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Review

State of the Research: Physical and Mental Health Benefits of Mindfulness-Based Interventions for Children and Adolescents

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Academic Editors: Sok Cheon Pak and Soo Liang Ooi

Special Issue: Health Benefits of Meditation

Abstract

Background: Research support for a variety of health benefits of mindfulness-based interventions for adults is robust. These include management of stress, anxiety, and depression; as a supportive treatment for eating disorders, PTSD, and psychosis; improved sleep; chronic pain management; support for tobacco, alcohol, and substance abstinence; and as adjunctive treatments for serious or chronic medical illnesses such as HIV, cancer, and heart conditions. As is typical with newer interventions, mindfulness intervention research that evaluates similar benefits for youth began later and is less advanced. This paper presents an in-depth, critical analysis of the state of the research on mental and physical health benefits of mindfulness-based interventions for children and adolescents.

Methods: Electronic databases and other resources were searched for the period from January 2000 to July 2018 to locate empirical studies of mindfulness-based interventions for children or adolescents that primarily assessed physical or mental health outcomes.

Results: Data from 25 published studies and 5 meta-analyses or systematic reviews are presented, along with a critical evaluation of the strengths and limitations of these studies.

Conclusions: Mindfulness research for youth has progressed considerably over the past decade. Nevertheless, the methodological limitations of many studies are significant. This, along with the heterogeneous nature of the studies, makes it difficult to arrive at any firm conclusions. However, the generally positive findings across many studies appear promising. Considered as a whole, current evidence suggests that mindfulness may be effective in improving the health and well-being of children and adolescents. Well-designed and carefully implemented studies will continue to advance our knowledge of mindfulness-based interventions for youth.

1. Introduction

Mindfulness-Based Stress Reduction (MBSR) was developed in the late 1970s as an adjunct to traditional treatment for medical patients with chronic pain and medical conditions [1, 2]. MBSR wasn't meant to *cure* the condition; instead it offered the opportunity for patients to cultivate a different relationship to their illness. Mechanisms by which mindfulness elicits its beneficial changes have been extensively studied [3, 4-8]. Fundamentally, mindfulness is believed to promote an uncoupling of physical or emotional pain from the cognitive and affective dimensions of suffering [9].

Four decades on, research support for the health benefits of mindfulness-based interventions (MBIs) for adults is robust. Meta-analyses of adult studies have reported benefits to practicing mindfulness that include management of chronic pain [10]; stress and anxiety management [11, 12]; treatment of depression [13, 14]; posttraumatic distress [15]; and as a complementary treatment in the management of psychosis [16]; eating disorders [17]; and other psychiatric conditions [12, 18-20]. Mindfulness practices have been shown to improve sleep quality [21]; assist with tobacco, alcohol, and substance abstinence [22-24]; and provide supportive treatment for serious medical conditions such as cancer [25-27]; fibromyalgia [28, 29]; and HIV [30].

Empirical research with children and youth, having begun nearly 30 years later, is considerably less developed. Early research investigated clinical conditions such as anxiety, depression, attentional problems, and HIV [31-34]. More recently, the focus has shifted towards school and universal prevention interventions. While recognizing the value of those programs, this article offers a critical review and discussion of the general state of the research on MBIs for children and adolescents with physical and mental health conditions.

2. Methods

The electronic databases Medline, CINAHL, PsycINFO, PubMed, Google Scholar, and *Mindfulness Research Monthly* (http://goamra.org) were searched for the period from January 2000 to July 2018 using combinations of the terms: mindful or mindfulness, MBSR, MBCT, MBIs, physical health, mental health, psychiatric, clinical, and chronic, along with child or children, adolescent or adolescence, youth, or young people. Searches were also conducted for meta-analyses and review articles. In addition, we cross-referenced our own databases and citation alerts, and contacted the investigators of several studies in progress.

Inclusion criteria and rationale: studies that (a) were published in English in peer-reviewed journals, (b) included a mindfulness-based intervention with children or adolescents, and (c) included quantitative or qualitative data collection and analyses. Although primarily focused on youth (ages 4-18), nine of reviewed studies included both adolescents and young adults (up to age 25).

Exclusion criteria and rationale: (a) studies of dispositional mindfulness and associations; (b) intervention studies that used non-practice based interventions (e.g., Acceptance and Commitment Therapy; Dialectical Behavior Therapy) so as to focus on mindfulness interventions in which the regular practice of mindfulness meditation is an essential component; (c) studies that used non-clinical, school-based, or community samples with no physical or mental health outcome measures, and (d) individual case studies, which, given the idiosyncratic nature of mindfulness, would be difficult to generalize.

Our database search found more than 170 peer-reviewed journal articles of mindfulness-based interventions associated with mental health outcomes, which is far too many to review individually. Furthermore, there are already five published systematic reviews and meta-analyses of MBIs with youth that have focused on mental health outcomes. Rather than attempt to describe this many individual studies, we felt it would be more meaningful to provide an overview and discussion of the synthesized literature on mindfulness for mental health conditions. In total, 25 studies of clinical and/or chronic physical health conditions and five systematic reviews/meta-analyses having mental health outcomes as a primary focus are evaluated.

3. Results

3.1 Mindfulness for Chronic and/or Clinical Physical Health Conditions

Very few mindfulness studies of youth with clinical physical health conditions were published prior to 2010. There has been a surge in studies since then, with more now in progress. The first systematic review of MBIs with clinical samples of adolescents with chronic illness evaluated eight studies that demonstrated feasibility—five reporting significant improvements in selected emotional distress outcomes [35]. Another recent systematic review of RCTs included 11 studies of clinical physical and pain conditions and 8 studies of psychiatric conditions [36]. Both of these reviews noted the general lack of methodological rigor and recommended larger randomized trials.

We reviewed 25 published, peer-reviewed mindfulness studies for chronic and/or clinical physical health conditions. Twenty-three were group-interventions, one was delivered individually by trained parents to their children [37], and the last was delivered in individual homes via audio recordings [38]. Almost all reported quantitative data, some mixed methods, and two included

only qualitative data. Clinical conditions included chronic pain and/or functional somatic syndromes (8 studies), HIV (5 studies), diabetes or diabetes-related risk conditions (4 studies), cancer (2 studies), cardiac diagnoses and/or devices (2 studies), and one study each of recurrent headaches, esophageal atresia, chronic illness (mixed diagnoses), and patients in outpatient primary health care with unspecified conditions. The characteristics and main findings of these studies are summarized in Table 1.

These are generally Stage I studies, which typically include protocol development, therapist training, and feasibility and acceptability testing using uncontrolled open trial study designs [39, 40]. Guided by methodological quality reviews of adult MBI research [41, 42], we also examined whether treatment fidelity was assessed, if mindfulness facilitator training was provided and described, if a standardized MBI was used, or if the MBI was adapted, were the adaptations described, explained, and manualized.

