

Applying Mindfulness Training to Benefit Children and Parents from Disadvantaged Families: A Randomized Controlled Trial of Family-Based Mindfulness Intervention

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Abstract

Children from economic disadvantaged families (EDFs) suffer from almost every domain of development and are susceptible to delayed cognitive development, language development, and poor mental health (Dickerson & Popli, 2011; Huston & Bentley, 2010). Economic disadvantage affects children and their families at three levels: the individual level, such as quality of food intake; the relational level, such as quality of parenting and peer relationships; and the institutional or contextual level, such as schooling, parental work conditions, and neighborhood environments (Yoshikawa, Aber & Beardslee, 2012). Disadvantaged children are also found to suffer from chronic physiological stress, which affects the activities of the sympathetic nervous system (blood pressure) and hypothalamic pituitary adrenal axis (dysregulated cortisol) (Obradovic et al., 2010). Parents from EDFs experience the same chronic cumulative stressors, resulting in high physiological and psychological stress. High levels of stress are associated with unresponsive, unaffectionate, irritable, harsh and inconsistent disciplining of children. Such parenting has unfavourable effects on the cognitive functioning and language development of children (Blair et al., 2011).

Family Stress Theory originated from 1990s which examined the effects of severe income loss on the family (Conger & Elder, 1994). It specifies the impacts of poverty on family interactional processes as well as the individual members of the family. Economic hardship leads to family pressure, which gives rise to parental emotional distress and problematic issues, such as alcohol abuse. Disruptions in couple functioning and parent-child relationships are more likely to arise due to the conflicts stemming from financial concerns and parenting practices. Such disruptions cause harsh, inconsistent, and uninvolved parenting, which consequently leads to emotional and behavioral problems and impaired competence of the child (Dinnellan et al., 2013).

However, on the other hand, children with high contextual sensitivity are also more capable to benefit from positive environmental influences (Boyce & Ellis, 2005). Mindfulness-based intervention may reduce biological stress reactivity of parents and children to stressor exposures (Creswell, 2015). It can also promote parents' sensitivity to children's needs and responsive behaviors that can facilitate the latter's development and adjustment.

From the age of four, a child learns to interpret internal emotional states, motives and intentions, and to understand and remember. The child learns inhibitory control – the ability to control impulses, pays better attention and avoids distractions in learning. The child’s working memory abilities are also improved through their learning to combine different pieces of information for problem solving (Rothbart, Sheese, Rueda, & Posner, 2011).

Mindfulness is defined as paying attention non-judgmentally to the present moment. Mindfulness training may improve the ability to strengthen the attentional processes, which not only promotes the executive functioning of children from EDFs, but also improves parents’ self-regulation of attention in response to their child’s challenging behavior and alters the dysfunctional patterns in parenting behavior [28]. Mindfulness thus promotes overall family relationship quality (Rigby, Schultz & Ryan, 2014). Mindfulness not only enhances the sensitivity and responsiveness of a parent in promoting their child’s development, but also promotes the ability to cope with adversity, as it alters the processing of emotional information, especially in enhancing positive recall and improving memory biases (Segal, Teasdale, & Williams, 2013).

Evidence of mindfulness training for families with young children and EDFs are emerging. However, the majority of them have flawed research designs, such as small sample sizes or the lack of a control group, and only few of them focused on preschool children. Black and Fernando (2013) developed a five-week mindfulness-based curriculum for 409 children from kindergarten to the sixth grade from low income and ethnic minority families. Results showed improvements in attention, self-control, and caring for others. However, there was no control group and effects on other developmental aspects of the child were unclear. Weijer-Bergsma et al. (2014) recruited 199 students aged 8 to 12 and students were randomized into intervention and waitlist control conditions. After six hours of training, small effect sizes of child-reported verbal sharing of emotions and bodily awareness of emotions increased immediately after intervention, and more significant improvements were found in child-reported differentiating emotions, sense of coherence, parent-reported anxiety, and angry/aggressive symptoms at the seven-week follow-up. The above two school-based studies had the advantage of large sizes but parents were not recruited for the programs.

