly attend to students' social and emotional functioning through both curriculum and ancillary programs (Zins & Elias, 2006). Indeed, for students to succeed in school, it seems ever more apparent that schools need to provide strong social and emotional components and support students' well-being in addition to providing strong academic curriculum and instruction (Zins, Weissberg, Wang, & Walberg, 2004).
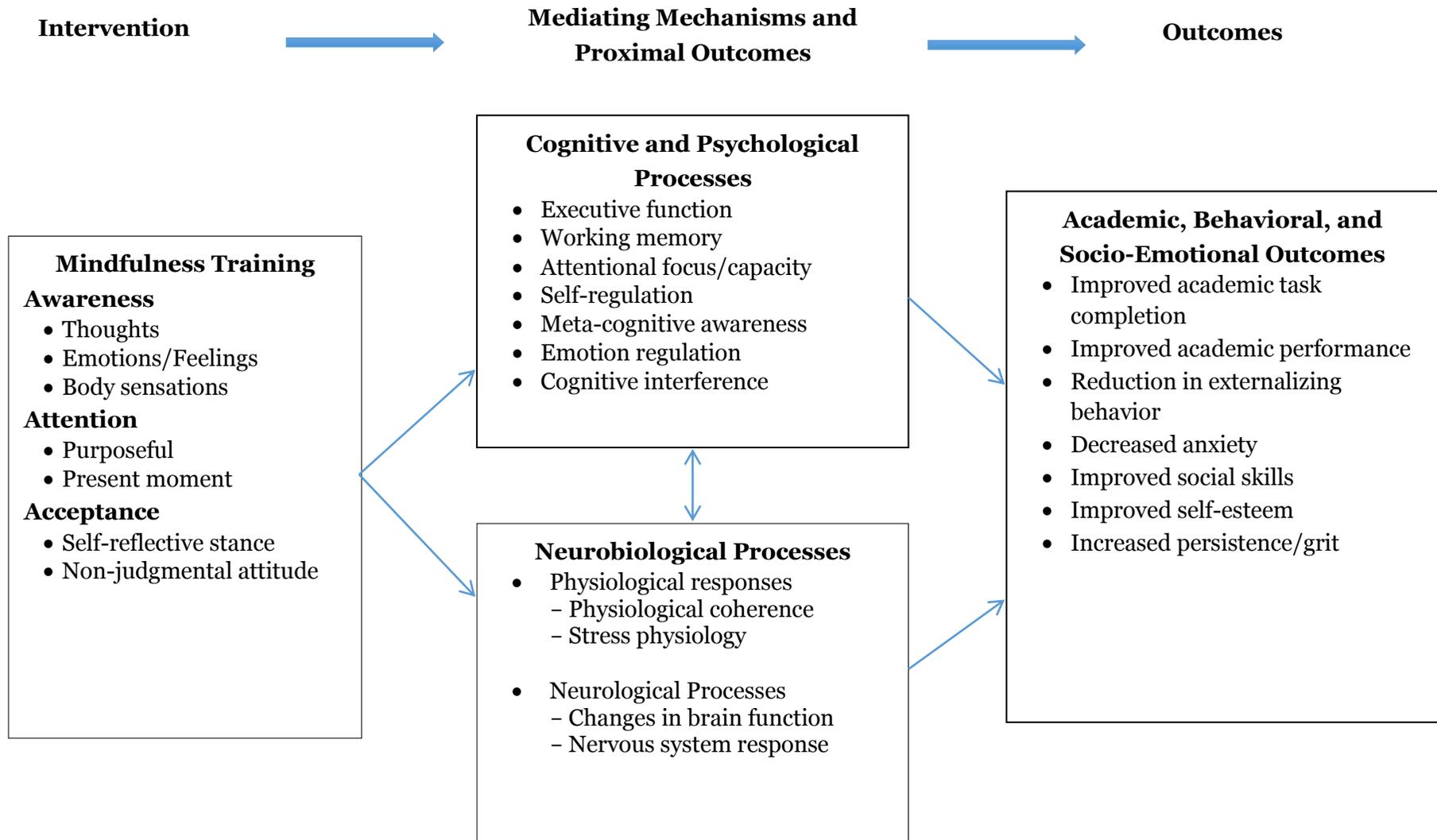
1.1.2 The Intervention

As schools have struggled to find ways to support students' overall well-being, one approach receiving growing interest is the use of mindfulness practices. Mindfulness, commonly defined as "paying attention in a particular way: on purpose, in the present moment, nonjudgmentally" (Kabat-Zinn, 1994, p. 4), is a popular topic in the public realm and being promoted by high profile stars and athletes as a means of improving health and well-being. The mindfulness practices of awareness, attention, and acceptance are interconnected to mindfulness outcomes, including a state or trait of an individual becoming increasingly

aware and attentive in the moment. Many scholars have embraced a two component model of mindfulness, (a) self-regulation of attention, described as bringing awareness to the focus of attention to a point of full attention to the changing thoughts, feelings, and sensations, and (b) orientation to experience, which refers to the attitude or approach one takes in attending to the present moment (Bishop et al., 2004). Research suggests that mindfulness practice improves performance on a variety of measures of self-regulation (Lo & Allen, 2008; Heeren, Van Broek, & Philippot, 2009), stress and mood disturbance (e.g., Speca et al., 2000). Empirically, there is evidence to support a direct link between mindfulness and cognitive, psychological and neurological processes, which in turn may affect behavioral, socio-emotional and achievement outcomes (see Figure 1).

As mindfulness seems to be a popular trend adopted by researchers and practitioners, it is also beginning to be considered in various areas of public policy, including education policy. Over the past decade, interest in mindfulness has been growing, and mindfulness-based approaches to improving health and well-being, particularly with adults, have spread across fields, including psychology, healthcare, neuroscience, and business. This burgeoning interest in mindfulness is due, at least in part, to a significant and growing body of evidence pointing to positive effects of mindfulness training for ameliorating a variety of negative problems and outcomes. Numerous studies and meta-analyses have investigated the use of mindfulness-based interventions (MBIs) in medical situations, with mindfulness training and practice being found to help patients with chronic conditions manage or reduce pain (e.g., Cramer, Haller, Lauche, & Dobos, 2012; Veehof, Oskam, Schreurs, & Bohlmeijer, 2011), fibromyalgia symptoms (i.e., Lauche, Holger, Dobos, Langhorst, & Schmidt, 2013), and stress in breast cancer patients (i.e., Zainal, Booth, & Huppert, 2013). Additionally, syntheses and meta-analyses have found positive effects of MBIs in treating individuals with mental health diagnoses, such as anxiety (de Vibe, Bjorndal, Tipton, Hammerstrom, & Kowalski, 2012; Vollestad, B. Nielsen, & H. Nielsen, 2012), psychiatric disorders (i.e., Chiesa, Calati, & Serretti, 2011), psychosis (Khoury, Lecomte, Gaudiano, & Paquin, 2013), personal development and quality of life (de Vibe et al., 2012) as well as stress among normally functioning individuals (i.e., Cheisa & Serretti, 2009) including university students (Regehr, Glancy, & Pitts, 2013).

Intervention → **Mediating Mechanisms and Proximal Outcomes** → **Outcomes**

Mindfulness Training

Awareness
- Thoughts
- Emotions/Feelings
- Body sensations

Attention
- Purposeful
- Present moment

Acceptance
- Self-reflective stance
- Non-judgmental attitude

Cognitive and Psychological Processes
- Executive function
- Working memory
- Attentional focus/capacity
- Self-regulation
- Meta-cognitive awareness
- Emotion regulation
- Cognitive interference

Neurobiological Processes
- Physiological responses
  – Physiological coherence
  – Stress physiology

- Neurological Processes
  – Changes in brain function
  – Nervous system response

Academic, Behavioral, and Socio-Emotional Outcomes
- Improved academic task completion
- Improved academic performance
- Reduction in externalizing behavior
- Decreased anxiety
- Improved social skills
- Improved self-esteem
- Increased persistence/grit

The use of MBIs is on the rise in schools across the United States and United Kingdom as more and more schools have begun implementing various mindfulness-based programs and integrating mindfulness into the curricula (e.g., MindUP, The Inner Resilience Program, South Burlington Wellness and Resilience Program, Mindful Schools, Learning to Breathe, Mindfulness in Schools Project, Still Quiet Place, Stressed Teens, and Wellness Works in Schools). Moreover, efforts to promote mindfulness practices are being included in public policy initiatives. In the U.K., for example, members of parliament have received training in mindfulness and have heard testimony of the evidence and benefits of mindfulness, including testimonies from thousands of school children who have experienced mindfulness training in school. Also this year, an all-party parliamentary group was launched in the U.K. to conduct a nine-month inquiry into the potential role of mindfulness in areas of public policy, including education (Booth, 2014). The third session of the all-party parliamentary group focused on "mindfulness in health and education," and members considered possible applications of mindfulness in health and education, with discussion of challenges for scaling up mindfulness programs to be included in teacher training as well as other potential policy actions (http://parliamentarywellbeinggroup.org.uk).