3.2 Chronic Pain

Seven studies reviewed MBIs with adolescents with chronic pain conditions, present for three or more months. All were primarily feasibility studies. Five were uncontrolled open trials and two were randomized controlled trials (RCTs); one with waitlisted controls and one with an active control condition [43]. Four studies reported follow-up assessments from 4 to 12 weeks post-intervention. Sample sizes were small, ranging from 6 to 20, and not powered to detect significant changes. None reported conducting an à priori power analysis. Six studies identified the 8-week intervention as being developmentally adapted from MBSR/MBCT. One 6-week intervention was adapted for teens from the adult program *Inner Resources for Stress* [44]. Modifications from adult programs included shorter sessions and practices and simplified language. Otherwise they mostly reported adhering to the content, sequence, and structure of the adult programs. All seven studies reported having training for the mindfulness facilitators. Six studies used a structured protocol or treatment manual. Detailed treatment fidelity assessment procedures were reported in only one study, with each session being videotaped and reviewed by an expert MBSR facilitator [45]. Two other studies reported that facilitators received supervision or telephone consultation during the program [44, 46]. Other than these, fidelity assessment methods were not reported. Each study assessed feasibility. Other outcome data were mostly self-report measures, which included pain-specific and psychological symptoms. Four of the seven studies used a validated mindfulness measure. Only one used a biological measure (salivary cortisol levels) to assess intervention effects [45].

Outcomes varied markedly. Two studies reported no significant changes on any self-report measure [43, 44]. Another reported insufficient post-intervention data for analysis [47]. Three uncontrolled open trials reported significant self-reported improvements from baseline on some (but not all) pain-specific and psychological measures at post-intervention and/or at follow-up [46, 48, 49]. Post-intervention changes in mindfulness were either not significant (4 studies) or not assessed (3 studies).

In the only study that included a biological measure (salivary cortisol), a sub-set of participants provided salivary cortisol samples at weeks 1 and 8, twice each day, which for the intervention group, was pre-post their mindfulness session [45]. Significant reductions in cortisol levels were reported only for the pre-post session measures (d = 0.77). No significant differences were found

between weeks, which suggest that the intervention resulted in transient rather than lasting effects. Since cortisol is generally considered to be a surrogate measure of stress levels [50], even the short-term effects are of interest. Comparison of pre-post session cortisol levels with an equivalent active control condition could provide further understanding of the influence of the MBI itself, while controlling for non-specific effects (e.g., being in supportive group with peers who share similar health concerns).

Ruskin and her colleagues [51] conducted an inductive qualitative content analysis of data collected from 17 subjects who were participating in a larger RCT of an MBSR protocol that was modified for teens [49]. Themes and sub-themes were identified in the areas of mindfulness skills, supportive environment, group exercises, empowerment, logistics, and expectations. Thematic analyses potentially offer more nuanced understandings of participants' experiences and perceived benefits. Additionally, the research team indicated their intention to use this data to further refine the protocol to focus specifically on the needs of youth living with chronic pain.

3.3 Human Immunodeficiency Virus (HIV)

Sibinga and her colleagues have conducted two small uncontrolled open trials [33, 52] and two larger RCTs [53, 54] of a manualized MBSR protocol adapted for youth diagnosed with HIV. Both open trials reported qualitative data. Thematic analysis of the 2008 study identified five themes: improved attitude, behavior, and self-care; decreased reactivity; and importance of the group. The 2011 study found interestingly diverse shifts in perspective among the participants, but all reported experiencing some positive benefits resulting from program participation.

The first RCT [53] found significant improvements in self-reported mindfulness, coping, aggression, and on neuropsychological measure of selective attention and cognitive control (Stroop task). In addition, a significant change in HIV viral load (HIV-VL) between baseline and the 3-month follow up was found for the MBSR group, which implies that the intervention resulted in a measure of improvement in HIV disease control. The second RCT included both qualitative and quantitative data and a 12-month follow-up. Qualitative thematic content analyses identified several challenges that may interfere with adherence to antiretroviral therapy [54]. Quantitative analyses are currently underway (E. Sibinga, personal communication, August 5, 2018). Both of these studies used active controls (Healthy Topics). The interventions were delivered by trained MBSR facilitators, and facilitators in both conditions completed fidelity assessment checklists each session. Thematic content analysis revealed benefits specific to this clinical population. In practicing non-judgmental awareness and acceptance, MBSR participants reported finding some relief from the pressures, stigma, and shame of living with HIV. Shifts in how these participants related to themselves appeared to be associated with improvements in medication adherence.

These four studies exemplify steady progress over a decade toward building an evidence base for the effectiveness of this MBI with this population. The qualitative analyses provide a depth of understanding about the experiences of youth living with HIV that quantitative analyses alone cannot capture. The consistent use of a structured, manualized protocol, delivered by trained MBSR facilitators, and including ongoing assessments of treatment fidelity is commendable, and opens the way to replication studies conducted by other research teams.

3.4 Cancer

Two published MBI studies have focused on adolescents with cancer. In a non-randomized feasibility trial with an inactive control group, no significant intervention effects were found for self-reported mindfulness, quality of life, or psychological symptoms; however, control participants reported significant increases in negative affect at the post-assessment [55]. The authors also reported significant recruitment issues, which are common with many intervention studies focused on selected diagnoses. An uncontrolled open trial of an eight-week adapted MBSR/MBCT protocol found significant within-group improvements in self-reported mindfulness and quality of life, and reductions in emotional distress [56].

Both of these studies described developmental modifications of the manualized adult MBSR/MBCT protocols, used mindfulness-trained facilitators, and included assessments of treatment fidelity (i.e., video-taped sessions reviewed by external MBSR practitioners). Recruitment challenges and resulting small samples limit the findings of these studies. A third study, which was an RCT of the manualized protocol, Mindfulness-based Cognitive Therapy for Children [2] has been conducted with children hospitalized with cancer diagnoses. Forty inpatient participants were randomized to either MBCT-C or a treatment-as-usual control group. Data analyses are complete and manuscript preparation is underway (S. Abedini, personal communication, June 11, 2018).

3.5 Diabetes, Diabetes Risk, and Obesity/Overweight

Four studies targeted adolescents with diabetes or diabetes-related risk conditions, each with different designs and MBIs. In one open trial, ten older adolescents with Type 1 diabetes mellitus (DM-1) participated in a structured 9-week modified MBSR intervention. Results suggested significant pre-post improvements in 7-day blood glucose levels, and in participants' perceived diabetes stress and management [57].