Felver et al. (2017) conducted a randomized trial for 41 healthy children aged 9 to 12 and their parents. The family-based mindfulness program lasted for eight weeks and each session took one and a half hours. Results showed medium effect size of significant improvements in conflict monitoring attention. Lo et al. (in press) conducted a randomized study of 100 children aged 5 to 7 with Attention Deficit and Hyperactivity symptomology. Participants completed a nine hour family-based mindfulness program and reported moderate sizes of improvements in reduction of child inattention and hyperactivity symptoms as well as small sizes of improvements in levels of parents' stress and well-being.

In addition to the study by Black and Fernando (2013), two recent studies suggested that mindfulness can benefit children and adults from EDFs. Poehlmann-Tynan et al. (2016) recruited 29 children from EDFs aged 3 to 5 and randomized them into a 12 hour mindfulness intervention plus reading treatment and a treatment-as-usual condition (ie. reading program only). Children who underwent the mindfulness intervention had significantly increased scores in attention and self-regulation at the post-test and the three-month follow-up. Van der Gucht, Takano, van Broeck, & Raes (2015) investigated the effect of mindfulness-based intervention on 42 participants from low income backgrounds. The mindfulness program lasted for eight weeks and each session was one and a half hours only. Results showed improvements symptoms of stress, anxiety and depression. Both studies have given initial support to the benefits of mindfulness to the mental health of EDFs. However, each study targeted either the children or adults from EDFs only, and they also had other methodological limitations, such as small sample sizes and the absence of control group. Previous studies in family-based mindfulness intervention focused on the benefits on attention and this is the first known randomized control trial that investigated the outcome of well-being of EDFs by applying a parallel parent and child mindfulness-based intervention.

Based on the literature, the following hypothesis was proposed for this study: i) children from EDFs in the intervention group would demonstrate better cognitive and language development, attention, behavioral and emotional regulation, and less behavioral problems than children in the

control group after FBMI. ii) parents in the intervention group will have lower parental stress, and higher levels of mindfulness, compared with the participants in the control group.

Methods

The effects of this intervention were tested using a two-arm randomized controlled trial, comparing the FBMI (arm 1), to a wait-list control (arm 2). The program effects were tested using both between-subject (comparison of two arms) and within-subject (comparison of measures at T1, T2, and T3). Assessments were made before (T1), after intervention (T2), and at the three month follow-up (T3).

Sample size estimation. Sample size calculation are based on the following two studies: Bogels et al. (2013) reported an effect size of 0.4 in parental stress, while Black and Fernando (2010) reported an effect size of 0.4 in children's attention and self-control. For a two-tailed α error of 5%, an 80% power, and a test of two independent groups, the required sample size will be 100 families per arm (Cohen, 1988). With references to the drop-out rate of 20% in two local mindfulness training studies (Hou et al., 2014; Lo et al., 2013) and speculation of a higher drop-out for EDFs (about 30%), we aim to recruit 130 families per group, and 260 families for the two arms in total.

Procedures

Program planning and training. The programs for parents and children were developed by following the first three steps of intervention research proposed by Feaser and Galinsky (2010) for large scale of clinical trials. First, develop program theories: FMBI adopted themes about and approaches to family stress of disadvantaged families and stress reactivity. The intervention is

designed to promote the use of acceptance and approach coping in the programs. Two evidence-based mindfulness training programs were selected for further adaptation for the present project. The parent mindfulness training is a brief version of the Mindful Parenting course developed by Bögels and Restifo (2014). The evidence-based programme was originally developed for reducing the stress of parents of adolescents with ADHD or aggression (Bögels et al., 2013). It was adopted in a feasibility study of a brief mindfulness-based intervention for parents of children with developmental disabilities (Lo et al., 2017). The protocol for the child program was developed by Snel (2013), for children aged 5 to 8. Pilot tests have been conducted in mid-2014 after the second practice team meeting and consultation with overseas reviewers. Pilot study 1, held in May to June 2014, was implemented to six children at aged 5; the researchers found that anxiety-depression symptoms and attention accuracy of the children were improved. Pilot study 2, held in August to September 2014, included eleven families. It was found that parental stress was reduced and there were improvement in the attention accuracy and the reduction of aggressive behaviors of the children. Minor modifications were made in each of the three major components of the mindfulness-based intervention, namely, in-class mindfulness exercises, discussion of relevance to context, and homework exercises. The same protocol was adopted to apply to a study for children with ADHD symptomology and their parents (Lo et al., 2016; Lo et al., in press).