Although the use of MBIs appears to be on the rise in schools, and policy makers are calling for more mindfulness in education policy, it is unclear whether mindfulness-based approaches do indeed positively impact academic, emotional, and behavioral outcomes in students. While there is a growing body of studies of MBIs on a range of cognitive, social, and psychological outcomes including working memory, attention, academic skills, social skills, and emotional regulation (Meiklejohn et al., 2012), few studies have synthesized this literature using systematic and quantitative methods and focused specifically on school-based interventions. Rather than being driven by substantial evidence of effects on student outcomes, the seemingly growing acceptance of MBI approaches for use in school settings appears to be largely driven by intervention studies with adult populations or hypotheses based on correlational data or theories that link mindfulness practice to positive outcomes. As schools develop practices and policies to try to more effectively and efficiently improve student outcomes, it is important that researchers, practitioners, policy makers, and other key stakeholders have access to evidence of MBI effects in order to make informed decisions rather than rely on anecdotal evidence and follow current popular trends.

This review will focus on mindfulness-based interventions (MBIs) with preschool, primary and secondary students in school settings. Mindfulness is a type of practice derived from the Buddhist traditions of Vipassana and Zen/Chan (Chiesa, Calati, & Serretti, 2011; Eberth & Sedlmeier, 2012), which is characterized by awareness of the current state of the mind and body without judgment, elaboration, or attachment (Burke, 2010; Eberth & Sedlmeier, 2012) through a variety of techniques. Ideally, these strategies would be taught explicitly during the training phase, with students eventually engaging in these cognitive and behavioral processes in a variety of other situations (Hwang & Kearney, 2013; Jha, Krompinger, & Baime, 2007).

For purposes of this review, MBIs will be operationalized as a set of practices in which individuals are trained to bring awareness to the current situation, focus on the breath or

another "anchor," and simply notice what is happening with acceptance, detachment, and non-judgment (Kabat-Zinn, 1983, 1990, 1994). MBIs include self-regulation of attention on the present moment and a "particular orientation toward one's experiences in the present moment… characterized by curiosity, openness, and acceptance" (Bishop et al., 2004, p. 292). More specifically, for the purposes of this review, MBIs will include one or a combination of the following elements (Hwang & Kearney, 2013; Jha et al., 2007):

1. Awareness of breathing
2. Awareness of bodily sensations
3. Awareness of actions
4. Awareness of mental states (thoughts, feelings)
5. Self-regulation and shifting of attention
6. Adoption of a non-judgmental attitude toward one's present state
7. A seated position or slow walking meditation
8. Purposeful attention to daily activities (i.e., mindfulness of eating)

Typically, MBIs are conducted by a trained implementer through teaching of a combination of the listed elements in a group setting, though sometimes in one-on-one setting with the implementer or therapist (i.e., Singh et al., 2007). The MBI includes the direct, explicit teaching of the principle, opportunity for students to practice the principle during the intervention time, followed by practice of the principle in other situations and daily life activities.

Some school-based MBIs used with pre-school, primary or secondary students include, but are not limited to, Mindfulness Based Stress Reduction (MBSR), Mindfulness Based Cognitive Therapy for Children (MBCT-C), Meditation on the Soles of the Feet (SoF), and Learning to BREATHE (LTB).

1.1.2.1 *Mindfulness Based Stress Reduction*

MBSR was developed in 1979 by Jon Kabat-Zinn as a treatment for adults in clinical settings with the goal of reducing stress. MBSR programs are group-administered and composed of weekly 2.5-hour sessions with a daily 45-minute homework assignment (Grossman, Niemann, Schmidt, & Walach, 2004). Participants receive instruction in various aspects of mindfulness, including mindful awareness during meditation, yoga, and daily life activities as a means to alleviate stress. Participants are taught to engage in continuous awareness of physical, mental, and emotional states without judgment or evaluation in a guided group practice with accompanying independent practice. Though typically designed for adults with medical diagnoses, researchers have also adapted and implemented MBSR with children in clinical settings (Bootzin & Stevens, 2005) and community settings (Saltzman & Goldin, 2008).

1.1.2.2 *Mindfulness Based Cognitive Therapy for Children (MBCT-C)*

Mindfulness based cognitive therapy (MBCT) was originally developed by Segal, Williams, and Teasdale (2002) as a treatment to reduce relapse of recurrent major depressive episodes in adults (Semple, Lee, Rosa, & Miller, 2010). MBCT was later adapted by Semple, Reid, and

Miller (2005) and Semple et al. (2010) for use with children (MBCT-C) to address anxiety. MBCT-C was modified for children by changing the duration of the intervention from 8 weeks to 12 weeks, reducing the amount of time of each seated period, and reducing the group size (Semple et al., 2010). During weekly 45-minute sessions, children were guided through a series of activities that included identifying their present emotional state, identifying worries, engaging in a mindful breathing exercise, learning a mindful technique related to one of the senses, debriefing of previous learning, and reflecting on the previously identified emotional state (Semple et al., 2005). Both MBCT (for adults) and MBCT-C combine mindfulness-based practices such as attention on the breath and awareness of the present moment with cognitive interventions to achieve "affective self-regulation" (p. 222). Another distinction between the adult and child programs is that MBCT-C encourages parental involvement in the form of information sessions, brief mindfulness training exercises, and home practice of meditation with children. Since its development, several studies of MBCT-C in school settings have been conducted (i.e., Semple et al., 2005), as well as in other settings (e.g., Lee, Semple, Rosa, & Miller, 2008; Bogels, Hoogstad, van Dun, DeShutter, & Restifo, 2008).

1.1.2.3 *Meditation on the Soles of the Feet (SoF)*

SoF is a MBI designed to cultivate self-control of aggressive behaviors through self-regulation of emotion. Participants who have a history of aggressive behaviors are trained to notice emotional states and redirect attention to a neutral focus; in this case, the sensation of the soles of the feet (Singh et al., 2007). A trained therapist conducts the SoF training with each participant individually. The routine consists of a 10-step process in which participants are taught to notice when they feel angry, assume a sitting or standing meditative position, breathe, and allow the emotion to be present with an attitude of acceptance. Participants then shift attention to the physical sensations on the soles of the feet until the emotion is at a manageable level. Participants complete guided practice sessions and are encouraged to use the technique independently whenever they feel it is needed (Singh et al., 2007).

1.1.2.4 *Learning to BREATHE (LTB)*

LTB is a MBI that was designed specifically for a classroom setting. The curriculum "tailors mindfulness-based approaches to the developmental needs of adolescents" by helping students be mindful of their present situation through lessons on body, thought, and emotion awareness, reducing self-judgment, and increasing mindfulness in everyday life (Broderick & Metz, 2009). LTB is a brief, six-lesson curriculum conducted in a group setting that has been integrated into school curriculum in health classes (Broderick & Metz, 2009) or choir classes (Metz et al., 2013). Each lesson includes a short overview of the mindfulness principle being studied, group discussion, time to practice mindfulness by applying the principle, and home meditation practice assignments with supporting materials (Broderick & Metz, 2009; Metz et al., 2013).

In the descriptions of these approaches, one can discern that there are more similarities between MBI approaches than differences. For example, all of the approaches incorporate a

training period of guided meditation techniques focusing on mindful attention and awareness of breath, body, or mind and followed by independent practice. The interventions differ in their intended purposes, such as treatment of anxiety and stress, managing aggressive behaviors, emotional regulation, and overall health promotion

Mindfulness interventions have been implemented in "core" content classes (reading and Language Arts, math, science, or social studies), in "elective periods" such as physical education classes (Napoli et al., 2008), choir classes (Metz et al., 2013), enrichment or intervention periods, or out-of-school contexts (e.g., after-school tutoring or summer school). The type of setting is often determined by the purposes or outcomes measured, as well as the practical and systemic constraints and requirements in the school. For example, Broderick & Metz (2009) examined outcomes related to mental health by conducting the intervention in students' health classes.