An RCT compared a 6-week mindfulness-based intervention of the manualized Learning to Breathe (L2B) program [58] with an evidence-based treatment (group CBT). Participants were 33 females with elevated depressive symptoms who were also at risk of Type 2 diabetes mellitus (DM-2), defined as being overweight/obese and/or having a family history of diabetes [59]. Both intervention groups reported significant reductions in depressive symptoms. No significant between-group differences were reported for mindfulness, stress, or anxiety. The L2B group achieved significant pre-post reductions in insulin resistance (p = .02) and fasting glucose levels (p = .04); however, these reductions were not maintained at the 6-month follow-up. This study has methodological strengths not common in reported other studies. Notably, this was an RCT of a manualized intervention compared to an active, evidence-based control condition, and it included biophysiological outcomes and a 6-month follow-up. Protocol-specific mindfulness training was provided for facilitators and treatment fidelity was assessed by expert review of audio-taped sessions.

Another RCT conducted with 37 overweight/obese females compared a 6-week, investigator-developed mindful eating intervention (MEI) with usual care controls (nutrition and exercise). Mean pre-post BMI increased significantly for controls and decreased significantly for the MEI group. No significant changes in mindfulness were found [60].

The last study recruited parents to conduct the intervention with their own children. Parents of 32 obese/overweight adolescents with mild intellectual disabilities were trained to instruct their children in Mindfulness-based Health Wellness [37]. This multi-component intervention included physical exercise, healthy eating/nutrition, hunger-related visualizing techniques, mindful eating, and Soles of the Feet (SoF) meditation. Fidelity assessments were conducted during the parent training and implementation phases. Weight loss targets were achieved for 30 of 32 participants, and maintained over the 4-year follow-up. These are impressive results; however, the influence of mindfulness on the outcomes is not clear, as increased exercise and dietary improvements were also reported. A dismantling trial (with/without exercise and nutrition components), could clarify the relative contributions of each component.

3.6 Other Chronic or Clinical Health Diagnoses

Two studies evaluated an adapted MBSR protocol for adolescents with cardiac diagnoses or devices. One was an uncontrolled open trial with 10 participants [61]; the other was a larger RCT (N = 46) with an active control group (online video health support group [62]. The second study was unique among those that assessed MBIs for chronic health conditions in that the authors reported conducting an à priori power analysis. Unfortunately, the sample size needed to detect medium effects (N = 52) was not achieved. Both groups reported significant illness-related reductions in stress; only the control group reported significantly improved coping. The six-week intervention used in this study was shorter than conventional MBSR, and though delivered by MBSR-trained facilitators, no rationale for shortening the program length was provided.

A mixed-methods RCT (N = 43) with an active health education control group examined the efficacy of a modified 8-week MBSR program with youth in a pediatric outpatient clinic and found no significant between-group differences in anxiety, positive and negative affect, or psychological symptoms. Qualitative analyses indicated that control group participants experienced benefits related to problem-solving skills, increased physical activity, and enhanced awareness of disease prevention. MBSR participants reported significant internally self-reflective changes in how they responded to stressors—using mindfulness practices to avoid conflict, improve sleep hygiene, and reduce stress [63].

Andreotti et al. [38] conducted an RCT with waitlisted controls. Twenty children born with esophageal atresia participated in a 6-week home-based program of audio-guided daily mindfulness practices. Parent participation was encouraged but not required. Significant between-group improvements were found for mindfulness, depressive symptoms, cognitive emotion regulation, and some parent-reported measures. This study is notable for using only pre-recorded audio guidance and being conducted in individual homes. With this design, outcomes would not be influenced by non-specific facilitator factors, psychoeducation, or group participation. Practice adherence was high (84%), as was parental participation—67% of practices were completed with a parent.

Uncontrolled open trials were conducted with youth for two different diagnoses. The Mindful Schools curriculum (www.mindfulschools.org) was adapted to focus on headache management for 20 adolescents with recurrent headaches. While no reductions were found for headache frequency, severity, or related disability, significant pre-post improvements were reported for pain acceptance [64].

A six-week, investigator-developed MBI was evaluated with 13 students who attended a school for youth with chronic illness. Significant pre-post reductions in anxiety were reported, but health-related quality of life, psychosocial functioning, and mindfulness showed no improvements [65].

3.7 Summary of Mindfulness for Chronic and/or Clinical Physical Health Conditions

Of the 25 studies reviewed, 14 were uncontrolled open trials, 10 were RCTs, and one was a changing criterion design. Six RCTs included active control conditions, but only one of these used an evidence-based comparison group [59]. The other four controlled trials used waitlisted, no treatment, or usual care controls. One was non-randomized. Sample sizes ranged from 7 to 72, with a mean sample size per study of 22. Only one study reported an à priori power analysis, using an estimated effect size calculated from a previous feasibility study; however, was unable to recruit the desired number of participants [62]. One study used a sample size of more than 50 participants [53]. Ten studies reported follow-up analyses that ranged from four weeks to four years.

We reviewed the methodology of these studies for quality and rigor [42]. Six studies reported assessing treatment fidelity, while sixteen did not, which is comparable to the rate seen in adult studies. Consistent with adult studies, 20 studies reported having facilitator mindfulness training, mostly utilizing the adult MBSR/ MBCT models. Four reported protocol-specific facilitator training in the youth-adapted MBI. Three studies did not describe any facilitator training, personal practice, or experience. Sixteen studies reported using a manualized protocol. The studies reviewed were primarily Stage I feasibility trials. Most feasibility data came from participant recruitment, retention, attendance, and feedback. Difficulties with recruitment were common, which may be a significant obstacle to conducting fully powered RCTs. Designing multi-site trials with collaboration across research teams could be one way to address this problem.

3.8 Mindfulness for Mental Health Conditions

Mental health is integral to physical health. This assessment of the state of mindfulness-based health research, therefore, would not be complete without some discussion of the benefits of MBIs for childhood mental health problems. Children and adolescents are experiencing stress at unprecedented levels—which increases the risk of anxiety, depression, substance abuse, and host of other emotional and behavioral problems [68, 69]. Anxiety disorders alone affect 31.9% of adolescents; the overall prevalence of mental disorders with severe impairment and/or distress is 22.2% [70]. Mental and substance use disorders are the leading cause of disability in children and youth worldwide [71]. Therefore, it is vital to understand if and how MBIs may ameliorate these problems.

Table 1 Selection of mindfulness studies for youth that focused on chronic and clinical physical health conditions.