Instructors of the program held a degree or above in social work, psychology, education, or nursing and completed a basic eight week mindfulness training program. Afterwards, they completed training courses offered by the research team – either a two-day training course for the parent program, or a six-day training course for the child program. Please refer to Table 1 and Table 2 for the session outlines of the respective programs.

Implementation and assessment. After the first assessment (T1), only the EDFs in arm 1 received FBMI and arm 2 was in the waiting list. After the intervention in arm 1, participants in both arms

completed the second assessment of the study (T2). Participants in the wait-list (arm 2) did not receive any intervention during this phase. Each session lasts 60 minutes for children for eight weeks and 90 minutes for parents for six weeks. Two additional half hour parent and child joint program were arranged in session 5 and 8. Ten minute daily homework practice is required for parents and children. Participants in the wait-list (arm 2) received the same intervention after T2. and a posttest after the program (T3).

Implementation fidelity: Mindfulness-Based Interventions–Teaching Assessment Criteria was adopted to assess treatment fidelity of the parent programs. It included six domains of competence in instructing a mindfulness program that can apply to a brief mindfulness-based intervention (Crane et al. 2013). Child programs were assessed by a five-point scale in two criteria adherence to manual and competence in teaching. All sessions were audio recorded for assessing treatment fidelity. 10% of all sessions were randomly selected for each group. Two independent reviewers were recruited to rate the implementation fidelity of the study.

Participant feedback and satisfaction: All participants who completed the FBMI were invited to complete a satisfaction questionnaire. The attendance rate and attrition rate were also assessed the participant's level of satisfaction.

Participants

Participants recruited from eight primary schools or integrated family service centers from four districts (Kwai Ching, Kwun Tong, Wong Tai Sin, and Yuen Long), which were ranked the top five among all districts in Hong Kong in terms of the percentage of low income population (Hong Kong Council of Social Service, 2013). School and family social workers promoted this program among eligible families and parents were invited to join a mindfulness seminar, after which they were invited to participate in the program with their children. Inclusion criteria of this study include: (1) families who were receipts of the Comprehensive Social Security Scheme, or (2) families who were

receiving the full rate School Textbook Assistance Scheme (STAS), and (3) both parents and children were committed to participate in the program. In 2018, the asset upper limit for CSSA is HKD42000 (about USD5385) for two person families, and HKD84000 (about USD10769) for families with four members or above. The STAS monthly household income upper limit and asset upper limit were HKD13700 (about USD 1756) and HKD338000 (about USD43333) for two-person families respectively, and HKD20100 (about USD2577) and HKD514000 (about USD65898) for four-person families respectively. The exclusion criteria will be children with developmental disorders, such as attention-deficit hyperactivity disorder, autistic spectrum disorder, and parents with psychosis, including schizophrenia and bipolar disorder.

One hundred families were randomized into the intervention group and the wait-list control group. The randomization procedure is as follows. A 10×10 table was created by randomly assigning digits 0 to 9. One row of the table is randomly selected, and the sequence of digits in that row is observed. A participant list is prepared, and the sequence of participants is observed. The first digit will determine the first participant's group, and so on. Participants with an even digit are assigned to the intervention group, and those with an odd digit are assigned to the control group. After the families are assigned to groups, another research team member contacts the parents by phone, to inform the parents about the results of randomization and to confirm that both the parents and the child will participate in the study. It means that the team member who interviews the families is blinded in the assignment process.

As shown in Figure 1, 8 families dropped out during wait-listing, and 2 families of the intervention groups participated for less than 3 lessons and did not complete the intervention. Therefore, in total, 90 families completed the FBMI. 48 families were assigned to the intervention group and 42 were assigned to the control group.

Measures

Primary outcomes

Parenting Stress. Parenting Stress Index Short Form (PSI-SF): The PSI includes 36 items and was developed to reveal the sources of difficulties and the level of parenting stress (Abidin, 1995). The scale is divided into three subscales: parental distress, parental-child dysfunctional interaction, and difficult child. The Chinese version has been validated (Lam, 1993). The internal consistency in this study for total score was 0.93.