In the growing area of MBI in schools, a review of the literature by Zenner and colleagues (2014) found that a majority of studies *(k* = 15 out of 24 total) used researchers or individuals hired by researchers to provide the intervention. For example, Napoli, Krech, and Holley (2005) used two implementers who had received professional training in mindfulness and had 10-20 years of experience in teaching mindfulness to deliver the intervention during children's regular physical education classes. Zenner and colleagues (2014) also found evidence of studies *(k* = 7) that used teachers to implement MBI, and two studies that used a combination of teacher and non-school trainers. For example, Metz et al. (2013) described a high school teacher who attended an eight-week MBSR program and two day in-service to prepare for implementing the LTB intervention. Metz and colleagues reported fidelity data using teacher-completed feedback forms and session logs, though the researchers reported that few of these forms were actually completed. The results of in-person fidelity observations indicated "lesson adherence, teacher enthusiasm and preparedness, and high student engagement" (Metz et al., 2013, p. 260).

MBIs may also involve parents or teachers, either as a supplement to student training or as the primary target of the intervention. For example, Semple and colleagues (2010) conducted parent-training sessions in mindfulness, which provided an overview of the program their children would be receiving at school, as well as some opportunities for the parents to engage in mindfulness practice. Parents were also encouraged to participate in their child's home practice sessions; however, no data were collected or analyzed as a result of these parent-training sessions. Other MBIs have been conducted with teachers or parents as the primary or only recipient of the intervention. In these interventions, the intent of providing teacher or parent training is to affect parent or teacher outcomes, with some hypothesizing indirect outcomes on students through changes in parent or teacher behavior from mindfulness practice. For example, Jennings and colleagues (2011) examined the effects of Cultivating Awareness and Resilience in Education (CARE), a mindfulness-based professional development program designed for teachers to reduce stress, improve teachers' performance, and prevent "burnout." CARE provides teachers with training in a series of mindfulness activities, with periods of silent reflection and opportunities to extend the practices into daily classroom routines. Teachers completed self-report measures in overall

well-being, time urgency perceptions, physical symptoms, school perceptions, and mindfulness. Teachers reported high satisfaction with the CARE training, although significant effects were found only for time urgency and measures of mindfulness. There were no measures of student performance. Because MBIs that target teachers or parents as the primary recipient of the MBI focus on different outcomes (teacher and parent outcomes versus student outcomes, with perhaps some secondary student outcomes) and are guided by a different theories of change hypothesized mechanisms in terms of student outcomes, we believe it is most appropriate to separate interventions targeting students from studies targeting teachers or parents as the primary recipient of the intervention. Therefore, we will focus this review on interventions in which students are the primary recipients of the MBI.

1.1.3 Rationale for the Intervention

Mindfulness-based strategies have been increasingly implemented in school settings to enhance and supplement instruction as a means of improving cognitive and academic performance and skills related to the learning process (e.g., attention, self-regulation, management of stress), enhancing social skills, and delivering a more holistic approach to develop the "whole person." The burgeoning interest in mindfulness-based interventions in school settings has been fueled by shifts in the educational environment, such as increased emphasis on high stakes testing and students with high levels of test anxiety (Gregor, 2005; Von Der Embse, Barterian, & Segool, 2013) and prevalence of behavioral and mental health problems in students. Further, the evidence supporting relationships of emotion regulation and stress with academic, cognitive, and behavioral functioning in school (Zins et al., 2004) has also fueled enthusiasm of MBIs. Moreover, there is emerging evidence that childhood adversity has been found to trigger neurobiological events that may alter brain development (Anderson & Teicher, 2004; Shonkoff, Boyce, & McEwen, 2009; Teicher, Andersen, Polcari, Anderson, & Navalta, 2002), potentially impairing stress response systems that underlie cognitive and emotional regulatory capacities (Anderson & Teicher, 2009). Children who experience chronic stress are potentially at-risk for difficulties with cognitive and emotion regulation, which can lead to maladaptive developmental trajectories (Compas, Connor-Smith, Saltzman, Thomsen, & Wadsworth, 2001). Emotional regulatory capabilities have been shown to mediate the relationship between exposure to stress and youth outcomes in multiple studies (Sandler, Braver, & Gensheimer, 2000; Wolchik, Coxe, Tein, Sandler, & Ayers, 2006).

Although the evidence for and theories of the mechanisms of mindfulness training is not well developed, research and theories suggest that mindfulness training affects well-being and development through changing psychological, cognitive, and biological processes (see Grabovac, Lau, & Willett, 2011, Melbourne Academic Mindfulness Interest Group, 2006, and Zelazo & Lyons, 2012 for a review of mechanisms of mindfulness training). For students, mindfulness interventions are hypothesized to improve students' capacities for self-regulation of emotions and enhance cognitive functioning, including executive function, working memory and attentional focus, and to affect physiological response which could improve behavior and academic achievement in school (Meiklejohn, 2012; See Figure 1). As

such, educators and schools have begun to adopt mindfulness-based interventions as part of educational programming.

1.1.3.1 *Academic Outcomes*

MBIs hold promise for influencing several important outcomes related to school success and achievement, namely increased learning and grades through increased grit, resiliency, self-regulation, and reading comprehension. Mindfulness training has been shown to positively affect students' emotional resiliency (Semple et al., 2010) and self-regulation (Mendelson et al., 2010). In a study of undergraduate students, Mrazek and colleagues (2013) suggested that mindfulness training had a positive effect on students' scores on the GRE reading comprehension measure by increasing working memory and decreasing thoughts unrelated to the task. While this study was done with older participants, this could potentially generalize to students in primary or secondary schools. We are interested in examining whether and how school-based intervention studies are measuring academic outcomes and the intervention effects on academic outcomes.

1.1.3.2 *Socio-emotional outcomes*

We hypothesize that during mindfulness practice, the adoption of a non-judgmental attitude will lead to increased emotional awareness and regulation and decreased anxiety. One possible pathway to decrease school-related anxiety is through the reduction of "cognitive interference," which was defined by Wine (1971, 1982) as an internalizing behavior where an individual experiences difficulties with attentional focus, concerns about competence, and preoccupation with self-oriented negative thoughts. Swanson and Howell (1996) suggested that cognitive interference is the most powerful predictor of academic anxiety. Since one of the fundamental elements of mindfulness is the awareness and acceptance of one's own thoughts and feelings, it is possible that students' cognitive interference can be reduced through mindfulness training (Beauchemin, Hutchins, & Patterson, 2008).

1.1.3.3 *Cognitive outcomes*

Mindfulness training has shown promise in increasing working memory capacity in adults (Jha et al., 2010). Similarly, in a study of mindfulness with adults and adolescents with ADHD, participants reported a decrease in attention-related symptoms (Zylowska et al., 2008). There is also preliminary evidence that MBIs may improve self-regulation outcomes (Meiklejohn et al., 2012).

1.1.3.4 *Behavioral outcomes*

MBIs may decrease externalizing behaviors in children by increasing the child's awareness of present circumstances (Bogels et al., 2008). Additionally, we hypothesize that increased mindful attention to daily activities, including academic activities, can lead to increased self-monitoring and self-regulation of attention, which can lead to an increase in task completion. Further, reviews of mindfulness interventions for individuals with developmental disabilities (Hwang & Kearney, 2013) and intellectual disabilities (Chapman

et al., 2013) reported a reduction in aggressive behaviors.

1.1.3.5 Biological outcomes

MBIs show promise for affecting individuals' physiological functioning. Preliminary investigations found that MBI have been associated with decreased levels of cortisol, a hormone associated with stress, in school-aged children (Sibinga, Perry-Parrish, Chung, Johnson, Smith, & Ellen, 2013). Additionally, mindfulness practices and other practices that can cause relaxation could have positive impacts on participants' heart rates, speed of breathing, and muscle tension (Hooker & Fodor, 2008).

