

Original Research

A Pilot Study of a School-Based Yoga and Mindfulness Program for GirlsVictoria M. Dahl¹, Alyssa L. Chimiklis^{1,2,*}, Sarah Peralta¹, Yasmin Siddiqui¹, Anil Chacko¹

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doi:10.21926/obm.icm.2501015**Received:** August 15, 2024**Accepted:** March 04, 2025**Published:** March 18, 2025**Abstract**

Schools have made commendable efforts to incorporate yoga and mindfulness programs to address the wellbeing of students; however, research on the efficacy of school-based yoga and mindfulness programs is still in its infancy, particularly with school-aged students at risk of developing externalizing disorders. Much of the research has also focused on evaluating interventions implemented by researchers, rather than evaluating those implemented by the school and its staff. The aim of this pilot study was to evaluate Little Flower Yoga, a promising yoga and mindfulness program for children. The study sample consisted of girls, 5-7 years old ($n = 14$), from low-income, minority backgrounds with exposure to multiple risk factors, and who met a predetermined threshold based on well-validated measures of emotion regulation and attentional difficulties to assess the effects of the intervention on emotion regulation, attention, and executive functioning. Objective and multi-method measures were used to assess outcomes across four time points. Results of repeated measures ANOVA found medium effects on child's emotional regulation (Partial $\eta^2 = 0.071$), as well as small effects on child's anger control (Partial $\eta^2 = 0.013$), per teacher report. Results also showed large effects on improving child's inhibitory control (Partial $\eta^2 = 0.244$) on a computerized task, but no



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effects on child's inattention and executive functioning. Additional analyses found that several participants experienced clinically meaningful change in executive functioning and emotion regulation. No significant changes were found at the 3-month follow-up. While the findings suggest that Little Flower Yoga shows promise as an approach to addressing emotion regulation and executive functioning difficulties in children, several limitations must be considered. The small sample size limits the generalizability of the results. Moreover, the study's reliance on teacher-reported measures introduces potential response bias, and the lack of long-term follow-up beyond three months limits understanding of the program's sustained impact. Further investigations utilizing a larger, more diverse sample and robust experimental designs are warranted.

Keywords

Yoga; mindfulness; schools; inattention; emotion regulation; females

1. Introduction

Multiple life stressors at home and at school confront today's youth, and exposure to these environmental stressors increases their risk for a range of negative outcomes and poses serious challenges to their development into healthy adults [1-3]. Exposure to such environmental stressors often contributes to the emergence of social-emotional difficulties, behavior problems, and poor academic performance [4]. Impairments in these areas can often lead to the development of externalizing disorders [2], including attention-deficit/hyperactivity disorder (ADHD) and disruptive behavioral disorders (i.e., oppositional defiant disorder and conduct disorder), which in turn can put youth at greater risk of interpersonal difficulties, poor grades, and lower rates of secondary education, irrespective of their socioeconomic status [5, 6].

Given the far-reaching and potentially harmful effects of impaired cognitive and emotional regulation, attention, and executive functioning, there has been a growing focus on interventions aimed at helping youth improve their emotional responses and refocus their attention. These efforts are particularly important for youth who face greater exposure to risk factors [4]. One area of focus within these interventions is addressing emotion dysregulation, which refers to difficulties in managing emotions—such as controlling which emotions are felt and how they are experienced or expressed. Emotion dysregulation is a common challenge in mental health disorders, including ADHD, bipolar disorder, and borderline personality disorder, and emerging evidence suggests that inflammation may contribute to these difficulties [7]. Given the need for accessible and effective approaches to support emotional well-being, schools have become an ideal setting for implementing these interventions. Schools not only have the ability to reach a large number of children but can also involve families and play a key role in protecting and promoting students' health and well-being [8].

Based on research conducted predominantly with adolescents, yoga and mindfulness meditation interventions have demonstrated that they have the potential to support and enhance the development of cognitive and emotion regulation capacities in youth [4]. The Eastern contemplative traditions of yoga and mindfulness are two separate, but interrelated practices that promote the

holistic well-being of their practitioners [9], and may be useful in the prevention of psychopathology, and of externalizing disorders in particular. A challenging aspect of yoga is that there are many different schools of yoga, each of which operationalizes yoga differently. According to the National Center for Complementary and Integrative Health, yoga is considered a mind-body intervention and often involves the following components breathing exercises, meditation, physical postures, and relaxation. Other perspectives view yoga as a set of practices rooted in traditional philosophies based on ashtanga yoga, which is an eight-limbed path that includes breathwork, movement, meditation [9]. In research with adults, yoga has been shown to positively affect physical and mental states and reduce stress in both clinical and non-clinical settings [10, 11]. Mindfulness meditation as a practice is a specific type of meditation, the goal of which is nonjudgmental moment-to-moment awareness of the present, a definition made popular by Jon Kabat-Zinn – the “father” of the Western concept of mindfulness, who studied the Buddhist tradition of mindfulness meditation and later combined it with Western science to create the Mindfulness-Based Stress Reduction Program (MBSR; [9, 12]). According to Bishop et al. [13], mindfulness is cognitive and intention-based, and involves the self-regulation of attention to the present moment with an accepting orientation to one’s experiences. As such, yoga and mindfulness meditation practices cultivate capacities for attention and awareness [9, 14], which have beneficial effects on the ability to respond to emotional stimuli in ways that do not result in adverse outcomes or consequences. Recent studies on yoga-based interventions have reported a variety of benefits of its practice in non-clinical populations of children, including improvements in self-regulation, attention, academic performance, executive function [15-18]. Research investigating the effects of school-based yoga interventions also suggest a link between yoga practice in schools and a range of positive child and adolescent outcomes, including improvements in concentration, stress management, attention, and social and intellectual functioning in at-risk, subclinical youth populations [19]. While preliminary findings suggest that offering yoga within the school curriculum may be an effective and feasible way to help youth improve their stress management and emotional regulation skills [4, 20, 21], most of these school-based yoga programs have been developed independently of one another and implemented within different populations of students, making it difficult for researchers, educators, and practitioners to compare features across programs and to determine whether a particular program is suitable for their needs [16, 17]. For example, Khalsa et al. [20] investigated the effects of an 11-week series of yoga sessions on the mental health of predominately white, middle class secondary school students, utilizing a modified version of the Yoga Ed program implemented by external yoga instructors. They found that yoga participants showed statistically significant differences over time relative to controls on measures of anger control and fatigue/inertia, though they did not conduct any post-intervention follow-up assessments to see if these results were sustained. In another study, Mendelson et al. [4] conducted a pilot randomized controlled trial assessing the feasibility, acceptability, and preliminary outcomes of a 12-week school-based yoga and mindfulness intervention in four urban, public elementary schools, which were randomized to an intervention or wait-list control condition (i.e., did not receive the intervention until after completion of the pilot trial). The intervention consisted of yoga-based physical activities, breathing techniques, and guided mindfulness practices, delivered by instructors from an external agency. Their findings indicated that the intervention was acceptable to students, teachers, and school administrators, and that it had a positive impact on problematic responses to stress including rumination, intrusive thoughts, and emotional arousal. In yet another study,