Self-regulation. Two behavior tests were administered to assess the child's self-regulation skills. The Counting Span Test proposed by Bull & Scerif (2001) was conducted as follows: stimuli were printed on plain white cards. On each card there were one to nine green spots and one to nine yellow spots. Yellow spots were presented as distractor items. Children were instructed to count the number of green spots on the card presented. The test was started with the span size of one card. Three trials were done per span size level. If participants made two errors on at a particular span level, the test would be terminated; otherwise, the number of cards will be increased after three trials. The total number of correct answers would be the score. The Head-Toes-Knees-Shoulders (HTKS) task measures behavioral regulation with children's responses to 31 trial commands (Ponitz et al., 2009). After habituating to two oral commands (e.g., "touch your head" and "touch your toes"), children were asked to respond in an unnatural way to two types (on the 16 trials from the Head-to-Toes task) and then four types (on the following 15 trials) of paired behavioral commands. For example, if the administrator said, "Touch your toes," the correct response would be for the child to touch his or her head; the correct response to a "Touch your knees" command would be for the child to touch his or her shoulders. Correct responses earned 2 points; incorrect responses earned 0 points; 1 point was given if the child gave an incorrect response, but self-corrected and ended with the correct action. Scores ranged from 0 to 62. Commands were given in a consistent, nonrandom order. Higher scores indicated higher levels of behavioral regulation.

Secondary outcomes for Child functioning

Attention. The Child Attention Network Test (ANT) was developed by Posner and Petersen (1990). It presents five fish in a horizontal row that appear above or below a set fixation point. The children were instructed to press a key indicating in which direction the central fish was pointing and to ignore the flanker fishes. Completion of the task allows calculation of three scores related to the efficiency of attention networks. Alerting is measured by the additional time required to respond with no cue, compared to the baseline of responding to a cue that informs the child that a target will occur shortly. Orienting is measured by the time taken to respond to a cue at the target location, minus the reaction time to a central cue. Attention is measured as interference by the flanker fish on the child's score. This test has been adopted as an outcome measure for child mindfulness program (Felver et al., 2017; Lo et al., in press).

Overall behavior. The Child Behavior Checklist (CBCL) was used to assess parents' ratings of their children's behavior problems (Achenbach & Rescorla, 2000). The test-retest reliability and criteria validity of the school children version of the CBCL have been established for Hong Kong Chinese (Leung et al., 2006). It has 67 items involving seven sub-scales (emotionally reactive, anxious/depressed, somatic complaints, withdrawn, aggressive behavior, attention problem, sleep problem). The internal consistency in this study for total score was 0.96.

Secondary outcomes for Parent functioning

Depression. The Patient Health Questionnaire (PHQ-9) includes 9 items that assess the parent's depression symptoms (Kroenke, Spitzer & Williams, 2001), directly based on the nine diagnostic criteria for major depressive disorder in the DSM-IV (Diagnostic and Statistical Manual Fourth Edition). The participants were asked to report their severity of depression symptoms using 4-point response scale where 0 = not at all and 3 = nearly every day. The internal consistency of the index in this study was .91.

Interpersonal mindfulness. The Interpersonal Mindfulness in Parenting (IM-P) scale includes 31 items that assess the parent's quality of mindfulness specific to his or her family context (Duncan, 2007). The Chinese version of IM-P include Compassion for Child, Non-judgmental Acceptance in

Parenting, Emotional Awareness in Parenting, and Listening with Full Attention. A scale validation study has been conducted by the first author and colleagues (Lo et al., in press). The internal consistency of the index in this study was .87.

Additional measures

Family functioning. The Family Adaptation, Partnership, Growth, Affection, Resolve (APGAR) Scale includes 5 items that assess the parent's satisfaction of family functions across five domains using 3-point response scale where 0 = hardly ever and 2 = almost always (Smilkstein, Ashworth & Montano, 1982). The internal consistency of the index in this study was .91.

Household chaos. The Confusion, Hubbub, and Order Scale (CHAOS) includes 6 items that assess the parent's perception of household chaos, using 5-point response scale where 1 = not at all like your own home and 5 = very much like your own home (Matheny et al., 1995). The internal consistency of the index in this study was .92.