1.1.4 Prior Reviews

While several reviews have been conducted on mindfulness-based interventions with adults for a myriad of problems and outcomes, less attention has been given to reviewing the literature on outcomes of mindfulness-based approaches for children and youth, particularly outcomes relevant to education. To date, we have located nine reviews of mindfulness-based interventions that include studies with children or youth. One of the reviews focused on health-related effects of sitting-meditative practices (Black, Milam, & Sussman, 2009) and two reviews were not specifically focused on children or education, but did include some studies of mindfulness-based approaches with children and/or youth with intellectual disabilities (Chapman, 2013) and developmental disabilities (Hwang & Kearney, 2013). The remaining five reviews examining effects of mindfulness-based interventions with children and youth are more relevant to the proposed review and will be discussed in more depth. Meiklejohn and colleagues (2012), Greenberg and Harris (2012), and Thompson and Gauntlett-Gilbert (2006) published traditional narrative reviews describing mindfulness interventions with children and youth. Meiklejohn and colleagues focused on literature related to integrating mindfulness training in primary and secondary education whereas Greenberg and Harris and Thompson and Guantlett-Gilbert reviewed mindfulness practices in clinical, prevention, or health promotion contexts. All three reviews described a variety of mindfulness-based approaches, and two summarized findings of intervention studies. These reviews concluded that mindfulness-based approaches are feasible and promising, but cautioned that additional and more rigorous research was needed. While these reviews provide an overview of mindfulness-based interventions with children and youth, the authors did not describe their search, selection, or coding procedures and did not quantitatively synthesize effects of the interventions, thus limiting the conclusions that can be drawn regarding the effects of mindfulness-based approaches with children and youth. In addition to several narrative reviews, three reviews were identified that used systematic review methods (Burke, 2010; Zenner, Hernleben-Kurz, & Walach, 2014; Zoogman, Goldberg, Hoyt, & Miller, 2014), two of which also quantitatively synthesized effects using meta-analytic methods (Zenner et al., 2014; Zoogman et al., 2014). Burke (2010) conducted a systematic review of mindfulness-based approaches with children and adolescents and identified 15 studies (6 used a between-group design) that met review criteria that included: articles written in English and studies that used secular contemplative mindfulness

mediation techniques. The author conducted a search for studies in 12 research databases and although the author did not limit the review to published studies, a comprehensive search for grey literature was not conducted and dissertations or conference papers were not accessed. This review included studies of mindfulness with clinical and non-clinical samples, but not all included studies are relevant to education (e.g., outpatient gastroesophageal reflux, body weight) and only four were conducted in school settings. Eight of the studies included in the Burke review were also included in the Meiklejohn review. Burke concluded that the studies provided evidence of the feasibility and acceptability of mindfulness-based approaches for children and adolescents, but the research base is limited by a lack of rigorous efficacy studies, which was attributed, in part, to the early stage of research in this area.

Two meta-analyses of mindfulness-based interventions with children and youth have been published. Zoogman et al., (2014) reports the first published meta-analysis of mindfulness meditation with youth. The search was conducted in 2011 and was limited to peer-reviewed journal articles published in English. Twenty studies (13 RCTs, 1 QED, and 6 within group pre-post test studies) reporting effects of mindfulness interventions with clinical and non-clinical samples were included in the meta-analysis. The mean effect of the included interventions was 0.227 [CI 0.148, 0.305] and heterogeneity was not significant. Of the 12 moderators tested, only one moderator was significant—studies using clinical samples reported significant larger effect sizes than studies using non-clinical samples. Additional analyses performed found significantly greater effects for psychological symptoms than measures of other outcomes.

Zenner and colleagues (2014) conducted a systematic review and meta-analysis of mindfulness-based interventions in schools with a focus on psychological outcomes (cognitive performance, emotional problems, stress and coping, and resilience). The authors conducted a comprehensive search in 2012 for published and unpublished reports yielding 24 studies (10 RCTs, 8 QEDs, 1 two-armed cohort study, and 5 non-controlled trials). The mean effect of the 19 studies using a comparison group design was $g = 0.40$ [0.21, 0.58]. The authors found significant effects on cognitive performance, resilience, and stress measures and non-significant effects on emotional problems. The authors found significant heterogeneity between studies. The included studies were often underpowered and small and a wide variety of programs were evaluated, with many researchers implementing their own programs. The authors concluded that mindfulness-based approaches in schools are promising and the available evidence justifies allocating resources to mindfulness intervention implementation and evaluation. They recommended larger studies employing more robust and well-validated measures be used in future research.

1.1.5 Contribution of this Review

The aforementioned reviews contribute to our understanding of mindfulness-based approaches with children and youth; however prior reviews are limited in several ways. First, most prior reviews used non-systematic search methods and narrative synthesis methods, are not directly relevant to education settings, or were limited by including only published

studies, thus limiting their applicability to informing practice and policy in education. This proposed systematic review will expand and improve upon prior work in several ways. First, this review will focus on a range of outcomes relevant to educational settings and will include academic performance outcomes which have not been included in prior reviews, thus providing timely information that can be used in school policy and practice decisions. Second, this review will employ a systematic and transparent process for searching, retrieving, and coding studies, including the search for unpublished studies. Using a systematic method to conduct the review of outcome research limits bias and reduces chance effects, leading to more reliable results (Cooper, 1998). Searching for unpublished studies could produce additional studies that have not been included in prior reviews. Further, explicitly and transparently describing the review process allows for others to replicate and expand the review to include new studies or criteria.

In short, this review will contribute to the literature by including the most recent research on mindfulness-based interventions in school settings, will include outcomes that have not been included in prior reviews of school-based mindfulness interventions, including behavioral and academic outcomes, and will employ stringent criteria for search, selection, coding, and analysis as specified in the Campbell Collaboration policies and guidelines to yield the most up-to-date and rigorous review to inform educational policy and practice and identify gaps in the current evidence base to guide future research in this growing area of practice and research.

OBJECTIVES OF THE REVIEW

The purpose of this review is to examine and synthesize evidence of mindfulness-based interventions implemented in school settings with primary and secondary school students on achievement, behavior and socio-emotional outcomes to inform education practice and policy. Specifically, this review is designed to answer the following research questions:

1. What types of mindfulness-based interventions are being evaluated in school settings?
2. What is the state and quality of evidence of intervention outcomes studies of mindfulness-based interventions in school settings?
3. What are the effects of mindfulness-based interventions on cognition, academic achievement, behavior and socio-emotional outcomes?

METHODS

1.1.6 Characteristics of the Studies Relevant to the Objectives of the Review

Most participant samples of MBI in preschool, primary, or secondary school settings have been within a class-wide intervention, with non-participating students participating in an alternate activity (i.e., Beauchemin et al., 2008). Studies to date have focused on feasibility and acceptability to the participants, yet there is a rapidly growing body of studies evaluating effects of MBIs on various outcomes with children and youth.

Studies in this area primarily employ self-reported or non-blind third party measures, such as surveys given to parents and teachers (Burke, 2010). Many studies use researcher-created measures (see "Attitudinal questions" in Beauchemin, et al., 2008), behavioral observation data and office discipline referrals (i.e., Singh et al., 2007), and participant self-reporting or parent/teacher reports (e.g., Napoli, Krech, & Holley, 2008; Zylowska et al., 2007). Some studies have also used standardized measures, such as the Test of Everyday Attention for Children (i.e., Napoli et al., 2008) or the Social Skills Rating System (i.e., Beauchemin et al., 2008)

Studies vary with respect to research designs, rigor, sample demographics, and interventions tested. Three representative studies are described below.

1. Napoli, Kretch, and Holley (2008) conducted a randomized control trial in which 228 students in grades 1-3 received The Attention Academy. Trainers who had received professional training in mindfulness and had at least 15 years of experience teaching mindfulness delivered the intervention. The instruction included activities such as attention on the breath, awareness of body, and de-briefing, and was facilitated by personnel highly experienced in mindfulness. The intervention was bi-weekly for 24 weeks. Findings indicate moderate effect sizes (0.39-0.60) in comparison to the control condition in attention, social skills, test anxiety, and selective attention. The study did not report demographics or disability status of participants.

2. Sibinga and colleagues (2013) conducted a randomized control trial of low-income, urban male youth in which 42 participants received either MBSR or a health education class. Dependent measures of psychological functioning from the Multidimensional Anxiety Scale for Children, sleep data, and salivary cortisol levels were collected at baseline, post-program, and at a three-month follow up. The MBSR intervention was taught by an instructor who had formal mindfulness training and over 10 years experience in mindfulness instruction for youth. MBSR participants showed improvements in self-reported measure of anxiety and coping, but there were no significant findings related to sleep. Cortisol levels in MBSR participants did not increase over time, but did among participants in the control condition.

3. Singh and colleagues (2007) used a multiple baseline across subjects design to assess the effectiveness of a Meditation on the Soles of the Feet, a mindfulness-based intervention, in reducing aggressive behaviors in three adolescents with conduct disorder. The intervention was delivered to participants individually by a therapist with extensive mindfulness training. Researchers collected observational data, office discipline referrals, and student self-reports of target behaviors. Target behaviors included severe aggressive behaviors, such as fire setting, cruelty to animals, and physical aggression with peers. Results show that the intervention resulted in a decrease in the target behaviors and was well tolerated and positively perceived by the participants.