researchers evaluated the efficacy of mindfulness training through yoga with predominately white, middle-class fourth- and fifth-grade girls, who were recruited from two public schools and randomly assigned to intervention and wait-list control groups, to reduce perceived stress, enhance coping abilities, self-esteem, and self-regulation [21]. The intervention consisted of 8 hour-long sessions adapted from the principles of Kabat-Zinn's MBSR program and included a yoga practice in each session; the intervention was delivered by the researchers during after school hours. White [21] found that self-esteem and self-regulation increased in both the intervention and the wait-list control groups, and those participants in the intervention group reported greater appraisal of stress and greater frequency of coping.

While the literature on the effects of mindfulness-based interventions within school settings continues to grow, the literature is still in its infancy. As demonstrated by the three previously discussed studies, most of the literature in this area focuses on largely older youth (late elementary school aged and older) from white, middle-class populations, and on populations of children exposed to relatively few risk factors [19]. Previous research on school-based yoga and mindfulness programs has also tended to only investigate the effects of interventions of relatively short duration (i.e., 8-12 weeks) and length (i.e., an hour, on average), leaving it unclear whether interventions with a "higher dosage" result in greater effects on outcomes of interest [22]. As such, there is a need for studies to take into consideration the importance of dosage (i.e., the length, frequency, and duration of yoga sessions) on the effectiveness of school-based yoga interventions by investigating the efficacy of programs utilizing a greater dosage of sessions.

In addition, as with much treatment research for child-targeted interventions, most of such evaluations focus on group-level statistics [23, 24], and their results may not be representative of individual-level change in participants [25]. Furthermore, due to the limitations of group-level statistical tools, including their susceptibility to sample size and within-group variability, researchers that utilize both statistical significance (i.e., the effects observed effects are unlikely to have occurred by chance) and clinical significance (i.e., are these effects substantial enough to make a real-world difference) allow for a deeper understanding of intervention effectiveness [26]. Examining the reliable change and clinical significance within a sample can reinforce group-level observations, as well as estimate individual-level change in order to obtain a more nuanced perspective about a treatment's effects. This process tends to be an underreported domain of analysis in the relevant literature on mindfulness and yoga programs for children; in a systematic review of eleven studies of yoga and mindfulness programs for the treatment of youth with ADHD, not one study included analyses of individual-level change and clinical significance in their data analysis plans [22].

Finally, given that few studies conduct follow-up assessments in the months following the end of such interventions, there is a need to investigate the maintenance of treatment effects of such interventions over the long-term (i.e., at least three to four months following the end of the intervention).

1.1 The Present Study

Given that emotional dysregulation and executive dysfunction (including attentional difficulties and impulsivity) lead to significant difficulties for children within the school setting [2, 27, 28], innovative school-based interventions are needed to address these challenges. One such program

is Little Flower Yoga for Kids, which is a New York based organization dedicated to making the tools of yoga and other mindfulness-based practices available to all children and teens in school-based settings. This organization offers a teacher training and certification program in yoga and mindfulness-based practices, which focuses on the physical, mental, emotional, and social wellbeing of students. Teachers are trained to use the five elements format (connect, breathe, move, focus, relax) to help students learn the principles of mindfulness.

Treatment intervention researchers from a university in New York collaborated with a local charter school to conduct a pilot study to evaluate this existing school-based yoga and mindfulness-based intervention. Little Flower Yoga for Kids is part of the routine curriculum at the charter school for students in all grade levels for the entire 9-month academic year, and is implemented by the school's full-time, state-certified yoga teacher, who is both a Registered Child Yoga Teacher (RCYT) and who has received her certification from the Little Flower Yoga for Kids Teacher Training Program. To the best of our knowledge, this marks the first time the Little Flower Yoga for Kids program has been formally evaluated in a research study. The overarching aim of our collaboration was to provide an initial evaluation of Little Flower Yoga for Kids program over the course of an academic school year.

While past research has shown that yoga programs and other mindfulness-based programs can yield positive outcomes on factors such as emotion regulation and attention [29-31], there are no independent studies examining the effects of a combined yoga and mindfulness-based intervention (Little Flower Yoga for Kids program) on both emotion regulation, attention, and executive functions (i.e., selective attention and inhibitory control). To our knowledge, there is no longitudinal study evaluating the impact of a yoga and mindfulness-based program on school-aged children with emotional and attentional challenges; this pilot study will be evaluating outcomes during and after a nine-month long intervention, as well as after a 3-month follow-up period. In addition, unlike the previously discussed evaluations of mindfulness-based approaches in schools, this pilot study will evaluate the effects of an existing program, which has been previously integrated within the school's curriculum, on young girls from a low-income community with high exposure to multiple risk factors (e.g., community violence, urban setting, poverty), using multi-method assessment.

A preliminary clinical trial was conducted over the course of twelve months (intervention implement for nine months, and a three-month follow-up) in a sample of fourteen students (ages four to six years) recruited from the kindergarten and first grade classes at the school who met a predetermined threshold of having either emotional regulation and/or attentional difficulties (as reported by their primary teacher). This pilot study had two primary aims: 1) to determine if the Little Flower Yoga for Kids program improved emotion regulation, attention, and/or executive functions (i.e., selective attention and inhibitory control) in children presenting with emotion regulation and/or attentional difficulties; and 2) to determine the longer term effects of the Little Flower Yoga for Kids program on emotion regulation, attention, and/or executive functions after a three-month period during which they were not receiving the intervention (i.e., summer vacation). Additionally, a secondary aim of this study was to determine the clinical significance (CS) of the treatment effects at the individual level from pre- to post-intervention.