Implementation fidelity: Mindfulness-Based Interventions–Teaching Assessment Criteria was adopted to assess treatment fidelity of the parent programs. It included six domains of competence in instructing a mindfulness program that might also apply to a brief mindfulness-based intervention (Crane et al. 2013). Child programs were assessed by a five-point scale in two criteria – adherence to manual and competence in teaching. All sessions were audio recorded for assessing treatment fidelity. 10% of all sessions were randomly selected for each group. Two independent reviewers were recruited to rate the implementation fidelity of the study.

Statistical analysis

The baseline characteristics of the intervention group and the waitlist control group will be compared by analysis of covariance for continuous variables and chi-square tests for categorical variables. The baseline factors include the age of the children and the parents, the sex of the children and the parents, parent's education, marital status, and the pre-test of scores of household chaos, PSI, PHQ, CBCL, and APGAR. The intervention effect was evaluated by comparing the

intervention (arm 1) and wait-list control groups (arm 2). Repeated measures ANOVA, with time (pretest and post-test) as the within-subject variable and group (treatment group and control group) as the between subject variable, was used to detect effects of time, group, and time \times group interactions for each of the outcome measures. All analyses were carried out according to the intention-to-treat approach. The participants' missing values will be imputed using the last-observation-carried-forward method. A two-sided P value of 0.05 or less would be considered to be statistically significant. In the case of significant results, effect sizes were calculated. Cohen (1988) suggested that $d = 0.2$ be considered a small effect size, 0.5 a medium effect size, and 0.8 a large effect size.

This study further attempted to explore the moderating effects of household chaos and mindful parenting, and the mediating effects of PSI and APGAR, using group (treatment vs group) as the independent variables; CBCL, self-regulation as dependent variables. The PROCESS macro was used to test the mediating effects on the relationship between group difference as the independent variable, and parents' stress or children's behavioral problems as dependent variables (Hayes, 2013). Bootstrapped estimates of confidence intervals (CIs) for indirect effects were calculated. It is bias-corrected because this approach does not assume distribution normality of sampled indirect effects (Preacher, Rucker, & Hayes, 2007). If 95% CIs do not encapsulate 0, they are considered significant and mediating effects exist. All analyses controlled for the child age and pretest value of the corresponding dependent variable.

We also examined the overall attrition rates, defined by completion of not less than half of the program, i.e., three sessions. Results of the RCT, attendance rates, and service user satisfaction data were included to investigate the overall feasibility of the program.

All analyses were performed using SPSS version 22.0.

Results

Demographics

Parents on average were aged 38.64 years old and children were 6.50 years old. A total of 93.1% of the parents were female and 55.9% of the children were male. As reported in Table 3, no significant differences were found in most demographics and pretest scores between the intervention and control group (all $p > .05$).

Changes in primary outcome measures at T2

As presented in Table 4, significant Time \times Group (2 pre-post \times 2 treatment-control ANOVA) interactions were shown in self-regulation, $F(1, 100) = 6.02, p < .05$; PSI parent-child dysfunctional interaction, $F(1, 100) = 9.10, p < .01$; PSI difficult child, $F(1, 100) = 7.27, p < .01$; and PSI total stress, $F(1, 100) = 7.80, p < .01$. These results indicated that after completing the FBMI, comparing with the control group, children from the intervention group were found to have more significant improvements in their self-regulation, and parents were found to have significant improvements in their parenting stress and stress.

Changes in secondary outcome measures at T2

As presented in Table 4, significant Time \times Group (2 pre-post \times 2 treatment-control ANOVA) interactions were shown in parent depression PHQ, $F(1, 100) = 4.37, p < .05$, and CBCL attention problem, $F(1, 100) = 4.45, p < .05$. These results indicated that after completing the FBMI, comparing with the control group, children from the intervention group were found to have significant improvements in their CBCL attention problems, and parents were found to have significant improvements in their parent's depression. However, changes in parent interpersonal mindfulness IM-P and family functioning APGAR were insignificant.