1.1.7 Criteria for Inclusion and Exclusion of Studies in the Review

1.1.7.1 Interventions

Interventions of interest include those that are a) conducted in a school setting (during the school day or in a school-based after school program) and b) use a mindfulness component/strategy. Mindfulness is broadly defined as "self-regulation of attention to the conscious awareness of one's immediate experiences while adopting an attitude of curiosity, openness, and acceptance" (Bishop et al., 2004, p. 174). While definitions and mindfulness practices vary across studies, "most involve focusing non-judgmental attention on moment-to-moment private experiences, such as breath, thoughts, physical sensations, or other external aspects of the environment" (Thompson & Gauntlett-Gilbert, 2008, p. 398). For the purposes of this review, mindfulness-based interventions include methods for teaching mindfulness awareness where participants are encouraged to focus their attention either on a covert activity (e.g., thoughts, feelings, urges) or overt activity (e.g., lights, sounds, smells). Mindfulness interventions include present moment work, meditation, relaxation skills training, breathing techniques and awareness of moment techniques delivered in vivo, via formal meditation practices or informal mindfulness exercises. Some specific interventions eligible include, but are not limited to, Mindfulness Based Stress Reduction (MBSR), Mindfulness Based Cognitive Therapy (MCBT), Learning to BREATHE, Inner Kids Program, and Acceptance and Commitment Therapy (ACT).

We will include studies that use multi-component interventions as long as one of the components is a mindfulness strategy. Mindfulness-based interventions targeting parents or staff/teachers intended to indirectly affect student outcomes will be excluded from this review.

We will exclude Transcendental Meditation interventions. The Transcendental Movement (TM) is another meditation-based intervention that has been implemented in schools (e.g., Quiet Time Program by David Lynch Foundation; Barnes, Davis & Trieher et al., 2003) and examined for the reduction of stress in adolescents (e.g., Barnes, Trieber, & Davis, 2001). Although MBIs and TM share a component of meditation, TM based interventions will be not be considered for this review for several reasons. Because TM is a concentrative technique in which the meditator focuses the mind using a mantra, a picture, or a physical experience (Sedlmeier et al., 2012), there is concern about the religious aspect of TM, which is not present in MBIs. In fact, in one area, school administrators cancelled plans to implement TM due to concerns by parents that it would be promoting a religion (The Associated Press, 2006). Further, a United States federal appeals court (1979) called TM a form of religious teaching and ruled that the practice could not be taught as an elective in public high schools in the state of New Jersey, United States (*Malnak v. Yogi*, 1979). Another difference between TM and MBIs is that MBIs typically contain a practice of generalizing the skill of mindfulness into day-to-day activities such as academic tasks or the regulation of attention, whereas TM is primarily viewed a period of meditation in order to "take a break" from day-to-day activities. Due to the differences in nature and intent from MBIs interventions utilizing TM will be excluded from is review.

1.1.7.2 Participants

Participants will be children in pre-school, primary and secondary school grades in regular education, special education or alternative education settings from any country. As we anticipate, and as prior reviews have suggested, effects of MBIs may differ based on whether the sample is comprised of students that are high risk or come from a clinical population or from the general population of students. Therefore, we will include MBIs that are implemented with any sample of students (e.g., general population, ADHD, special education) and will code the studies accordingly. Because we are interested in informing education policy, studies that include participants in inpatient hospital or residential settings will be excluded from this review. Studies in which parents or teachers are the primary recipients of the intervention will be excluded, although studies that include a parent or teacher component of an MBI intervention with students will be included.

1.1.7.3 Outcomes

Studies must report at least one of the following outcomes:

1. Cognition (e.g., executive function, memory, cognition, attention)

2. Academic performance (e.g., standardized achievement tests, measures of content mastery, reading, grades)

3. Behavior (e.g., disciplinary referrals, aggression and other externalizing behaviors, time on task, compliance, attendance)

4. Socio-emotional (e.g., anxiety, stress, engagement, social skills, self-esteem, emotion regulation, grit)

5. Physiological outcomes (e.g., cortisol, heart rate, brain activity)

Measurement of above outcomes may be conducted using standardized or unstandardized instruments and may be self-, parent-, or teacher-reported or researcher administered measures. To be included in the meta-analysis, primary study authors must report enough information to calculate an effect size. If sufficient information to calculate an effect size is not provided, every effort will be made to contact primary study authors and request the necessary information.

1.1.7.4 Research methods/designs

To be included in this review, studies must use one of the following research designs: randomized controlled trial (RCT), quasi-experimental design (QED), single-group pre-post test design (SGPP) or single subject design (SSD). For RCT and QED studies, wait list control, no treatment, treatment-as-usual and alternative treatment groups will be considered acceptable comparison groups. The type of comparison group used in each study will be coded and examined as a moderator. We will not require that studies provide pre-test data or make statistical adjustments; however, we will code such data and will use in the

analysis. To be eligible for inclusion, SSD studies must employ one of the following designs: alternating treatments, multiple baseline, or withdrawal. Although it is not typical for single-group or single subject designs to be included in Campbell reviews, this is a relatively nascent area of research and we believe it is important to provide a comprehensive picture of the state of evidence related to mindfulness-based interventions in school settings. These studies are being included in this review to provide a description of mindfulness interventions being used in schools and the means and extent to which interventions are being assessed. We will quantitatively synthesize effects separately by study design. Limitations and biases related to study designs that are inherently weaker will be explicitly recognized and discussed.

1.1.7.5   Other criteria

Studies will be included if they were conducted or published between 1990 and present. No additional criteria will be applied. The search will not be restricted by geography, language, publication status or other study characteristics.

1.1.7.6   Procedures for applying inclusion criteria

One reviewer will conduct the initial search in all sources and will save the search results in an electronic format. At this stage, the reviewer will examine titles and abstracts and will discard results that are obviously ineligible (non-empirical report, book review, editorial, adult participants, prior to 1990 etc.). For those that are not obviously ineligible, the reviewer will retrieve the reports, save them in an electronic file, and document the bibliographic information, source, and date retrieved in a database. Two reviewers will then independently screen each of the reports for eligibility using a screening instrument (see Appendix A). A third reviewer will compare the coding and identify all discrepancies. The review team will meet to discuss discrepancies and will resolve all discrepancies through consensus.

1.1.8 Search Strategy for Finding Eligible Studies

We propose to include all studies that meet the inclusion criteria outlined above. We will attempt to identify and retrieve both published and unpublished studies through a comprehensive search that includes multiple electronic databases, research registers, grey literature sources, and reference lists of reviews and relevant studies.

1) *Electronic Databases*

    a.   Academic Search Premier

    b.   Australian Education Index

    c.   British Education Index

    d.   CBCA Education

    e.   Education Complete

f. ERIC

g. FRANCIS

h. MEDLINE

i. ProQuest Dissertations and Theses

j. PsycINFO

k. Social Science Citation Index

l. Social Service Abstracts

m. Sociological Abstracts

n. CINAHL

o. SPORTDiscus

2) *Research Registers and Websites*

a. Cochrane Collaboration Library

b. Database of Abstracts of Reviews of Effectiveness

c. National Technical Information Service

d. System for Information on Grey Literature

e. Evidence for Policy Practice Information and Coordinating Centre (EPPI-Centre)

f. Association for Mindfulness in Education (mindfuleducation.org)

g. Mindfulness in Schools Project (mindfulnessinschools.org)

3) *Grey literature sources*

a. Social Science Research Network

b. Authors of prior studies will be contacted in an attempt to obtain unpublished studies, studies in process and published studies missed in the database search.

c. Conference abstracts and proceedings will be reviewed to identify potentially relevant studies. Conference searches will include:

   i. The Society for Research on Educational Effectiveness (https://www.sree.org/pages/conferences/index.php)

ii. American Educational Research Association Repository (http://www.aera.net/EventsMeetings/tabid/10063/Default.aspx.)

iii. Society for Research on Child Development (SCRD)

iv. Society for Research on Adolescence (SRA)

d. Clearinghouses, research centers and government websites will be reviewed to identify potential sources of relevant data:

i. The US Department of Education's web site contains reports of funded programs and initiatives: http://www2.ed.gov/about/offices/list/opepd/ppss/reports.html

ii. The Institution of Education Sciences, What Works Clearinghouse contains reports of intervention investigations: http://ies.ed.gov/funding/grantsearch/index.asp

iii. Mindfulness Research Guide: http://www.mindfulexperience.org/mrg-user-reviews.php

iv. Garrison Institute's Contemplative Education Database: www.garrisoninstitute.org

4) The reference lists from prior reviews and included studies will be reviewed for potential studies. We will also conduct forward citation searching using Google Scholar to search for studies citing our included studies.