For Aim 1, we hypothesized that participation in Little Flower Yoga for Kids program would be associated with demonstrated improvements in participants' emotion regulation, executive functioning, and attention. More specifically, we hypothesized that participation in the program would also be associated with demonstrated improvements in the emotion regulation domains of

anger control and emotional self-control, as well as improvement in the executive function domains of selective attention and inhibitory control, in addition to overall improvements in executive functioning for all participants. These hypotheses were based on Mendelson et al.'s [4] and Khalsa et al.'s [20] findings that mindfulness-based intervention programs helped to improve emotion regulation, anger control, and other executive functions in typically developing school-aged students. For Aim 2, we hypothesized that these improvements would remain following a three-month follow-up period, during which participants received no intervention. For Aim 3, we hypothesized that, in addition to significant change, clinically meaningful change would be demonstrated following the intervention (i.e., from pre- to post-test) for emotion regulation, executive function, and attention outcomes in participants who began in the clinical range prior to participation in the intervention.

2. Method

2.1 Participants

The participants consisted of 14 students recruited from the kindergarten and first grade classes at a charter school for all girls located New York. Students from all grades (K-5) at the school take the yoga and mindfulness-based practices class, which follows the Little Flower Yoga for Kids program's curriculum, once or twice a week as part of their enrichment curriculum. For this study, we evaluated the effects of the yoga and mindfulness-based practices class on select students from the kindergarten and first grade classes. This age range was chosen because the kindergarten and first grade students receive the highest "dosage" of the intervention, in that they attend the class two to three times a week, while the upper grades regularly attend only once a week. We also chose this age group because they were the students with the least previous exposure to the yoga and mindfulness-based program, as all students at the school take the class starting in kindergarten. Additionally, because the study was conducted at an all-girls school, there were no male subjects in our study.

After approval from the relevant institutional review boards (IRBs), the research team recruited teachers from three kindergarten and three first-grade classes at the school. During an information session before the start of the school year, the teachers were informed about the study and the time commitment required. Five of the six teachers consented to participate. Following consent, teachers were asked to observe their students during the first two weeks of the school year and nominate five students who appeared to have difficulties with emotion regulation and/or attention. At the end of the second week, teachers completed the Behavioral Assessment System for Children – 3rd Edition (BASC-3; [32]) Teacher Rating Scales (TRS), an emotion regulation measure, and the Swanson, Nolan, and Pelham Version IV Rating Scale (SNAP-IV; [33]), a measure of inattention, for the nominated students to determine if they had elevated levels of difficulties. For the BASC-3 TRS, a t-score >60 on the Anger Control or Emotional Self-Control scales indicated difficulties, and for the SNAP-IV, an average score >2 on the Inattention scale identified attention problems, per the norms provided in the manuals for both measures. These BASC-3 TRS and SNAP-IV were chosen because they included scales that most closely represented the variables under consideration in this study (i.e., emotion regulation and inattention). Previous research has shown that teacher ratings of behavioral and emotional difficulties are reliable predictors of future negative outcomes and are effective for screening participants for studies targeting individuals with minimal but detectable

symptoms [34]. Once the students from each class were identified (25 students overall), the yoga and mindfulness class instructor reached out to the parents of the students – either via phone or in person – to inform them about the study and ask their permission for the research team to contact them directly. If the parent gave their permission, the research team contacted them via phone to give them more details about the study and answer any questions. After speaking with the parents, consent forms were sent home to be reviewed and signed by the parents. Parents were also sent a brief demographic questionnaire, which they were asked to complete and return with the signed consent form. Parental consent was obtained from 14 of the 25 nominated students.

The final sample consisted of 6 kindergarten students and 8 first graders, ranging from 4 to 6 years old in age, with the mean age of 5.4 years (SD = 0.756). All the included students were female, eight participants were Black/African American, one was Caucasian, one was Native Hawaiian/Pacific Islander, three were multiracial, and one student’s race was not reported. Six participants identified as Hispanic/Latina, while the remaining eight participants did not. Table 1 shows the demographic information for study participants at baseline.

Table 1 Baseline Demographic Characteristics.

Child’s Grade	Total (<i>n</i> = 14)
Kindergarten	6 (42.9%)
First Grade	8 (57.1%)
Child’s Age (Years)	5.43 (0.756)
Child’s Race	
Native Hawaiian/Pacific Islander	1 (7.1%)
Black/African American	8 (57.1%)
White/Caucasian	1 (7.1%)
More than one race	3 (21.4)
Not Available	1 (7.1%)
Child’s Ethnicity	
No	7 (50.0%)
Yes (Hispanic or Latino)	7 (50.0%)
Parental Education Level (GED or Higher)	
Mother	11 (78.57%)
Father	7 (50.0%)
Not Available	4 (28.6%)
Parental Income	14,000 (15806.5)
Marital Status	
Married	3 (21.4%)
Married but Separated	1 (7.1%)
Divorced	3 (21.4%)
Never Married/Single	7 (50.0%)
Mother’s Race	
Native Hawaiian/Pacific Islander	1 (7.1%)
Black/African American	9 (64.3%)
White/Caucasian	1 (7.1%)

More than one race	2 (14.3%)
Mother's Ethnicity	
No	8 (57.1%)
Yes (Hispanic or Latino)	6 (42.9%)
Father's Race	
Native Hawaiian/Pacific Islander	1 (7.1%)
Black/African American	7 (50.0%)
White/Caucasian	2 (14.3%)
More than one race	3 (21.4%)
Father's Ethnicity	
No	8 (57.1%)
Yes (Hispanic or Latino)	6 (42.9%)

Note. Figures in parentheses are standard deviations or percentiles.

2.2 Procedures

After parental consent was obtained for the 14 students included in the study, multi-method measures of emotion regulation, attention, and executive functions (described below) were administered to the participants and their teachers at four time points: baseline (prior to the start of the program's curriculum), mid-treatment (4.5 months after the program's start), post-treatment (at the end of the school year, 9 months after the program's start), and follow-up (3 months after the program's end). After baseline data collection was complete, the yoga and mindfulness-based practices class teacher began implementing the Little Flower Yoga for Kids program's curriculum within her lesson plans. Participants in the study attended the yoga and mindfulness-based practices class once or twice a week (depending on the class schedule for that trimester); all participants were able to attend a total of 43 classes, on average (based on the school's scheduling of classes, the total number of classes that each participant could attend throughout the duration of the school year ranged from 36 to 53 classes). The class sizes were approximately 25-30 students each, with one teacher and one teacher's aide; the classes took place in the yoga and mindfulness-based practices class teacher's assigned classroom, and typically took place in the morning to early afternoon (i.e., between 8 am to 12 pm). Pre-, Mid-, and Post-intervention, as well as follow-up, assessment measures were administered by trained research assistants to each participant and to their teachers in the school setting. In addition, the yoga instructor was asked to track participant attendance and engagement for each of the study participants in all the classes; engagement was measured by assigning a rating between "0" (i.e., student did not engage in class content or activities at all) and "4" (i.e., student frequently participated in class activities, engaged with class content, and showed great effort throughout class).