Change at T3 follow-up

As presented in Table 4, results of the three-month follow-up were examined by paired samples. Overall, the positive changes of EDFs continued after of T-tests (pretest vs. 3-month follow-up) for intervention group were significant in CBCL anxious/depressed, $t(1, 50) = 4.57, p < .001$; CBCL withdrawn/depressed, $t(1, 50) = 3.10, p < .01$; CBCL somatic complaints, $t(1, 50) = 2.88, p < .01$; CBCL attention problems, $t(1, 50) = 5.58, p < .001$; CBCL aggressive behaviour, $t(1, 50) = 4.07, p$

< .001; CBCL internalizing problems, $t(1, 50) = 4.44, p < .001$; CBCL externalizing problems, $t(1, 50) = 4.17, p < .001$; CBCL total problems, $t(1, 50) = 5.13, p < .001$; memory span, $t(1, 50) = -5.39, p < .001$; self-regulation, $t(1, 50) = -4.11, p < .001$; PSI parental distress, $t(1, 50) = 2.65, p < .05$; PSI difficult child, $t(1, 50) = 2.06, p < .05$; PSI total stress, $t(1, 50) = 2.56, p < .05$; PHQ, $t(1, 50) = 2.53, p < .01$; and APGAR, $t(1, 50) = -2.20, p < .05$. These results indicated that after completing the FBMI for three months, children from the intervention group were found to have made further improvements in their behavioral problems, and parents were found to have made further improvements in their parenting stress, depression and perceived family functioning. However, changes in parent interpersonal mindfulness and household chaos were insignificant.

Analyses of Moderation effects of household chaos

The effect of the treatment on the moderation effects of household chaos was examined using group (treatment vs. control) as the independent variable; posttest CBCL attention problems as the dependent variables; and baseline household chaos as moderator, controlling for the pretest value of the dependent variable. All results were summarized in Table 5. A total of 10,000 replications were used in the bootstrapped estimates of CIs. Predicting CBCL attention problems, there was a significant interaction effect between group and baseline household chaos, $b = .04, t = 1.99, p < .05$ (shown in Figure 3), and the slopes of group on posttest CBCL attention problems were significantly different from zero at moderate ($t = 2.65, p < .01$) and high ($t = 3.35, p < .01$) levels of baseline household chaos, but not low ($p > .05$).

Mediation Analyses

The effect of the treatment on the mediator was examined using group (treatment vs. control) as the independent variable; CBCL attention problems as the dependent variables; and change of the SWAN score, change of PSI parent-child dysfunctional interaction, those of PSI difficult child, and those of PSI total stress as mediators, controlling for the pretest value of the dependent variable. Results were summarized in Table 5. A total of 10,000 replications were used in the bootstrapped

estimates of CIs. Predicting CBCL attention problems, there was a significant indirect effect from group via change of PSI parent-child dysfunctional interaction ($ab = .04$, $SE = .02$, $95\% CI = [.01, .10]$), via changes of PSI difficult child ($ab = .08$, $SE = .03$, $95\% CI = [.02, .16]$), and via change of PSI total stress ($ab = .08$, $SE = .03$, $95\% CI = [.02, .16]$), as shown in Figure 2.

Feedback and Implementation Fidelity

Positive feedback was received from the participants who completed the intervention. 86 parents who had completed all sessions of the FBMI to complete the feedback form. A total of 72 parents completed the questionnaire and the response rate was 83.72%. A total of 93.06% of the respondents felt satisfied with the content of the FBMI and 91.67% of them considered that their management of stress and emotions were enhanced.

Among the completers, the attendance rate of treatment groups was 91.50%, that of wait-list groups was 78.10%, and that of all groups was 83.66%. The attrition rate judged from participating at least three sessions of more of the program was 3.92% of treatment groups, that of wait-list groups was 19.61%, and that of all groups was 11.76%.

For the implementation fidelity, the average rating of MBI-TAC was 5.3 (range 5.0 - 5.7) out of 6, and the fidelity checklist for child program were 3.58 in adherence and 3.50 in competence out of 5.

Discussion (to be completed by Ted)

Although ADHD is one of the most common mental disorders in early childhood, existing treatments have limitations, and the families of children with ADHD experience high levels of stress that create a great burden to school systems and the community. Poor management of child behavior and family relationships further increase the risks of other comorbid psychopathologic conditions, such as oppositional defiant disorders and conduct disorders in children and major depressive disorders in caregivers. The search for effective treatments to improve the functioning

and quality of life of families of children with ADHD should be a priority in the mental health care and education sectors.