Study	Health condition(s)	Intervention	Sample size Age range	Main outcomes	Study design	Results

Ali et al. [48]	Functional somatic syndromes & chronic pain	Modified MBSR, 8 wks, home practice, optional parent group	*N* = 15 Ages 10-18	Mindfulness Functional disability Symptom impact Perceived stress HR QoL Anxiety	Uncontrolled open trial	• Mindfulness N.S.
						• Sig. improvements in
						  o Functional disability
						  o Symptom impact (not sustained)
						  o Perceived stress (at week 12 only)
						  o Anxiety (maintained at follow-up)

Andreotti et al. [38]	Esophageal atresia	Generic MBI, 6 wks, home practice with guided audios	*N* = 19 Ages 8-12	Mindfulness Depressive symptoms Cognitive emotion regulation Positive & negative affect State & trait anxiety	RCT vs. WLC	• Sig. between-group improvements in
						  o Mindfulness
						  o Depressive symptoms
						  o Some aspects of cognitive emotion regulation
						  o Parent report positive & negative affect; state & trait anxiety
						• MBI + WLC combined
						  o Self-evaluation ES = .39 - .76
						  o Parent report ES = .72 - .87

Chadi et al. [45]	Chronic pain	Adapted MBSR/MBCT, 8 wks	*N* = 19 Ages 13-18	HR QOL Depression & anxiety Pain perception	RCT vs. WLC	• All self-report measures N.S. • Cortisol levels o Sig. lower pre-post session (*d* = 0.77)

				Psychological distress Salivary cortisol		o Pre-post level weeks 1-8 N.S.
Daly et al. [60]	Obesity	Adapted MEI, 6 wks	*N* = 37 Ages 14-17	Mindfulness Weight (lbs/in) & BMI	RCT v. usual care control group	• Mindfulness N.S. • Sig. decrease in weight & BMI (post) • Further decrease at 4-wk follow-up
Ellis et al. [57]	Type 1 diabetes mellitus	Adapted MBSR, 9 wks	*N* = 10 Ages 16-20	Diabetes stress & management Metabolic control (HbA1c) 7-day blood glucose levels	Uncontrolled open trial	• Sig. improvement diabetes stress • 7-day blood glucose levels (pre-post)

Freedenberg et al. [61]	High-risk cardiac diagnoses	Modified MBSR, 6 wks	*N* = 10 Ages 12-18	Depression & anxiety Stress & coping	Uncontrolled open trial	• Sig. reductions only for anxiety
						 • Coping skills inversely related to
						     o Anxiety (*p* = .04)
						     o depression (*p* = .001)

Freedenberg et al. [62]	Cardiac diagnoses— devices	Modified MBSR, 6 wks	*N* = 46 Ages 12-18	Depression & anxiety Stress & coping	RCT vs. online video health support group	• Sig. stress reduction for both groups • Improved coping in online group only

Hesse et al. [64]	Recurrent headaches	Adapted Mindful Schools, 8 wks	*N* = 20 Ages 11-16	Headache frequency & severity Headache-related disability Depression & anxiety	Uncontrolled open trial	• Sig. improvements in
						     o Depressive symptoms
						     o Pain acceptance
						     o Parent-rated QOL

				Pain acceptance, HR QOL		
Jastrowski-Mano et al. [43]	Chronic pain	Adapted MBSR-T, 6 wks	*N* = 6 Ages 12-17	Mindful self-efficacy (MSES) Pain frequency/severity State-trait anxiety QOL Pain catastrophizing Activity limitation	RCT vs. psychoeducation control group	• MSES increase N.S. • All other measures N.S.
Kerrigan et al. [52]	HIV/at risk of HIV	Adapted MBSR, 9 wks	*N* = 10 Ages 13-21	Qualitative analysis Sibinga et al. [66] cohort	Qualitative, uncontrolled open trial	• Themes identified o Perception/experience of mindfulness o Shifts in perspective & sense of self o Positive changes coping with stress
Kerrigan et al. [54]	HIV	Adapted MBSR, 8 wks	*N* = 20 Ages 13–24	Thematic content analysis of Sibinga et al. [67] cohort	Qualitative analysis of RCT	• Themes identified o role of mindfulness in increasing disease acceptance o ART adherence
Lagor et al. [65]	Chronic illness	Author developed MBI, 6 wks	*N* = 13 Ages 8-18	Mindfulness HR QOL Depression & anxiety Anger Disruptive behaviors Self-concept	Uncontrolled open trial	• Mindfulness N.S. • Sig. reduction in anxiety • All other measures N.S.

Lovas et al. [46]	Chronic pain	MARS-A, 8 wks	*N* = 7 Ages 14-17	Depression & anxiety Pain intensity & frequency Somatic symptoms Functional disability	Uncontrolled open trial	• Depression N.S. • Sig. pre-post reductions in pain intensity • Sig. pre to 3-mo follow-up reductions in pain intensity, pain duration, somatic symptoms, functional disability • Sig. post to 3-mo follow-up reductions in somatic symptoms & functional disability
Malboeuf-Hurtubise et al. [55]	Cancer	Adapted MBSR, 8 wks	*N* = 14 Ages 11-18	Mindfulness Depression & anxiety Positive & negative affect Cancer-related QOL Sleep quality	Non-randomized vs. no-treatment control group	• Mindfulness N.S. • Control group sig. increase in negative affect • All other measures N.S.
Myers et al. [37]	Overweight or obese with IDD	MBHW + SoF + nutrition + exercise, Tele-health program, parent-delivered	*N* = 32 Ages 14-21	Weekly measure of weight 6-mo physician check-up Social validity ratings	Changing criterion design: 10-wk baseline; intervention; 4-yr follow-up	• 30/32 participants met weight goals • Mean time to goal weight = 73.6 wks (*SD* = 17.16) • Weight losses were sustained over 4-yr follow-up

Ruskin et al. [47]	Chronic pain	Adapted MBSR-A, 8 wks	*N* = 16 Ages 13-17	Mindfulness Pain characteristics Avoidance/fusion Chronic pain acceptance Psychological inflexibility	Uncontrolled open trial	• At baseline
						  ◦ Mindfulness negatively correlated with psychological inflexibility
						  ◦ Lower disability associated with

						greater trait mindfulness & less avoidant coping behavior

Ruskin, Gagnon et al. [49]	Chronic pain	Adapted MBSR-A, 8 wks	*N* = 21 Ages 12-18	Mindfulness Pain characteristics Functional disability Anxiety & depression Pain acceptance Pain catastrophizing Perceived social support	Uncontrolled open trial	• Mindfulness N.S.
						• Sig. effect baseline to 3-mo follow-up
						  ○ Functional disability (*d* = 0.31)
						  ○ Activity engagement (*d* = 0.47)
						  ○ Pain willingness (*d* = 0.54)
						  ○ Pain acceptance (*d* = 0.55)
						• All other measures N.S.

Ruskin, Harris et al.[51]	Chronic pain	Adapted MBSR-A, 8 wks	*N* = 17 Ages 12-18	Inductive content analysis of Ruskin, Gagnon et al. [49] cohort	Mixed methods analysis of focus group data	• Content analysis identified 6 themes
						  ○ Mindfulness skills
						  ○ Supportive environment
						  ○ Group exercises (likes & dislikes)
						  ○ Empowerment
						  ○ Program expectations
						  ○ Program logistics

Shomaker et al. [59]	Obese or at-risk of Type 2 diabetes mellitus	L2B, 6 wks	*N* = 33 Ages 12-17	Mindfulness Depression & anxiety Perceived stress Insulin resistance BMI	RCT vs. CBT	• Mindfulness N.S.
						• Sig. between-group changes
						  ○ Decreased depression at post (d = .56) & 6-mo follow-up (*d* = .69)
						  ○ Sig. improved insulin resistance & fasting insulin at post (*d* = .93; *d* = .78). Follow-up N.S.