2.3 Measures

2.3.1 Demographics

Parents were asked to complete a questionnaire created by the research team, which was used to capture demographic information about the child and her parent(s) related to the ethnicity and race of the child and parent(s), socioeconomic status, parent(s) education, and family/household

composition, which took approximately 15 minutes to complete. Sociodemographic characteristics were collected to describe the specific population included in this study.

2.3.2 Emotion Regulation and Executive Functions

The Behavioral Assessment System for Children – 3rd Edition (BASC-3; [32]) Teacher Rating Scales (TRS) was used to assess participants' ability to self-regulate their emotions and to demonstrate skills that are considered executive functions. Responses on the BASC-3 TRS range from "never" (1) to "almost always" (4). To minimize teacher burden, we focused on a subset of items from the assessment, which took approximately 10 minutes to complete. Specifically, we administered items from three of the Content Scales: Anger Control, Emotional Self-Control, and Executive Functioning. The Anger Control Content Scale evaluates an individual's propensity for quick and impulsive anger, as well as their ability to regulate emotions and exercise self-control. For instance, one of the items on the Anger Control Scale is, "Loses control when angry". The Emotional Self Control Content Scale measures an individual's ability to regulate their emotions in response to environmental changes; an example of an item from the Emotional Self Control Scale includes, "Overreacts to stressful situations". The Executive Functioning Content Scale assesses an individual's ability to control behavior by planning, anticipating, inhibiting, and maintaining goal-directed behavior. An example of an item from the Executive Functioning Scale includes, "Disrupts the schoolwork of other children". For all three content scales, higher scores indicate greater impairment. Overall, the BASC-3 TRS has been found to have strong internal consistency, relatively high test/retest reliability ($r > 0.80$), and moderate interrater reliability ($0.70 > r > 0.60$).

2.3.3 Selective Attention and Inhibitory Control

The Task of Executive Control (TEC; [35]) is a standardized, computer-administered assessment designed to measure key aspects of attentional processes, including sustained attention, selective attention, and objective inattention. The task took approximately 30 minutes for participants to complete. Each given task consists of on-screen instructions, a set of practice trials with feedback and 100 timed-interval stimuli that require responses. For this study we looked at the test scales that measured selective attention (i.e., the Selective Attention Factor *T* Score) and inhibitory control/impulsivity (i.e., 0-back and 1-back inhibit tasks commission errors). For all three test scales, higher scores indicate greater impairment. This assessment is well validated and has a history of use in both research and clinical settings [36]. Evidence for convergent validity of the TEC is based on its high correlations with other validated assessments of executive functioning. The TEC has been found to have high internal consistency ($r > 0.80$) for most of the assessment's factor, summary, and task scores. Test-retest reliability for factor and summary scores has been found to be moderate ($0.80 > r > 0.60$).

2.3.4 Inattention

The Swanson, Nolan, and Pelham Version IV Rating Scale (SNAP-IV; [33]) was used to obtain ratings on participants' inattention. Teachers were asked to complete this measure, which took approximately 10 minutes. The SNAP-IV is a 26-item parent/teacher report that assesses symptoms of Inattention, Hyperactivity/Impulsivity and Disruptive Behavior. For this study the teachers were

asked to complete only the items from the inattention subscale. Items are rated on a 4-point scale from (0) *not at all* to (3) *very much*. Average rating-per-item (ARI) subscale scores are calculated by summing the scores on the items of the subset and dividing the number of items in the subset, resulting in a subscale score that can range from 0 to 3. On the inattention subscale, higher scores indicate greater impairment. The SNAP-IV is a reliable tool for identifying ADHD, although race differences in teacher ratings should be studied further [37]. The SNAP-IV has also been reported to have good-to-excellent internal consistency [33].

2.4 Little Flower Yoga for Kids Program

The Little Flower Yoga for Kids program is a manualized program comprised of five elements Connect, Breathe, Move, Focus, and Relax [9]. These five elements in combination make up a 40-minute class (approximately 8 minutes per element). The elements are structured to incorporate mindfulness-based practices and facilitate discussions. For instance, “Connect” activities help children to foster both internal and external connections, including “Layers of Sound”, an activity during which students explore what they can hear around them in an intentional way that will enable them to learn to attune their hearing to those sounds that are most important at a given moment. “Breathe” activities are used to teach children that they have some control over their emotional state through activities like “Belly Waves”, in which students practice deepening their breath and exploring how this makes them feel in their bodies. Learning to gain control of breath can aid the child in regulating her emotional and energy level. “Move” activities consist of yoga poses and are utilized to help children maintain alertness, channel the child’s energy, improve health and brain development, as well as build their confidence. “Focus” activities allow children the opportunity to experiment with what it means to focus, such as in the “Popcorn Thoughts” activity, in which the students are taught to notice how thoughts arise, when they arise, and how they can be distracting. In addition, children learn through repetition throughout the course to notice when their mind wanders and to bring it back to the task at hand. “Relax” activities provide the children the opportunity to rest both the body and mind, through activities that involve progressive muscle relaxation or body scans.

Given that Little Flower Yoga for Kids is a manualized program, the instructor is able to carefully select from a wide range of activities when planning lessons for the week, which were the same for all students in the kindergarten and first grade classes. The following lesson plan is an example of the Little Flower Yoga for Kids curriculum: The class begins with a Connect activity in which the students complete an “Emotion Faces Worksheet” (defining emotions) and have a class discussion; this is followed by a Breathe activity consisting of “Belly Waves”, which allows the students the opportunity to deepen their breath and explore sensations in their bellies. Following the Breathe activity, students do Movement practice, which entails basic asana experiences, including “Sun Salutations”, “Warrior Poses”, and “Balance Poses”. The Focus activity, “Popcorn Thought”, follows, and it involves teaching students how to anchor attention to a thought, as well as how to identify when they get distracted, highlighting that this is a natural occurrence. The class ends with the Relax element, which involves exploring sensations in the body after participating in “Tense and Let Go” (tensing and then relaxing muscle groups).