1.1.8.1 Search Terms and Keywords

We will use combinations of terms related to the intervention, population, study design, and setting to search the electronic databases. Database-specific strategies will be explored for each database, including the use of truncation and database-specific limiters and thesauri will be consulted to employ more precise search strategies within each database. Below are examples of the types of terms we anticipate using:

1) Intervention: mindful* OR meditat* OR yoga OR "breath* technique" OR "mindfulness based stress reduction" OR MBSR OR "Mindfulness-based cognitive therapy" OR MBCT OR "learning to breathe" OR MindUP OR "Meditation on the Soles of the Feet" OR "non-judgmental awareness" OR "present-moment"

AND

2) Report type: evaluation OR intervention OR treatment OR outcome OR program OR trial OR experiment OR "control group" OR "controlled trial" OR "quasi-experiment*" OR random*

AND

3) Targeted population: "elementary school" OR "primary school" OR "high school" OR "secondary school" OR "middle school" OR kindergarten OR pre-kindergarten

1.1.8.2 Hand Searching

We will hand search the most recent issues of key journals (i.e., those that have provided a high number of included studies).

1.1.9 Data Extraction and Study Coding Procedures

For all studies that pass the eligibility screening process described above, two reviewers will independently code all eligible studies using a structured data extraction form (see Appendix B). The data extraction form includes items related to bibliographic information and source descriptors; methods and procedures; context, nature, and implementation of the intervention; sample characteristics; and outcome data needed to calculate effect sizes. Two trained coders, Brandy Maynard and Veronica Miller, will code all included studies. If greater than 20 studies are eligible for inclusion in the review, a third coder may be recruited to assist with coding. Maynard is a trained Campbell reviewer and has substantial experience coding intervention studies for systematic reviews. Veronica Miller is a graduate student who also has experience coding intervention studies. Both coders have been involved in the development of the data extraction form and protocol. Moreover, coders will pilot test the code form together using diverse types of studies and will discuss any items that are unclear and ensure mutual understanding of all items. Following pilot testing of the form, two coders will independently code 100% of the included studies. Coders will compare coding and will identify and discuss discrepancies, which will be resolved through consensus. If consensus cannot be reached between the two coders, a third member of the review team will be consulted to resolve the discrepancy. Initial discrepancies will be recorded and inter-rater reliability will be reported.

1.1.10 Risk of Bias

Two review authors will independently assess risk of bias in RCT and QED studies using the Cochrane Collaboration's risk of bias tool (Higgins et al., 2011) for RCTs and the new extended Cochrane risk of bias tool for non-randomized studies of interventions (ACROBAT-NRS; Sterne, Higgins, & Reeves, 2014) for non-randomized trials. For the risk of bias for randomized trials, we will assess risk of bias for each of the six following domains: allocation, blinding, complete outcome data, selective reporting, and other potential sources of bias (i.e., intervention fidelity). Each study will be coded as "low", "high", or "unclear" risk of bias on each of the domains. For non-randomized trials, we will follow the guidelines as published by Cochrane's development group for the ACROBAT-NRSI (Sterne et al., 2014). Following independent coding by two authors, coders will meet to identify any discrepancies, and all discrepancies will be resolved through consensus. If consensus cannot be reached between the two reviewers, a third member of the review team will be consulted. Risk of bias in each domain will be reported within and across studies in the results section

using narrative and graphs. We anticipate that most studies included in this review will be at high risk of bias; thus, we do not plan to restrict analyses based on risk of bias nor do we anticipate using risk of bias as a moderator variable. We plan to present all included studies and provide a narrative discussion of risk of bias to include discussion of the potential limitations of the review as well as implications of bias in the interpretation of the results in the Discussion section of the review.

1.1.11 Publication bias will be assessed by examining the symmetry of a funnel plot where the relative effect size and sample size are plotted for each study.

1.1.12 Synthesis Procedures and Statistical Analysis

We will conduct descriptive analyses on variables of interest from all included studies to provide information regarding:

- Study participants (e.g., risk level/subgroups, gender, race, income level, grade, age),

- Settings where studies are situated (e.g., school type, classroom type, geographical location/country, community characteristics),

- Relevant intervention characteristics (e.g., mindfulness strategies used, involvement of parents/teachers, duration of intervention, modality of intervention, implementer training), and

- Risk of bias across RCT and QED studies on each domain

Following descriptive analysis, we will estimate effect sizes for each included study. For RCT and QED studies, we will calculate the magnitude of effect using the standardized mean difference effect size with Hedges' g correction for continuous outcomes and odds ratios for outcomes presented as dichotomous variables. We anticipate that outcomes within a category will be measured using similar metrics and therefore, effect sizes within each category will only use either Hedges' g or odds ratio metrics in the analysis. If, however, outcomes within one of the outcome categories are measured in different metrics, we will convert them to Hedges' g using CMA software. For SSD studies, we will estimate study level effect sizes using a standardized mean difference effect, which is similar to a Cohen's d (Hedges, Pustejovsky, & Shadish, 2012; Shadish, Hedges, & Pustejovsky, 2014). Indeed, prior comparative studies of available effect size options for SSD studies (i.e., PND, general linear approaches, and the percentage reduction measure) suggested that the standardized mean difference effect is the most consistent effect size metric for single case designs (Olive & Smith, 2005). For single group pre-post test studies, the standardized mean gain effect size statistic will be used. All effect sizes will be calculated using a 95% confidence interval. We will code all effect sizes so that a positive effect reflects outcomes favoring the treatment group.

Following the estimation of individual study level effects, we will conduct separate meta-analyses to pool RCT studies, QED studies, SGPP studies and SSD studies for each outcome construct. For group designs, a weighted mean effect will be calculated by weighting each

study level effect size by the inverse of its variance. For SSD studies, we will follow procedures described in Shadish et al. (2014). Random effects statistical models will be used throughout unless a compelling case arises for fixed effect analysis. As noted above, RCT studies will be pooled separately from QED studies; however, if RCT and QED studies are found to be homogenous, studies will be pooled to allow for greater statistical power.

We are interested in four primary outcome constructs: cognition, academic performance, externalizing behaviors, and socio-emotional functioning. We anticipate that included studies will use multiple measures for each outcome, multiple reports of the same outcome measure, multiple follow-up time points, and possibly more than one counterfactual condition. These circumstances create statistical dependencies that violate assumptions of standard meta-analytic methods. In order to ensure independence of study-level effect sizes, we will include only one effect size estimate from each independent sample on each outcome construct.

For cases in which a study uses multiple measures (i.e., observation and a standardized instrument) of the same construct, we will code data for each measure and create a study level average across the measures. Each of the four outcome constructs of interest to this review likely encompass a range of behaviors that may cluster into conceptually distinct outcomes. Therefore, we plan to code the specific subtype of outcome for all codable effect sizes. The strategy will allow an examination of the relation between the intervention for different behavior subtypes and to conduct sensitivity analyses of the impact of aggregating the subtypes into one study level effect size as well.

In cases of multiple reports on the same outcome (i.e., parent and child report), we will code data for each report and take an average of all reports. Because averaging reports may result in masking different viewpoints of different reporters, we will examine their concordance beforehand by performing sensitivity analysis to see if results vary across reporters (Littell, Corcoran, & Pillai, 2008).

In cases where multiple points of follow-up are provided, we will code follow-up points to conduct a separate analysis for effect sizes comparing studies with similar points of follow-up. In cases where studies report multiple measures or multiple reports on the same outcome, the mean of the measures will be taken to estimate a study-level average across the measures of the same construct. In the case of multiple counterfactual conditions, we will select the comparison condition that is most similar to those in the other included studies.

Following the estimation of summary effects, we will conduct a test of homogeneity (Q-test) to compare the observed variance to what would be expected from sampling error. The I^2 statistic will also be used to describe the percentage of total variation across studies due to the heterogeneity rather than chance. We will also construct a forest plot displaying study-level mean effect sizes and 95% confidence intervals for the included studies to provide opportunity for visual analysis of the precision of the estimated effect sizes, detection of studies with extreme effects, and information regarding heterogeneity of studies.

Provided there are a sufficient number of studies, we will conduct moderator analysis to examine characteristics of the study methods, interventions, and student samples that may be associated with effect size. The approach to moderator analysis will be dependent upon

the available data. If there are sufficient studies available, meta-regression will be used. If we do not have adequate statistical power for meta-regression, we will use the analog to the ANOVA to conduct moderator analysis using the following variables: 1) Type of mindfulness intervention; 2) duration of intervention (continuous measure); 3) at home practice (yes/no); 4) training of implementers (yes/no); and 5) fidelity. Sensitivity analysis will be conducted to examine the potential effects of outliers and studies not reporting or controlling for group differences. If necessary, additional sensitivity analysis will be conducted if other issues arise that may impede our confidence in the estimated pooled effect size estimates. Analysis will be conducted using Comprehensive Meta-Analysis 2.2 (CMA).