Sibinga et al. [33]	HIV	Adapted MBSR, 8 wks	$N = 11$ Ages 13-21	Thematic analysis	Mixed methods, uncontrolled open trial	• Thematic analysis identified 5 themes
						  o Improved attitude
						  o Decreased reactivity
						  o Improved behavior
						  o Improved self-care
						  o Importance of group

Sibinga et al. [66]	HIV/at-risk of HIV	Adapted MBSR, 9 wks	$N = 33$ Ages 13-21	Health & illness QoL Psychological symptoms	Uncontrolled open trial	• Sig. reduction in hostility, general & emotional discomfort • Qualitative themes of perceived improvements in interpersonal relationships, school achievement, physical health, reduced stress

Sibinga et al. [63]	Unspecified (outpatient primary health care clinic)	Adapted MBSR, 8 wks	$N = 43$ Ages 14-22	State-trait anxiety Perceived stress Affect QoL Coping Self-efficacy & self-esteem	Mixed methods RCT vs. health education control group	• No sig. between-group differences
						• Themes identified
						  o Increased calm
						  o Conflict avoidance
						  o Self-awareness
						  o Self-regulation

Van der Gucht et al. [56]	Cancer (post-treatment)	Adapted MBSR/MBCT, 8 wks	$N = 16$ Ages 14-24	Mindfulness QoL Depression Anxiety & stress Cognitive reactivity Dampening of positive	Uncontrolled open trial	• Large ES at 3-mo follow-up
						  o Mindfulness ($d = 1.14$)
						  o Emotional distress ($d = 0.86$)
						  o Cognitive reactivity ($d = 0.63$)
						• Med-large ES at post & 3-mo follow-up

				affect Attitudes towards self Cognitive vulnerabilities Fear of cancer recurrence		o QoL (*d = 0.53; d = 0.75)* o Dampening of positive affect (*d = 0.58; d = 0.71)* o Attitudes towards self (*d = 0.89; d = 0.90)* • Other measures N.S.
Waelde et al. [44]	Chronic pain	Inner Resources for Teens (IRT), 6 wks	*N* = 20 Ages 13-17	Pain intensity & functioning Depression Functional disability	Uncontrolled open trial	• All self-report measures N.S. • Sig. improvement in parent-reported worry about child's pain (*d* = 0.75)
Webb et al. [53]	HIV	Adapted MBSR, 9 wks	*N* = 72 Ages 14-22	Mindfulness Perceived stress Stress & coping Aggression HIV QOL Medication adherence Cognitive self-regulation HIV disease activity (CD4/HIV VL)	RCT vs. health education control group	• Sig. improvements at 3-mo follow-up o Mindfulness o Problem solving coping o QoL o Decreased aggression • Sig. increase cognitive self-regulation at post; 3-month follow-up N.S. • MBSR more likely to have/maintain reduced HIV VL 3-mo follow-up

Notes: MBSR = Mindfulness-based Stress Reduction; MBSR-T = Mindfulness-based Stress Reduction for Teens (Stressed Teens); MBSR-A = Mindfulness-based Stress Reduction for Adolescents; MBCT = Mindfulness-based Cognitive Therapy; MEI = Mindful Eating Intervention; MARS-A = Mindful Awareness & Resilience Skills for Adolescents; MBHW = Mindfulness-based Health and Wellness; SoF = Meditation on the Soles of the Feet; L2B = Learning to Breathe; CHEER = Cultivating Healthy Eating, Exercise & Relaxation; HR = Health related; QoL = Quality of Life; IDD = Intellectual or developmental disability; RCT = randomized controlled trial; WLC = waitlist control; BMI = Body Mass Index; HIV VL = Human Immunodeficiency Virus viral load; ART = anti-retroviral therapy.

Only a few mindfulness programs have been developed specifically to treat psychiatric problems. These are: Mindfulness-based Cognitive Therapy for Children (MBCT-C) for anxiety [2]; Dialectical Behavior Therapy for Adolescents (DBT-A) for dysregulated emotions and self-harming behaviors [72]; and MYmind, which along with its parallel Mindful Parenting program [73], was developed for ADHD [74] and autism spectrum disorders [75]. Although most MBIs were not intended to be psychiatric interventions, the majority of published child and adolescent mindfulness studies have evaluated some component of emotional or psychological health-related outcomes. Most of the studies included in the meta-analyses discussed here were conducted with interventions that were not originally intended for psychiatric populations. Many of the studies adapted or used selected components of an established intervention (often MBSR) in response to the demands of the research sample or the environment; however, several studies describe investigator-developed interventions or various combinations of interventions. The specific MBIs that were included in each analysis are listed in Table 2.

Although the first studies of MBIs with children took place less than two decades ago, this area of research has grown so rapidly that a thorough review is beyond the scope of this article. Since 2000, over 2,000 peer-reviewed articles have been published on mindfulness and child or adolescent mental health, which include more than 170 empirical studies. So, rather than examine individual studies, we briefly describe and discuss the findings of five systematic reviews and/or meta-analyses that have been published in the past ten years. Results from these quantitative analyses are summarized in Table 2.

One early qualitative review evaluated 15 studies and concluded that mindfulness interventions were feasible, generally acceptable, and that, although the evidence for the efficacy of the interventions was lacking, there were no indications that any of the programs evaluated did any harm [76]. Greenberg and Harris [77] appraised the state of research in child mindfulness and concluded that, although mindfulness may be an effective intervention to build resilience in children, enthusiasm for promoting these practices outweighed the evidence supporting them. The evidence today is somewhat stronger, although many of the claims made about the benefits of MBIs continue to exceed what is supported by empirical research.

3.9 Overview of Systematic Reviews and Meta-Analyses for Mental Health Conditions

The five mental health reviews and meta-analyses summarized in Table 2 evaluated studies that consisted of both clinical and non-clinical populations. Nearly every included study investigated some aspect of mental health or psychological well-being as primary outcome variables. A lot of them, even those using clinically diagnosed samples, were conducted in school settings.

Carsley, Khoury, and Heath [78] examined 24 school-based studies (non-clinical populations) in which mental health or well-being was a primary outcome. Interestingly, they found larger effect sizes for older children (ages 15-18) and for studies that used a combination of mindfulness interventions (e.g., breathing and yoga). Thought-provoking results were also found in their analyses of facilitator effects. For mental health outcomes, effects were only significant when the intervention was delivered by a trained teacher vs. an outside facilitator. Contrariwise, for mindfulness outcomes, effects were only significant when the intervention was delivered by an

outside facilitator rather than a trained teacher. This suggests that the type of facilitator can affect outcomes, and should be considered when developing future studies.