2.5 Data Analyses

Data were analyzed using the Statistical Package for Social Sciences (SPSS), version 24.0 [38], after selecting a significance level of 0.05. Preliminary analyses (Shapiro-Wilk test) confirmed whether the assumptions of normality held for the different variables. Given the moderate amount of variability in reported parental education for participants, and given past research that SES (which parental education level can be used to measure) can have an impact on the effectiveness of child-based interventions [39-41], this was controlled for as a confounding variable in our analyses. Parental income was not used as a measure of SES due to the fact that it was not reported by four of the participants' families, and due to the fact that the high amount of variability in its reporting was potentially due to differences in how parents chose to report their income (i.e., monthly income vs. yearly income). To reduce the number of statistical tests, the variables were grouped into three conceptual categories to correspond to the hypotheses when conducting the MANCOVA tests. One grouping was emotion regulation. This group included the relevant variables from the BASC-3 (i.e., the content scales of Anger Control and Emotional Self-Regulation). The second grouping was measures of executive function, which included the responses from teachers on the BASC-3 (i.e., the Executive Functioning content scale) and the data from the performance test, the TEC. The third grouping was measures of attention, which included the responses from the teachers on the SNAP-IV. We applied repeated measure MANCOVAs to test for significant pre-, mid-, and posttest differences in the three data groupings categories. Because we had directional hypotheses, all tests of significance were one-tailed *t* tests. The effect size of change reported for the overall model is partial eta-squared (η^2) - values less than 0.06 are considered small effect sizes, values between 0.06 and 0.14 are medium effect sizes, and values greater than 0.14 represent large effect sizes [42]. Additionally, changes from posttest to follow-up were analyzed for each variable by means of paired *t* tests; because we had directional hypotheses, all tests of significance were one-tailed.

We also calculated clinically meaningful change on an individual level as techniques used to determine it are considered advantageous since they are not affected by sample size and allow for investigation of the characteristics of individuals who make clinically meaningful change versus those who do not [25]. According to Jacobson and Truax [43], the best method for determining CS considers clinically meaningful change to have occurred when an individual makes both reliable change (RC; improvement on a measure taking into account measurement error) and recovery (scores on a particular measure moving from the clinical range prior to treatment to a normative range post treatment).

To examine clinically meaningful change, we utilized Jacobson and Truax's [43] reliable change index (RCI) method, in which pre-post change for each participant on the measures of emotion regulation, executive functioning, and attention was compared to RC indices (to examine RC) and cutoff scores (to examine normal functioning). These indices and scores are determined using the means, standard deviations, and test-retest reliability collected from a typically developing/normative sample. Specifically, the RCI was calculated by dividing the pre-post difference score by the standard error of the difference between the two scores for each measure, with an RCI > 1.96 indicating reliable change ($p < 0.05$). Recovery was defined by clinical cutoff scores based on the midpoint between the mean of the normative population and the mean of the clinical population [43]. These indices and scores were then used to classify participants into one of six categories at posttreatment: 1) deterioration of functioning; 2) no reliable improvement or recovery;

3) no reliable improvement, came in functional; 4) reliably improved, not recovered; 5) reliably improved, came in functional; and 6) reliably improved and recovered [25]. Analyses for reliable and clinical change were conducted using the ClinTools Software for Windows, version 4.1 [44].

We also calculated descriptive statistics (i.e., mean, standard deviation, variance, and skewness) for the variables of attendance (i.e., number of classes missed) and engagement (i.e., average engagement rating throughout intervention) to determine outliers for consideration in the analyses. Summary engagement and attendance data are presented in Table 2.

Table 2 Attendance and Engagement in Little Flower Yoga Program Classes.

Variable	M (SD)	Range	Skewness
Number of classes attended	40.64 (7.69)	21–53	-1.07
Number of missed classes	4.00 (7.19)	0–25	2.29
Engagement average rating	3.92 (0.14)	3.6–4.0	-1.78

Note. Engagement average is the individual average of all the engagement ratings for each participant, which were collected following each attended class and ranged from 0–4; *M* = mean; *SD* = standard deviation.

2.6 Ethics Statement

This study received approval from New York University, University Committee on Activities Involving Human Subjects with approval number IRBFY2016-459 on the date 5/10/16.

3. Results

3.1 Statistical Data Analysis

A series of one-way repeated measures MANCOVAs were conducted to examine the statistically significant effects of the intervention on several outcomes of interest over time: emotion regulation, executive functioning, and inattention. Data were available for all participants at pre- and post-treatment. We also conducted a series of paired *t*-tests to assess changes in these outcomes between the post-treatment and the three-month follow-up assessments. Data were available for only eight of the fourteen participants at both post-treatment and follow-up, due to four participants moving to a new school over the three-month period, and due to two parents failing to give permission for their child to continue participating in the study (i.e., consent forms were not returned for these participants at the start of the new school year, as required by the IRB). As such, these six participants were excluded from the follow-up paired *t*-test analyses.

3.1.1 Emotion Regulation

From the BASC-3 TRS the variables selected for analysis were Anger Control and Emotional Self Control. The repeated measures MANCOVA analysis yielded large effects, though not statistically significant, in overall emotion regulation from pre-test to post-test after controlling for parental education level, as reported by teacher ratings, $F(4, 26) = 1.208, p = 0.331, \eta^2 = 0.157$. Univariate tests indicated that the intervention had a medium effect on Anger Control, ($F(2, 14) = 0.392, p = 0.683, \eta^2 = 0.053$), and a large effect on Emotional Self Control ($F(2, 14) = 1.735, p = 0.212, \eta^2 =$

0.199), though improvements for both outcomes were not statistically significant after controlling for parental education level. Additionally, no differences were observed in any of the variables between the post-test and the 3-month follow-up: for Anger Control, $t(7) = -0.516, p = 0.622$; for Emotional Self Control, $t(7) = 0.305, p = 0.770$. Table 3 presents the pre-, mid-, and post-test means, standard deviations, and effect sizes for the individual variables and emotion regulation overall.

Table 3 Effects of Little Flower Yoga Program on Child Outcomes—Statistical Significance.