1.1.13 Treatment of Qualitative Research

Qualitative studies will not be included in this review.

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SOURCES OF SUPPORT

DECLARATIONS OF INTEREST

The review team declares no potential conflicts of interest.

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ROLES AND RESPONSIBILITIES

Roles	Name(s)	Background, Skills, Areas of Expertise
Content	Maynard Miller Solis	Brandy Maynard and Veronica Miller will be responsible for the substantive content related to mindfulness. Maynard has been trained in and implemented Dialectical Behavior Therapy and Miller also has been trained in mindfulness techniques. Solis will provide content area expertise related to educational research and outcomes.
Systematic Review Methods	Maynard Solis	Brandy Maynard and Michael Solis have significant experience and expertise in systematic review methods. Both Maynard and Solis have completed and published multiple systematic reviews/research syntheses. In addition, Maynard has been trained in C2 methods and is actively involved in C2- she has produced two Campbell reviews and is co-author on two additional reviews, is an editorial board member of the ECG, is a C2 methods trainer, and has been elected as co-chair of the social welfare group. Solis also participated in two days of C2 methods training at the 2013 C2 Colloquium.
Statistical Analysis	Maynard Solis	Brandy Maynard will be responsible for statistical analysis. Maynard has been trained in meta-analytic techniques and Maynard and Solis have conducted several meta-analyses.
Information Retrieval	Maynard Solis Miller	Maynard, Solis, and Miller are experienced in information retrieval. Maynard and Solis will also consult with information retrieval specialists within their institutions in the planning and execution of the search strategy. Dollars have also been budgeted

		to consult and procure services from an information retrieval specialist to search specialized, foreign databases to which the review team does not have experience or access.
Other Roles	Describe as needed	

ACKNOWLEDGEMENTS

EXPECTED TIMEFRAME

Search and selection of studies: November, 2014

Coding of studies: March, 2015

Analysis: April, 2015

Draft review submission: July 31, 2015

PLANS FOR UPDATING THE REVIEW

We will update the review in four years from date of publication of this review.

AUTHORS' RESPONSIBILITIES

Authors' responsibilities

By completing this protocol, you accept responsibility for preparing, maintaining, and updating the review in accordance with Campbell Collaboration policy. The Coordinating Group will provide as much support as possible to assist with the preparation of the review. A draft review must be submitted to the Coordinating Group within two years of protocol acceptance. If drafts are not submitted before the agreed deadlines, or if we are unable to contact you for an extended period, the Coordinating Group has the right to de-register the title or transfer the title to alternative authors. The Coordinating Group also has the right to de-register or transfer the title if it does not meet the standards of the Coordinating Group and/or the Campbell Collaboration.

You accept responsibility for maintaining the review in light of new evidence, comments and criticisms, and other developments, and updating the review every five years, when substantial new evidence becomes available, or, if requested, transferring responsibility for maintaining the review to others as agreed with the Coordinating Group.

Publication in the Campbell Library

The support of the Coordinating Group in preparing your review is conditional upon your agreement to publish the protocol, finished review, and subsequent updates in the Campbell Library. The Campbell Collaboration places no restrictions on publication of the findings of a Campbell systematic review in a more abbreviated form as a journal article either before or after the publication of the monograph version in *Campbell Systematic Reviews*. Some journals, however, have restrictions that preclude publication of findings that have been, or will be, reported elsewhere and authors considering publication in such a journal should be aware of possible conflict with publication of the monograph version in *Campbell Systematic Reviews*. Publication in a journal after publication or in press status in *Campbell Systematic Reviews* should acknowledge the Campbell version and include a citation to it. Note that systematic reviews published in *Campbell Systematic Reviews* and co-registered with the Cochrane Collaboration may have additional requirements or restrictions for co-publication. Review authors accept responsibility for meeting any co-publication requirements.

I understand the commitment required to undertake a Campbell review, and agree to publish in the Campbell Library. Signed on behalf of the authors:

Form completed by: **Date:**

Brandy R. Maynard   **8/26/14**

Mindfulness-Based Interventions for Improving Academic Achievement, Behavior, and Socio-Emotional Functioning of Primary and Secondary Students Screening Form

1. Study ID#: __ __ __   [STID]

2. Date of Screening: __ __- __ __- __ __ __ __   [SCDATE]

3. Primary Author: _____
   [AUTH]

4. Bibliographic info (APA format):   [BIB]

5. Is this study a: [STYPE]
   - ❑ 1. RCT
   - ❑ 2. QED
   - ❑ 3. Single subject design
   - ❑ 4. Single group pre-post design
   - ❑ 5. None of the above- IF CHECKED THEN STOP

6. Is this a study of a school-based intervention for children/youth (PK-12)?   [PART]
   - ❑ 0. No- STOP
   - ❑ 1. Yes
   - ❑ 2. Unsure

7. Is this study examining effects of a mindfulness-based intervention as defined in the protocol?
   [INT2]
   - ❑ 0. No- STOP
   - ❑ 1. Yes
   - ❑ 2. Unsure

8. Does this study report at least one of the following outcomes: cognition, academic performance, behavior, socio-emotional functioning?
   [OUTCOME]
   - ❑ 0. No- STOP
   - ❑ 1. Yes

9. Is this study eligible for the review?   [ELIG]
   - ❑ 0. No: Reason _____
   - ❑ 1. Yes
   - ❑ 2. Need more information to make decision

10. Notes/Comments   [SNOTE]

APPENDIX B: CODING FORM

Mindfulness-Based Interventions Review
Data Coding Form

Study ID#: _____   Coder: _____   Date of coding: _____

Section A – Source Descriptors

A1. Report Type   [rtype]
- ❑ 1. Journal Article
- ❑ 2. Book/book chapter
- ❑ 3. Gov't report (local, state, federal)
- ❑ 4. Conference proceedings
- ❑ 5. Thesis or Dissertation
- ❑ 6. Unpub report (non-gov't, tech report)
- ❑ 7. Other (specify): _____
- ❑ 5. Expert Referral

A2. Country   [country]
- ❑ 1. USA
- ❑ 2. Canada
- ❑ 3. Australia
- ❑ 4. Europe
- ❑ 5. Asia
- ❑ 6. Other (specify): _____

A3. Language if other than English _____   [lang]

Section B1—Group Design (RCT, QED, SGPP)
Study Methods, Quality and Risk of Bias

B1.1. Method of assignment to condition(s)   [grp_assign]
- ❑ 1. Random, simple
- ❑ 2. Random, after matching, stratification, blocking, etc.
- ❑ 3. Quasi-random-assigned by some naturally occurring process
- ❑ 4. Matched or statistically SGPP study
- ❑ 5. N/A- SGPP study
- ❑ 99. Not specified / not enough information to determine

B1.2. Unit of assignment to conditions   [txassign]
- ❑ 1. Individual participant
- ❑ 2. Group/Cluster: specify _____
- ❑ 3. Other: _____
- ❑ 4. N/A- SGPP study
- ❑ 99. Not enough information to determine

B1.3. How was random assignment performed: [random]
- ❑ 1. Computer generated
- ❑ 2. Random numbers table
- ❑ 3. Coin toss/dice/shuffling
- ❑ 4. Not reported
- ❑ 5. Unclear description
- ❑ 6. N/A-No random assignment

B1.4. What method was used to conceal allocation sequence?   [alloc]
- ❑ 1. Sealed number/coded envelope
- ❑ 2. Other
- ❑ 3. No concealment
- ❑ 4. Not reported
- ❑ 5. Unclear description
- ❑ 6. N/A- No random assignment

B1.5. Were the outcome assessors blinded?   [blind]
- ❑ 0. No
- ❑ 1. Yes

B1.6. Were participants blinded to condition?   [blindpart]
- ❑ 0. No
- ❑ 1. Yes

B1.7. Did the study have high attrition (for RCT/QED, exceeds WWC attrition criteria; for SGPP, > 20%)?   [grp_attrit]
- ❑ 1. Yes
- ❑ 2. No
- ❑ 99. Not enough information to calculate

B1.8. If matching was used, how were groups matched?   [grp_match]
- ❑ 1. Matched on pretest measure
- ❑ 2. Matched on demographics
- ❑ 3. Matched on both of the above
- ❑ 4. Propensity Score Matching
- ❑ 5. Other matching technique: _____
- ❑ 6. N/A- SGPP study
- ❑ 7. Not enough information to determine

B1.9. Results of statistical comparisons of pretest differences   [grp_pre]
- ❑ 1. No comparisons made