The review conducted by Zenner, Herrnleben-Kurz, and Walach [79] also analyzed school-based studies, all of which had psychological outcomes grouped into five domains: cognitive performance; emotional problems; factors of resilience; perceived stress and coping; and third person ratings of behaviors. Notably, this was the only review that included unpublished studies. Of the 24 studies evaluated, 16 were published or in press with peer-reviewed journals and eight were unpublished data, including five master's theses or doctoral dissertations. Our current understanding of the "dose-response" relationship of the amount of mindfulness practice on outcomes is limited, so it's important to note that a separate analysis of ten RCTs found a substantial correlation between effect size and minutes of mindfulness practiced.

Chi et al. [80] analyzed 18 RCTs of MBSR for youth ages 12-25. Three studies involved participants with clinically diagnosed major depressive disorders, while the remaining 15 studies included participants with varying levels of depressive symptoms. MBSR was found to have moderate effects in reducing depressive symptoms at the end of the intervention; however these effects appeared to dissipate somewhat over time. Albeit, this interpretation must be moderated by the low statistical power (only seven studies included a follow-up measure), no statistically significant effects were found at follow-up.

Kallapiran et al. [81] conducted three separate analyses. The first compared MBSR/MBCT to non-active treatment controls in non-clinical populations (5 studies) in which MBSR/MBCT was found to be more effective than non-active controls in non-clinical populations. The second compared Acceptance and Commitment Therapy (ACT) to active treatment controls in clinical populations (3 studies). In these studies, ACT was found to be comparable to active treatments. The third analysis compared other MBIs to non-active treatment controls in non-clinical populations (3 studies). Other MBIs were found to be effective for improving anxiety and stress, but not depression, as compared to the non-active controls.

Only four of the 20 studies included in the Zoogman et al. [82] meta-analysis involved clinical samples. Most of the 20 included studies were conducted in school settings. Outcomes measures varied, and included anxiety, depression, measures of general functioning (e.g., social skills, quality of life), and measures of mindfulness and attention. Zoogman et al. conducted separate analyses of the clinical and non-clinical studies and found that the effect size for studies with clinical samples was nearly three times the magnitude of that found in studies with non-clinical populations. In addition, psychological outcomes showed a larger effect than other outcomes (e.g., academic). These findings suggest that mindfulness as a treatment for psychopathology should be examined more closely—in particular by conducting RCTs in clinical settings with clinically diagnosed youth.

In the aggregate, these meta-analytic data suggest that the use of MBIs for a variety of mental health problems has shown generally positive outcomes, although the effect sizes tend to be smaller than those found in similar programs for adult mental health problems [14, 15, 18, 20, 83]. In the few RCTs that did include active controls, mindfulness interventions also appear to have equal or greater effects than did an assortment of active control treatments.

Table 2 Meta-Analyses of Mindfulness Studies for Youth that Focus on Mental Health Outcomes.

Study	Health condition(s)	Intervention(s) (*N* studies)	Total *N* Age range	Main outcomes Effect size (*N* studies)[e]	Study design (*N* studies)	Conclusions

Carlsey et al. [78][a]	Non-clinical anxiety, depression, stress, test anxiety	Total 24 studies
		• Teacher facilitated (9)
		• Outside facilitator (15)
		• Mindfulness (13)
		• Mindful yoga (4)
		• VMI (6)
		• Arts-based (1)
			N = 3977 Ages 6-18	• Teacher facilitated, *g* = 0.28
				• Outside facilitator, *g* = 0.20
				• Omnibus outcome, *g* = 0.24
				• Mental health & well-being, *g* = 0.23
					Open trial (2) Wait list (6) TAU (9) Active controls (7)	• Largest effect sizes for interventions
						  ○ With ages 15-18
						  ○ That included combinations of mindfulness activities

Chi et al. [80]	Diagnosed clinical depression (3), depressive symptoms (15)	MBSR (18)[d]	*N* = 2,042 Ages 12-25	Omnibus outcomes
				• Post-intervention, *g* = 0.45
				• Follow-up, *g* = 0.24, N.S.
					RCT of MBSR vs. No Tx (10) TAU (2) Active controls (6)	• Average treatment effect was moderated by
						  ○ Control condition
						  ○ Treatment duration
						  ○ Baseline depression
						• Follow-up effects N.S.

Kallapiran et al. [81][b]	Non-clinical stress, anxiety, depression	MBSR/MBCT* (5)	*N* = 659 Ages 8-20	• Stress, *g* = .31 • Anxiety, *g* = .96 • Depression, *g* = .42	RCT v. non-active controls	• MBSR/MBCT more effective than non-active controls
	Diagnosed clinical anxiety, depression	ACT (3)	*N* = 263 Ages 7-18	• Anxiety, *g* = .02 • Depression, *g* = .57 • QoL, *g* = .38	RCT v. active controls	• ACT was comparable to active treatment controls

	Non-clinical stress, anxiety, depression	Other MBIs (3)	N = 196 Ages 9-17	• Stress, g = .67 • Anxiety, g = .87 • Depression, g = .42	RCT v. non-active controls	• Sig. between-group reduction of anxiety & stress • Depression N.S.
Zenner et al. [79][a]	Non-clinical cognitive performance, resilience, stress & coping, emotional problems	Total 24 studies[c] MBSR MBCT* DBT* ACT Positive psychology	N = 2,224 Ages 6-19	• Overall g = 0.40 • Cognitive performance, g = 0.80 • Resilience, g = 0.36 • Stress & coping, g = 0.39 • Emotional problems, g = 0.19 N.S. • Third person ratings, g = 0.25	RCT (10) Quasi-RCT (8) 2-Arm Cohort (1) Open (5)	• ES for pre-post only designs (g = 0.41) similar to controlled designs • Correlation between ES & minutes of mindfulness for RCTs was substantial (R^2 adjusted = 0.52)

Zoogman et al. [82]	Clinical and non-clinical anxiety, depression, attention, general functioning (e.g., social skills, QoL)	Total 20 studies
		• 4 clinical
		• 16 non-clinical
		
		MBSR (3)
		MBCT-C* (3)
		Part of MBSR (5)
		Other (9)
			N = 1,914 Ages 6-21	• Omnibus measures del = 0.227 (20)
				• Objective measures del = 0.230 (6)
				• Non-objective measures del = 0.255 (19)
				• Psychological symptoms del = 0.373 (15)
				• Not psychological symptoms del = 0.207 (15)
				• Attention & mindfulness del = 0.280 (6)
					Tx only (6) Open CT (1) RCT (14)	• Sig. larger effect sizes found for:
						  o psychological symptoms vs. other variables (0.37 vs. 0.21, p = .028)
						  o clinical samples vs. non-clinical samples (0.50 vs. 0.20, p = .024)
						• Mindfulness interventions increased mindfulness & attention