Variable	Pre-Treatment M (SD)	Mid-Treatment M (SD)	Post-Treatment M (SD)	F	η^2
Emotion Regulation					
Anger Control	59.91 (12.83)	59.73 (14.28)	58.73 (10.04)	0.392	0.053
Emotional Self Control	64.91 (12.37)	65.00 (13.48)	61.91 (8.62)	0.1.735	0.199
Combined				1.208	0.157
Executive Function					
Executive Functioning	64.22 (6.92)	60.22 (10.14)	63.44 (6.31)	0.419	0.065
Selective Attention	50.00 (12.46)	46.56 (6.56)	47.33 (6.93)	0.134	0.022
0-back Inhibit Commissions	49.67 (11.42)	42.44 (7.25)	44.33 (7.63)	0.492	0.076
1-back Inhibit Commissions	50.33 (14.93)	47.00 (9.12)	44.67 (6.73)	0.432	0.067
Combined				0.503	0.183
Attention					
Inattention	1.82 (0.73)	1.57 (0.79)	1.88 (0.74)	0.459	0.155

Note. * Indicates significant F test at $p < 0.05$; Combined = multivariate test results; M = mean; SD = standard deviation; η^2 = partial eta-squared.

3.1.2 Executive Function

From the BASC-3 TRS the variable selected for analysis was Executive Functioning, and the variables selected for analysis from the TEC were Selective Attention (factor score), and inhibitory control (i.e., the 0-back and 1-back inhibit commissions task scores). The repeated measures MANCOVA analysis indicated a large effect of the intervention on overall executive function from pre-test to post-test, though improvements were not found to be statistically significant after controlling for parental education level, ($F(8, 18) = 0.503, p = 0.838, \eta^2 = 0.183$). Univariate tests also indicated that there was a medium – but not statistically significant – effect of the intervention on Executive Functioning, as reported by teacher ratings ($F(2, 12) = 0.419, p = 0.667, \eta^2 = 0.065$), and a small, statistically insignificant effect on Selective Attention ($F(2, 18) = 0.134, p = 0.876, \eta^2 = 0.022$). Medium, statistically insignificant improvements following the intervention were seen for inhibitory control according to the 0-back inhibit commissions task score ($F(2, 12) = 0.492, p = 0.623, \eta^2 = 0.076$) and the 1-back inhibit commissions task scores ($F(2, 12) = 0.432, p = 0.659, \eta^2 = 0.067$). Additionally, no significant differences were observed in any of the variables between the post-test and the 3-month follow-up: for Executive Functioning, $t(7) = 0.676, p = 0.521$; for Selective Attention, $t(5) = 0.206, p = 0.845$; for 0-back inhibit commissions, $t(7) = -0.403, p = 0.699$; and for 1-back inhibit

commissions, $t(7) = 0.318$, $p = 0.760$. It should be noted that two of the participant's results were excluded from the Selective Attention post-test to 3-month follow-up analysis due to the fact that their performance on the TEC at the 3-month follow-up period was too poor for factor scores to be calculated for that metric. Table 3 presents the pre-, mid-, and post-test means, standard deviations, and effect sizes for the individual variables and executive functioning overall.

3.1.3 Inattention

From the SNAP-IV the variable selected for analysis was Inattention. The repeated measures ANOVA analysis yielded large but statistically insignificant improvements in attention from pre-test to post-test, after controlling for parental education level, $F(2, 5) = 0.459$, $p = 0.656$, $\eta^2 = 0.155$. Table 3 presents the pre-, mid-, and post-test means, standard deviations, and effect sizes for attention. Additionally, no differences were observed in Inattention between the post-test and the 3-month follow-up, $t(7) = 1.038$, $p = 0.334$.

3.2 Clinical Significance

For four of the participants (about 28% of the sample) the pre- and post-treatment data for the BASC-3 measure could not be used because the participants aged out of one assessment group and into the next (i.e., from the "Preschool" rating form for ages 2-5 to the "Child" rating form for ages 6-11), and the norms were not consistent across the forms, preventing the observation of change within these individuals on these outcomes. On the TEC measure, for three of the participants (about 21% of the sample) the pre- or post-treatment data could not be used to observe change on the variable of selective attention because factor scores could not be calculated due to poor effort on the tasks at either or both assessment time points. All individuals who had data for both pre- and post-intervention times were included in the analyses.

To examine clinically meaningful change, pre-post change for each participant on the measures of emotion regulation, executive functioning, and attention was compared to reliable change (RC) indices (to examine RC) and cutoff scores (to examine normal functioning). These indices and scores are established from the norms (i.e., means, standard deviations, and test-retest reliabilities) reported in the literature for the measures utilized in this study, collected from a normal sample of individuals of at least average functioning. Table 4 contains RC indices and cutoff scores for the subscales from the BASC-3 TRS, TEC, and SNAP-IV utilized to measure the outcomes of interest in this study. Based on these indices and scores, each child was placed into one of six categories: no improvement or recovery; no improvement, came in functional; reliably improved, not recovered; reliably improved, came in functional; and reliably improved and recovered. Of most interest are children who are classified as reliably improved and those who experienced clinically meaningful change (i.e., fall in the reliably improved and recovered category).

Table 4 Reliable Change (RC) Indices and Cutoff Scores for Child Outcome Measures.

Variable	RC Index x_2-x_1/S_{diff}	Cutoff Score $M \pm 2(SD)$
Anger Control	10.42	6.76
Emotional Self Control	10.42	16.87
Executive Functioning	13.65	11.33
Selective Attention	5.82	14.76
0-back Inhibit Commissions	4.44	4.24
1-back Inhibit Commissions	3.48	4.16

Note. RC indices and cutoff scores were determined based on Jacobsen and Traux’s model [43]; RC = reliable change; x_2-x_1/S_{diff} = pre-post difference score divided by the standard error of the difference between the two scores; M = mean; SD = standard deviation.

As indicated in Table 5, 2 to 4 of the 11 children fell into one of the reliably improved categories for all domains of executive function, as measured by the TEC (i.e., selective attention, 0-back inhibit commissions, and 1-back inhibit commissions). In addition, 3 of these children fell into the reliably improved and recovered category for at least one of the domains of executive functioning, which suggests clinically meaningful change. 1 to 2 participants (out of the 10 children included in this particular analysis) also fell into one of the reliably improved categories within at least one of the domains of emotion regulation, as measured by the BASC-3 TRS (i.e., anger control and emotional self-control). Table 5 also shows that at least 1 of the children saw reliable improvement within each of the domains of executive functioning, and 1 to 2 of children saw reliable improvement within each of the domains of emotion regulation over the course of the study, with the potential to continue to see improvement to the point of recovery.