- ❑ 2. No statistically significant differences
- ❑ 3. Significant differences judged unimportant by coder
- ❑ 4. Significant differences judged of uncertain importance by coder
- ❑ 5. Significant differences judged important by coder
- ❑ 6. N/A- SGPP study

B1.10. If groups were non-equivalent at baseline, were statistical controls used? [grp_ctrl]

- ❑ 1. Yes
- ❑ 2. No
- ❑ 3. N/A- SGPP study

Section B2—Multiple Group (RCT, QED)
Dependent Variables and Effect Size Information

Continuous outcomes

Construct ID	Outcome	Measure	Valid?	Source (participant, clinician, parent)	Timing (end of treatment, 3 month, etc.)	Tx analytic sample size	Control group analytic sample size	Intervention group Baseline Mean (SD)	Intervention group Post Mean (SD)	Control group Baseline Mean (SD)	Control group Post Mean (SD)	Values for t, F, other

Note: Construct ID- 1= Cognitive; 2= Academic performance; 3= Behavior; 4= Socio-emotional

Dichotomous outcomes

Construct ID	Outcome	Measure	Valid?	Source (participant, clinician, parent)	Timing of measurement (end of treatment, 3 month, etc.)	Tx analytic sample size	Control group analytic sample size	Intervention group % successful	Intervention group % not successful	Control group % successful	Control group % not successful	Values for statistical tests (i.e. chi-square)

Note: Construct ID- 1= Cognitive; 2= Academic performance; 3= Behavior; 4= Socio-emotional

Section C—Single Subject (SSD)
Study Methods and Quality Determination

C1. SSD study design   [ssd_design]
- ❑ 1. Alternating treatments
- ❑ 2. Multiple baseline
- ❑ 3. Withdrawal design
- ❑ 4. Other: _____

C2. The outcomes were measured by more than one assessor   [ssd_assess]
- ❑ 1. Yes, number of assessors_____
- ❑ 2. No
- ❑ 99. Not specified

C3. The assessors collected interrater agreement in each phase for 20% of observations
(Kappa).   [ssd_20p]
- ❑ 1. Yes
- ❑ 2. No
- ❑ 99. Not specified

C4. Interrater reliability was =/> .80 for each phase.   [ssd_rel]
- ❑ 1. Yes
- ❑ 2. No
- ❑ 99. Not specified

C5. The study included more than one phase.   [ssd_phase]
- ❑ 1. Yes
- ❑ 2. No
- ❑ 99. Not specified

C6. Each phase included at least three observations   [ssd_phobs]
- ❑ 1. Yes
- ❑ 2. No
- ❑ 99. Not specified

C7. The IV was systematically manipulated by the researcher(s)   [ssd_ivman]
- ❑ 1. Yes
- ❑ 2. No
- ❑ 99. Not specified

Section D

Participants, Intervention Agents, and Setting Descriptors

D1. Mean Age of participants _____. [age]

D2. Grade level of participants [grd]
- ❑ 1. Elementary School (K-5)
- ❑ 2. Middle school (6-8)
- ❑ 3. High school (9-12)
- ❑ 4. Mixture of grade levels
- ❑ 99. Not enough information to determine

D3. Race/Ethnicity [raceth]
- ❑ 1. African American ____%
- ❑ 2. Asian American____%
- ❑ 3. European American ____%
- ❑ 4. Hispanic American____%
- ❑ 5. Other ____%
- ❑ 99. Not specified

D4. Sex [sex]
- ❑ Male____%

D5. Free or Reduced Lunch [frl]
- ❑ 1. Receiving ____%
- ❑ 2. Not Specified

D6. Type of students in sample [stype1]
- ❑ 1. Regular / non-clinical/ non- special ed
- ❑ 2. Clinical or Special Ed Population: Specify _____
- ❑ 99. Not specified

D7. If clinical/special ed sample, please specify: [stype2]
_____

D8. Type of School [schtyp]
- ❑ 1. Public
- ❑ 2. Private
- ❑ 3. Alternative
- ❑ 4. Charter
- ❑ 5. Other (specify): _____
- ❑ 99. Not specified

D9. Who provided the services? [intagt]
- ❑ 1. Non-School Master's or PhD clinician
- ❑ 2. School Clinician (Social Worker, Psychologist, Counselor)
- ❑ 3. Teacher
- ❑ 4. Other school personnel
- ❑ 5. Researchers
- ❑ 6. Multiple providers _____(list)
- ❑ 7. Other: _____(list)
- ❑ 99. Not specified

D10. Did the provider receive special training on the intervention? [tr_intagt]
- ❑ 1. Yes
- ❑ 2. No
- ❑ 99. Not Specified

Section E
Intervention Descriptors and Fidelity

E1. Name of intervention: _____   [name]

E2. Stated goal/purpose of the intervention: (check all that apply)   [goal]
- ❑ 1. Cognitive performance
- ❑ 2. Academic Performance
- ❑ 3. Behavior
- ❑ 4. Socio-emotional functioning
- ❑ 5. Other _____
- ❑ 6. Not specified

E3. What mindfulness strategies characterize the intervention?   [strategy]
(SELECT ALL THAT APPLY)
- ❑ 1. Present moment work
- ❑ 2. Meditation
- ❑ 3. Relaxation skills training
- ❑ 4. Breathing techniques/breath awareness
- ❑ 5. Awareness of moment
- ❑ 6. Mindfulness exercises
- ❑ 7. Body scan
- ❑ 8. Yoga
- ❑ 12. Other- specify: _____

E4. Was mindfulness the primary mechanism of interest in this study?   [prim]
- ❑ 0. No
- ❑ 1. Yes
- ❑ 2. Unsure

E5. What non-mindfulness strategies were part of the intervention?   [nonmind]
(SELECT ALL THAT APPLY)
- ❑ 0. None
- ❑ 1. Behavioral Strategies *(Interventions involve the use of various behavioral techniques, such as rewards, token economies, contingency contracts, and the like to replace or modify behavior)*
- ❑ 2. Cognitively-Oriented Programs (*Interventions focus on changing thinking processes or cognitive skill)*
- ❑ 3. Counseling, Talk Therapy (*These programs utilize traditional talk/psychotherapy techniques)*
- ❑ 4. Other (specify)_____

E6. Is this a manualized program (did researchers or implementers use a written manual, protocol or guide to implement the program/intervention)? [manual]
- ❑ 0. No
- ❑ 1. Yes
- ❑ 2. Unsure

E7. Role of the evaluator/author/research team or staff in the program. [arole]
- ❑ 1. Researcher delivered the treatment
- ❑ 2. Researcher involved in planning, designing, supervising, or managing the treatment
- ❑ 3. Researcher independent of treatment- research role only

❑ 4. Cannot tell

E8. Treatment Format: (SELECT ALL THAT APPLY)   [format]
    ❑ 1. Individual (one-on-one)
    ❑ 2. Group
    ❑ 3. Individual & Group
    ❑ 4. Other: _____
    ❑ 5. Not enough information to determine

E9. Were parents involved in the intervention?   [parent]
    ❑ 0. No
    ❑ 1. Yes: Describe parent involvement: _____
    ❑ 2. Unsure

E10. Were teachers involved in the intervention?   [teacher]
    ❑ 0. No
    ❑ 1. Yes, as interventionist: Describe _____
    ❑ 2. Yes, as recipients: Describe _____
    ❑ 2. Unsure

E11. Length of treatment (# of weeks): _____   [length]
E12. Frequency of sessions (#per week)   [freq]
E13. Total # of sessions: _____   [sessions]
E14. Total minutes of tx sessions_____   [hours]
E15. Minutes of mindfulness practice in sessions _____   [m-dose]
E16. How much at-home practice was expected?   [hmwork]
    Specify # of minutes _____
E17. Did the study measure fidelity?   [fidel]
    ❑ 1. Yes
    ❑ 2. No
E18. How was fidelity assessed?   [fidel_asses]
    ❑ 1. Researcher observations
    ❑ 2. Interviews of participants
    ❑ 3. Surveys of participants
    ❑ 4. Participant logs
    ❑ 5. Administrative records
    ❑ 6. Checklists
    ❑ 7. Other _____
    ❑ 99. Not specified
E19. Level of adherence to the tx: [fidel_ad]
    ❑ 1. Percent or Level _____
    ❑ 99. Not specified

Section F—Comparison Condition

F1.   What did the control/comparison group receive?   [compcond]
- ❑   0. No comparison group
- ❑   1. Nothing or wait list
- ❑   2. "Treatment as usual": Specify _____
- ❑   3. Specified treatment: Specify _____
- ❑   4. Other: _____