Notes: QoL = Quality of Life; MBSR = Mindfulness-Based Stress Reduction; MBCT = Mindfulness-Based Cognitive Therapy, ACT = Acceptance and Commitment Therapy; VMI = various mindfulness activities; Tx = Treatment; RCT = randomized controlled trial; TAU = treatment as usual; ES = effect size. * Intervention developed to treat emotional or psychological concerns. [a] Only studies conducted in elementary and high schools were included. [b] Included 11 studies [total *N* = 1,454; age range 7-18], which were analyzed as three separate meta-analyses. No omnibus meta-analysis was conducted. [c] Sixteen studies were published or in-press with peer-reviewed journals, eight were unpublished. [d] Fourteen studies were published in peer-reviewed journals, four were dissertations. [e] Hedge's *g* is notated as *g.*

4. State of the Research

Before offering our conclusions about the state of mindfulness research for youth with health conditions, we briefly explore several disparate topics. These include generally where this body of research currently stands, obstacles to conducting mindfulness research, and what may need to be done to advance the field further into Stage II. We also discuss some limitations of the current research, the problematic reporting of some studies, the file drawer problem, and close with a brief justification of the need to conduct health outcome research with youth in school settings.

Broadly speaking, the field of youth mindfulness research is still in Stage I, as described by the National Institutes of Health (NIH) stage model [39, 40]. Research at this stage consists mainly of feasibility and pilot testing of novel interventions, adapting existing interventions to new populations, and manual writing. Most of the studies we have discussed were under-powered. Many used open trial or quasi-experimental non-randomized designs. Most of the studies that did include a control group used passive (no-treatment or waitlisted) controls. Follow-up assessments tended to be short-term or non-existent. Developing competency standards and adherence measures for implementing the treatment is one essential next step. Although the adult MBSR and MBCT programs have developed rigorous training standards for facilitators, there are presently few manualized youth-focused interventions, and no clearly defined standards to train those who implement them.

Progress is happening, both in the methodological rigor of study designs, and in breaking new ground by moving into novel areas of investigation. An excellent example of the former is a robust Phase II study now underway (S. Bögels, PI). This is a large-scale (*N* = 120), fully-powered, multicenter randomized clinical trial to measure the effects of mindfulness training as compared to methylphenidate in youth diagnosed with ADHD. The MBI is the manualized MYmind protocol [84]. Clinical assessment data is being collected via multiple methods (e.g., questionnaires, behavioral measures, and neuropsychological tests) and from multiple informants (e.g., child, parent, teachers, and researcher) at four times: pre- and post-intervention and at 4- and 10-months following the start of treatment. Additionally, an economic evaluation will be conducted to ascertain the relative cost-effectiveness of each intervention [85]. An excellent example of a study that has broken new ground is a recently completed study that assessed the effectiveness of the manualized MBCT-C for youth with a diagnosed generalized, social, and/or separation anxiety disorder and at risk for bipolar disorder [86]. The novel component of this study is that it used functional magnetic resonance imaging (fMRI) as the primary outcome measure. To the best of our knowledge, this is the first published mindfulness intervention study with children or

adolescents that has evaluated the effectiveness of the intervention using a robust neurophysiological measure.

4.1 Obstacles to Conducting Research

Although mindfulness researchers have seen substantial funding increases over the past decade, the level of funding for mindfulness studies in general, and the portion of funds allocated to child or adolescent research are still small. In 2018, for example, the National Institutes of Health provided nearly 66.4 million dollars in funding for 205 mindfulness research projects. This may seem like a great deal until we consider other areas of research. For example, in the same year, the National Cancer Institute provided nearly 3.7 billion dollars to conduct cancer research. Furthermore, of this federal mindfulness research funding, only 23% (15.4 million dollars) funded 54 child and adolescent studies [87]. This is typical of most new interventions—research typically begins with adults and is later adapted downward for use with teens and children. Although over the past ten years we have seen an escalating interest in developing, evaluating, and implementing MBIs for children and adolescents, research funding is limited and can be difficult to obtain.

MBI researchers also have a Stage I challenge unique to this field, which is first defining and then assessing mindfulness. To understand an intervention, we need to focus on its precise mechanism of effectiveness. Within mindfulness research, there is no generally accepted operational definition of mindfulness, nor are there many reliable and valid ways to measure the acquisition of mindfulness skills [41]. Essentially, we must evaluate whether mindfulness training actually increases mindfulness. At present, measuring mindfulness is often done by proxy—with assessments related to attention, executive function, observable behaviors, or clinical symptomology. Only a few youth studies have used fMRI [86] or other physiological measures [45, 88]. Self-report questionnaires are the most common method in use—all of which have major limitations [89]. Only a few of these have been validated for use with children and adolescents, and each has problems [90].

4.2 Moving onto Stage II

Stage II research consists of fully-powered RCTs, conducted by well-trained research clinicians in controlled settings. Use of active control groups allows researchers to compare the efficacy of mindfulness to existing efficacious treatments. In this stage, research designs should consider which components of treatment are effective for whom, and seek a better understanding of effective mechanisms of change. To move more solidly into Stage II trials, MBI manuals and methods to assess protocol adherence first need to be written and tested. Procedures need to be developed for training and assessing facilitator competence. Stage III efficacy research is similar to Stage II, except that instead of clinical research providers and settings, these are community-based studies that retain a high level of experimental control. Although many MBI studies with children take place in schools, most still meet Stage I criteria as small scale, non-randomized, uncontrolled development or pilot studies.

4.3 Scientific Rigor

The limitations of much of the published mindfulness research with both adults and youth are regularly noted by reviewers. These include insufficiently powered designs, failure to use active control conditions, and including no or short-term follow-up assessments. Statistical issues include no clearly defined à priori tests, increased likelihood of Type I errors resulting from uncorrected multiple tests, and conducting data analyses on the completion sample rather than the intent-to-treat (ITT) sample.

When designing studies, researchers also need to give consideration to the difference between active control group designs that control for non-specific effects (e.g., placebo) versus active control group designs that include an evidence-based treatment (e.g., CBT). These studies represent comparative effectiveness research [91]. For non-specific controlled designs, the MBI should show superiority. For comparative effectiveness studies, the MBI should show equivalence. Essentially, we should aim to demonstrate that MBI is better than placebo and at least as good as a known efficacious treatment. This distinction is important when conducting à priori power analyses, in the interpretation of findings, and in supporting quality medical decision-making.