Table 5 Effects of Little Flower Yoga Program on Child Outcomes—Clinical Significance.

Variable	No Improvement or Recovery <i>n</i> (%)	No Improvement Came in Functional <i>n</i> (%)	Reliably Improved Not Recovered <i>n</i> (%)	Reliably Improved Came in Functional <i>n</i> (%)	Reliably Improved and Recovered <i>n</i> (%)
Emotion Regulation					
Anger Control	3 (30.0)	5 (50.0)	2 (20.0)	0 (0.0)	0 (0.0)
Emotional Self Control	6 (60.0)	3 (30.0)	1 (10.0)	0 (0.0)	0 (0.0)
Executive Function					
Executive Functioning	8 (80.0)	2 (20.0)	0 (0.0)	0 (0.0)	0 (0.0)
Selective Attention	0 (0.0)	9 (81.8)	1 (9.1)	0 (0.0)	1 (9.1)
0-back Inhibit Commissions	3 (23.1)	7 (53.8)	1 (7.7)	0 (0.0)	2 (15.4)
1-back Inhibit Commissions	2 (15.4)	7 (53.8)	1 (7.7)	1 (7.7)	2 (15.4)

Note. For Anger Control, Emotional Self Control, and Executive Functioning *n* = 10 (measured by the BASC-3); for Selective Attention *n* = 11 and for 0-back Inhibit Commissions, and 1-back inhibit *n* = 13 (measure by the TEC). Clinical significance was calculated using scores from the pre- and post-intervention assessments.

The results from the clinical significance analyses also indicate that a large proportion of the children began the study at a functional level, with between 20-80% of children falling into one of the “came in functional” categories for all domains of executive functioning (i.e., 2 children in executive functioning, 9 children in selective attention, 7 children in 0-back inhibit commissions, and 7 children in 1-back inhibit commissions), and between 30-50% of children for all domains of emotion regulation (i.e., 5 children in anger control and 3 children in emotional self-control). A wide range of participants saw no clinically significant improvement or recovery over the course of the study, with 15 to 80% of children falling into that category across the four domains of executive functioning (i.e., 8 children in executive functioning, 0 children in selective attention, 3 children in 0-back inhibit commissions, and 2 children in 1-back inhibit commissions), and 30-60% of children across the two domains of emotion regulation (i.e., 3 children in anger control and 6 children in emotional self-control).

4. Discussion

The current pilot study aimed to evaluate the effectiveness of the Little Flower Yoga for Kids program on improving emotion regulation, attention, and/or executive functions (i.e., selective attention and inhibitory control) in children presenting with emotion regulation and/or attentional difficulties. The study examined both statistically significant and clinically meaningful effects on these outcomes of interest. In addition, the present pilot study evaluated whether participation in a nine-month long yoga and mindfulness-based intervention was associated with improvements in emotion regulation, attention, and executive functions for school-aged children with emotional and attentional challenges and who were at risk for developing more severe disorders. This pilot study also evaluated whether these improvements were maintained following a three-month period during which participants did not receive the intervention.

We hypothesized that participation in Little Flower Yoga for Kids program would be associated with demonstrated improvements in participants’ emotion regulation, executive functioning, and attention on a group and individual level. In addition, we predicted that these improvements would remain following a three-month follow up period, during which participants received no intervention. Finally, we hypothesized that, in addition to significant change, clinically meaningful change would be demonstrated following the intervention (i.e., from pre- to post-test) for emotion regulation, executive function, and attention outcomes in participants who began in the clinical range prior to participation in the intervention. Findings from this preliminary clinical trial suggest that the yoga and mindfulness-based practices class resulted in moderate to large effects at the group level in several of the domains of executive functioning and emotion regulation, including anger control, emotional self-control, and inhibitory control, and inattention. Additionally, clinically meaningful change was also found on the individual level for three of the participants in these areas of executive functioning (and another seven participants were already performing at functional levels prior to the start of the study). Clinically meaningful change was also found for several participants on some of the additional domains of executive functioning and emotion regulation that did not reach statistical significance on the group level. No significant improvements in any of the outcomes of interest were found at the 3-month follow-up. The results from this pilot study contribute to the literature suggesting that school-based mindfulness interventions, such as the Little Flower Yoga for Kids program, may help to improve youth’s

emotion regulation and executive functioning capabilities over time, and which may also be beneficial for promoting improvements in long-term outcomes for children who have difficulties in these domains. However, more research is needed to empirically evaluate whether these improvements are above and beyond those seen in children receiving typical school programming, as well as if the short-term benefits of such mindfulness interventions lead to improved long-term outcomes.

While mindfulness interventions have been shown to be beneficial for many individuals, they may not be effective for everyone, and in some cases, they could even exacerbate certain issues [45]. Similar to other interventions such as therapy or exercise, some participants may experience increased distress or negative reactions, particularly if they are coping with trauma or mental health challenges. The results of this pilot study align with and differ from previous evaluations of similar mindfulness interventions with same-aged populations and similar outcomes. For example, Black & Fernando [46] reported moderate improvements in attention and self-control, based on teacher reports, while Bazzano et al. [47] found statistically significant improvements in emotional and psychosocial quality of life in elementary school students participating in a yoga curriculum. However, the moderate to large improvements observed in emotion regulation and executive functioning in this study differed from findings in other studies. White [21], for instance, found no significant changes in perceived stress, coping abilities, self-esteem, or self-regulation in fourth- and fifth-grade girls who participated in a yoga and mindfulness program. This discrepancy may be due to differences in study design, sample characteristics, and participant needs, as this study focused on children with emotion regulation and/or attention challenges, while the others involved typically developing students. This distinction could help explain the greater improvements seen in children who had more room for growth. The results of this pilot study are explored in more detail below.