This is the first randomized control trial of mindfulness-based intervention for young children and their parents from disadvantaged. The positive result on the child primary outcome measure, inattention and hyperactivity symptoms, have provided initial evidence base regarding FBMI as a treatment option to ADHD. The improvement of overall behaviour problem also suggested such intervention can lead to reduction of internalizing and externalizing problems to the children.

The benefits to parents is also impressive. The overall reduction of parental stress and increase in psychological well-being, demonstrating the value of mindfulness in enhancing parent's stress management and self-management. Although there is no separate measure on family functioning, one of the subscale of PSI parent-child dysfunctional interaction showed the relational effects of mindfulness. It suggested that mindfulness training contributes to symptom reduction for individual family member but also for cultivating a nurturing living environment.

Another strength of the present study is to include multiple measure for attention and parent's stress reactivity. The significant improvement in ANT for children suggested that the change of attentional process in treatment can be evaluated in a time limited behaviour assessment procedure and it should be adopted in accompany with self-reported scales to strengthen the evidence-base of FBMI. In this study, we did not find positive change in HRV after mindfulness training and the reason is unclear. Researchers may explore a refined procedure for data collection. An alternative explanation is that HRV is less favourable measure for evaluating ADHD symptoms, compared with other internalizing symptoms, such as depression. [xxx]

One limitation of this study was that the drop-out rate of FBMI is relatively high, compared with mindfulness-based intervention program for adults. Those of waitlist control group were slightly above 30%. Based on our contacts with the families, we found that parents look for treatment effects in a short time, and it was also common to have time clash with other children interest classes and intervention programs. Another limitation was that the short project period does

not allow us to investigate the sustainability of the treatment effects. Further studies should also consider a 6-month or 1-year follow-up period to verify the sustainability of the treatment effects.

Application of FBMI may also be considered for children with other clinical problems, such as autism spectrum disorder, severe behavioral problems, conduct disorders, depression, and anxiety. More studies of FBMI is recommended for strengthening the evidence base of this recently developed approach.

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TABLE 1. Mindfulness training for parents (developed by the Herman Hay-ming Lo)

Session	Theme	Goal
1	Stress of being a parent	<ul style="list-style-type: none"> · Establish motivation to learn mindfulness for promotion of family health · Introduce mindfulness training · Introduce body scan · Introduce stretching
2	Automatic reactions	<ul style="list-style-type: none"> · Notice physiological, emotional and cognitive reaction in stressful moments of parenting · Use of mindful breathing and nonjudgmental attitude in managing the reaction in parenting · introduce mindfulness to breath and body
3	Respond to children mindfully	<ul style="list-style-type: none"> · Further notice reactive patterns in parenting · Introduce three minute breathing as coping · Practice deep listening in mindfulness
4	Quality parenting	<ul style="list-style-type: none"> · Joint session: practice with children, progress review · Introduce mindfulness to sounds and thoughts · mindful living for ADHD children and family caregivers · Exploring difficulties with mindfulness practice
5	Facing difficulties with kindness	<ul style="list-style-type: none"> · Introduce lovingkindness practice for self-care, and care of others
6	Self-care of parents	<ul style="list-style-type: none"> · Joint session: practice with children, progress review · Care plan of children and self · Consolidate learning

TABLE 2. Child program of family-based mindfulness intervention (developed by Snel, 2014)

Session	Theme	Goal
1	A for attention	<ul style="list-style-type: none"> - Establish motivation of be attentive and mindful - Use breathing as a beginning of exploration of attention
2	Exploring our body	<ul style="list-style-type: none"> - Introduce mindful movement exercises - Expand awareness of body sensation
3	Tasting, Smelling, Hearing, Seeing and Feeling	<ul style="list-style-type: none"> - Introduce the use of multiple senses in understanding our inner and outside world
4	Feel our feelings	<ul style="list-style-type: none"> - Learn to be aware and to describe feelings
5	Accepting feelings	<ul style="list-style-type: none"> - Acknowledge feelings of self and others - Experience the importance of accepting feelings
6	Conscious movement	<ul style="list-style-type: none"> - Bring attention and awareness to self and others
7	The power of awareness and thoughts	<ul style="list-style-type: none"> - Experience the application of mindful attention and thoughts in daily life
8	Being nice is good	<ul style="list-style-type: none"> - Consolidate learning - Practice of lovingkindness