The heterogeneity of the interventions, absence of manualized treatment protocols, and failures to assess the fidelity of the treatment, make it difficult to compare results across studies or to replicate previous studies. Recruitment of participants is often based on convenience. That is, research participants are recruited from groups or organizations geographically accessible to the investigator [92]. Convenience samples may have limited demographic or socioeconomic diversity, which may constrain the generalizability of the findings.

Standardization of the structure, manualized protocols, and rigorous facilitator training in the adult MBSR and MBCT programs has advanced the field by promoting the assessment of facilitator competence and adherence to the treatment, and allow for studies to be replicated. Many studies we evaluated used empirically sound, manualized youth protocols, while some reported on study-specific interventions. Although adaptations are often necessary when working with different populations, sharing manualized protocols between research teams could prove valuable to the field as a whole. The movement toward standardized treatments, assessment of treatment fidelity, and defined facilitator training is evident. Unfortunately, there are only modest indicators that research design metrics have improved over time [42].

Few studies reported assessing or monitoring for adverse effects [11]. For example, it is not uncommon to observe increased emotional intensity—particularly for those with a trauma history—which carries with it the potential for worsening anxiety, depression, self-harm, or even suicidality [93]. MBCT is one of the few mindfulness programs that includes information about potential risks to participants in its training protocol [94].

4.4 Quality of the Reporting

Many research articles present less than robust findings. Surprisingly few indicated that they included any measure of mindfulness in the outcomes. Many do not provide replicable details about their "adapted" mindfulness intervention, describe the "child-friendly" modifications that were made, or provide adequate information about facilitator training or experience. The clarity and completeness with which studies are reported may not reflect the quality of the study itself,

but it does make interpreting the findings quite challenging. For example, one recent RCT reported significant outcomes following an adapted MBSR intervention [95]. Large effect sizes were reported for both reductions in ADHD symptoms (ES = .75) and increases in mindfulness (ES = .74); however, the authors did not identify the statistic used or offer any analysis of the relationship between these changes. A small (*N* = 6) open trial pilot study evaluated children diagnosed with ADHD [96]. Although the authors reported a number of statistically significant pre-post changes, it is difficult to draw any firm conclusions from their data for three reasons: (a) the sample size was quite small, (b) there was no control group, and (c) an extensive battery included many sub-tests that were independently analyzed using only uncorrected *t*-tests or U-Mann Whitney tests—which increased the likelihood that some of the reported results were the consequence of Type I familywise errors. It's also not unusual to see reports that emphasize limited results while ignoring non-significant findings. Another RCT reported significant differences on one measure of self-regulation; however, two measures of inhibitory control showed no significant changes. At the 3-month follow-up, none of the three measures showed significant between-group differences. Nonetheless, the authors concluded that mindfulness "may increase self-regulation and attentional control in economically disadvantaged preschoolers" [97, 55].

4.5 Negative Findings and the File Drawer Problem

Nearly all published research indicates that MBIs with children and adolescents can affect small, but significant improvements in a variety of health outcomes. In addition to the studies reviewed here, only a handful of studies have reported no beneficial outcomes at all. An evaluation of the audio-guided Inner Explorer program [98] with elementary students reported no significant differences in mindfulness, EF, emotion regulation, grades, SEL scores, or days absent/tardy as compared no-treatment controls [99]. A school-based program, .b (dot-be), was recently investigated as a prevention program for anxiety, depression, and eating disorders in a large scale RCT [100]. Contrary to earlier studies [101, 102], no significant changes were found on any of the assessed outcome variables. A randomized study of children ages 4-7 compared a single-session, three-minute "sounds in space" mindfulness induction activity with a "dot-to-dot activity" comparison group and found no significant differences on four measures of executive function [103]. Other single-session interventions have shown little or no effects [104], which suggests that learning mindfulness skills may require repetition and practice.

Publication bias, which is also known as the "file drawer problem" [105], affects all research, including the field of mindfulness. Many more mindfulness studies have likely been conducted, have found no effects, or possibly even adverse effects, and then were never published. Even with published studies, we note that positive findings tend to be emphasized (particularly in the abstracts), while null findings are downplayed or ignored. Despite having evidence of a file drawer problem, as more high-quality research is published, the strength of the evidential support for MBIs is also increasing.

4.6 Conducting Mindfulness-Based Health Outcome Studies in School Settings

Rempel [106] has made a strong argument for mindfulness as a universal prevention program in schools. She noted that schools are increasingly focused on the development of qualities such as empathy, compassion, creativity, and prosocial relationships. MBIs traditionally value the

cultivation of these qualities. In terms of feasibility, it may be less costly and more efficient to take health interventions to the child rather than attempting to bring the child to the intervention. Consequently, much of the mindfulness research aimed at improving mental health conditions in particular is already being conducted in K-12 schools. Weare [107] noted that well-conducted school-based mindfulness interventions are inexpensive to implement, appear to be popular with students and teachers, and may reduce the overall burden of health spending by focusing on preventive interventions. Training teachers in mindfulness skills has also been shown to increase their sense of well-being and teaching self-efficacy, and improve their ability to manage classroom behaviors [108]. A recent review of ten school-based programs concluded that early evidence shows promise for the effectiveness of MBIs in managing teacher and student stress, improving attention and executive function, and bolstering social-emotional resiliencies [109]. In addition, many of these programs are conducted in regular classrooms during normal school hours, thereby increasing the generalizability of the findings [110]. Some downsides of working in schools include difficulties implementing controlled experimental designs, maintaining protocol fidelity across classrooms or schools, intervention contamination between classrooms within a school, and collecting long-term follow-up data.

5. Conclusions

This paper is not a systematic review of the published research, but rather a representative sampling intended to offer the reader perspective on the state of research at this time. The quality and scientific rigor of the published studies in this area range from excellent to poor, the sample sizes from three to over 300, and the specific mindfulness interventions range from a few minutes to several years. The past decade has seen escalating interest in developing, evaluating, and implementing MBIs for children. Along with a review of the literature, we offered a critical look at issues commonly seen in study designs and methods, and how those issues may impact the meaningfulness and relevance of the reported findings.

Mindfulness research for youth has progressed considerably over the past decade and seems to be moving toward more robust Phase II studies. Nevertheless, the methodological limitations of many published studies are significant. This, along with the heterogeneous nature of the studies, makes it difficult to arrive at any firm conclusions. However, heterogeneity may be helpful at this stage and the generally positive findings across many studies appear promising. Considered as a whole, current evidence suggests that mindfulness may be effective in improving the health and well-being of children and adolescents. Well-designed and carefully implemented studies will continue to advance our knowledge of mindfulness-based interventions for youth.

Author Contributions

RJS and CB conceived and developed the presented methods and ideas. CB conducted the initial research literature searches with contributions from RJS. Both authors evaluated and discussed the accumulated body of research and contributed to the manuscript. RJS prepared the final manuscript.

Competing Interests

Both authors have declared that no competing interests exist.

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