4.1 Effects of a Yoga and Mindfulness-Based Class on Child Functioning

The group level analyses demonstrated several medium to large effects, though none of these results reached statistical significance, which was unsurprising, given the small sample size of this study. Overall, emotion regulation saw a large effect size ($\eta^2 = 0.157$), while anger control individually saw a small effect ($\eta^2 = 0.053$) and emotional self-control saw a large effect ($\eta^2 = 0.199$), as measured by the BASC-3-TRS. The overall measure of executive functioning saw a large effect size ($\eta^2 = 0.183$). Within the domain of executive functioning, two objective measures of executive functioning – inhibitory control, measured by the TEC subscale of 0-back inhibit commissions and 1-back inhibit commissions – saw medium effects ($\eta^2 = 0.076$ and $\eta^2 = 0.067$, respectively), as did a subjective measure of executive functioning (i.e., the BASC-TRS; $\eta^2 = 0.183$). In addition, there was a large effect on inattention, as measured by the SNAP-IV ($\eta^2 = 0.155$). Group-level analyses also found no significant follow-up effects, indicating that no future improvements were gained, and, in the case of inhibitory control, no post-treatment improvements were lost over the three months following the post-treatment assessment. Analyses across outcomes showed that the socioeconomic status of the participants (as measured by parental education level) did not have a statistically significant impact on the results, as demonstrated by a lack of statistically significant interaction effects in the various MANCOVAs.

When clinically meaningful individual-level changes were considered, a notably different picture of the results emerged. Between 18 to 30% of children who participated in the study fell into one

of the reliably improved categories for the domains of executive function measured by the TEC (i.e., 18% for selective attention, 23.1% for 0-back inhibit commissions, and 30.8% 1-back inhibit commissions). Between 10-20% of children also fell into one of the reliably improved categories for all domains of emotion regulation, as measured by the BASC-3 (i.e., 20% for anger control and 10% for emotional self-control). In addition, between 9 to 15% of these children fell into the reliably improved *and* recovered category for most domains of executive functioning, which suggests clinically meaningful change. These clinically meaningful improvements provide further support for the potential of school-based yoga and mindfulness-based programs for treating emotional and executive functioning related impairments in children. Specifically, these data provide preliminary empirical evidence that a yoga and mindfulness-based intervention program results in clinically meaningful change in emotion regulation and executive functioning in some children, and even pushes some into the normal range of functioning on these measures. However, given the lack of a control group in this study, these results should be considered with caution, as they may have resulted from the natural maturation of the participants or other confounding factors. These results do lend support to the argument that researchers evaluating the effects of yoga and mindful meditation interventions should examine clinically meaningful change in order to provide important and unique information about the clinical and social importance of treatment effects for individual children and families [48, 49]. The results also demonstrated a varied clinical presentation of the children nominated by their teachers to participate in this study, in that for some of them (i.e., 20 to 80%, depending on which outcome), their teachers reported functioning – or that the child performed within the normal range (i.e., came in functional) – prior to beginning the program (for a particular outcome). As a result, these children had less opportunity to reliably improve their emotion regulation and executive functioning skills than their peers who started out impaired on a particular outcome.

Finally, it is important to consider the overlap – or lack of overlap – that was found between the statistically significant findings and the clinically meaningful findings. When examining statistically significant differences, the only significant outcome emerged for inhibitory control (as measured by 0-back inhibit commissions on the TEC). In line with this finding, approximately 15% of children also demonstrated reliable and clinically meaningful change in this area of functioning. Interestingly, reliable and/or clinically meaningful change was also found for anger control (20%), emotional self-control (10%), selective attention (18%), and inhibitory control (as measured by 1-back inhibit commissions on the TEC; 31%), even though statistically significant change did not emerge for any of these domains. The importance of these findings lies in the fact that they suggest that, even when treatment may not result in statistically significant group or pre-post differences, a considerable number of individuals may experience clinically meaningful change.

4.2 Limitations and Future Directions

There are several notable limitations to this pilot study that should be considered. First, the sample size was small and multiple statistical tests were performed. Therefore, the reported effect sizes are more reliable effect indicators than the statistical tests. However, given that there was no control group, we cannot definitively state that the reported effects were due to the intervention alone and not confounded by maturation or other outside effects.

A significant limitation of this study was the lack of male participants, which limits the generalizability of the findings. Additionally, six participants were lost between post-treatment and the three-month follow-up, contributing to a notable dropout rate. Furthermore, some participants' data could not be included in the analyses due to missing values, such as when BASC-3-TRS measures were invalid because participants aged out of their assessment group, or TEC scores could not be calculated due to poor effort during tasks at one or more assessment points.

In addition, due to the limited amount of information available on the psychometric properties of some measures, we were not able to assess clinically meaningful change for all the measures utilized in the study (i.e., the SNAP-IV). Thus, this is not a complete assessment of clinically meaningful change on all domains that were assessed in the study. Furthermore, a large proportion of outcomes assessed, including anger control, emotional self-control, executive functioning, and attention, all relied on self-report. This method of reporting may be vulnerable to certain biases (e.g., response bias). Self-report may be convenient and a standard method of collecting data, however, findings on this outcome are vulnerable to expectancy bias (i.e., due to teachers wanting to 'help out' by overstating any observed changes) and the subjectivity of how a teacher views their student, particularly in relation to the other students in their class. Future research should interpret findings from measures that also include reports from others or utilize direct observational methods in order to avoid possible expectancy effects [50]. In addition, our ability to detect clinically meaningful change in our sample was somewhat limited, since many teachers reported the included students as functional prior to beginning treatment on at least one of the evaluated outcomes. Future research with a more clinically impaired sample may shed additional light on the effectiveness of yoga/mindfulness programs for children with regards to change at the individual level.

4.3 Clinical Implications

Several clinical implications from this pilot study are important to note. This pilot study highlights the potential of mindfulness-based practices and yoga to be utilized as a treatment for children with emotion regulation and executive functioning impairments by demonstrating that the positive effects of treatment extend beyond statistically significant improvements in inhibitory control, but also clinically meaningful change for some children in the various domains of emotion regulation and executive functioning. The reliable change and clinically significant results that emerged in this investigation show that intervention effects go beyond group-level statistics. These results emphasize the importance of considering distinct information about the individuals who are involved in treatment and demonstrate how we can build upon group-level tests to provide information about within-group variation [49]. This pre-liminary information could be essential in determining what treatments work best for which individuals based on important characteristics, like degree of impairment or socio-demographics.

Author Contributions

Drs. Dahl, Chimiklis, and Chacko were responsible for project development. Drs. Dahl and Chimiklis, Ms. Peralta, and Ms. Siddiqui conducted data collection. Dr. Dahl, Ms. Peralta, and Ms. Siddiqui conducted data analyses. Drs. Dahl and Chimiklis were responsible for writing the manuscript of the paper, with editing assistance from Dr. Chacko, Ms. Peralta, and Ms. Siddiqui.

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Competing Interests

The authors declare that they have no conflict of interest.

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