

Effects of a Digital Parent-Child Single-Session Growth Mindset Intervention on Adolescent Depression and Anxiety Symptoms: A 3-Arm Waitlist Randomized Controlled Trial

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Abstract

Background: Depression and anxiety are prevalent among adolescents globally. Parents are the most direct and crucial pillars in supporting adolescents' mental health, and parental mindsets matter. Yet digital parent-child mindset interventions are rare and understudied. Given promising results from single-session interventions for youth, this study developed and evaluated a parent and child single-session intervention on mindsets of intelligence, failure, and emotion (PC-SMILE) to alleviate adolescent depression and anxiety.

Objective: This study aimed to examine the effectiveness of PC-SMILE in reducing depression and anxiety symptoms among adolescents, compared to the child single-session intervention on mindsets of intelligence, failure, and emotion (C-SMILE) and waitlist control groups.

Methods: Classes from each secondary school were randomized to one of three intervention conditions: PC-SMILE, C-SMILE, or waitlist control. Each intervention took approximately 45 minutes online, which included parent-version and child-version. Both parents and students in the PC-SMILE group received the intervention. For the C-SMILE group, only students received the intervention. Students in the three groups were assessed at 3 time points: baseline before intervention, 2 weeks post-intervention, and 3 months post-intervention, while parents were assessed in baseline and 3-month follow-up. Generalized estimating equations were used to test the effectiveness of the single-session interventions.

Results: A total of 390 parent-child dyads from 7 secondary schools were randomly assigned to either the PC-SMILE intervention group (n = 126), the C-SMILE intervention group (n = 138), or the waitlist control group (n = 126). The intent-to-treat analysis found no significant time*group interaction effects on all outcome measures. However, the results revealed a significant decrease at 2 weeks post-intervention in symptoms of anxiety ($P < .001$) and depression ($P = .042$) and hopelessness ($P = .017$) and a significant improvement in mental well-being ($P = .037$) and parent-child relationships ($P = .003$) for the PC-SMILE group, and the enhancement in parent-child relationships sustained at the 3-months follow-up ($P = .004$). Moderation analysis showed that participants with higher baseline depression and anxiety levels and girls exhibited greater improvements in depression and anxiety symptoms.

Conclusions: The PC-SMILE intervention showed preliminary evidence of effectiveness in reducing adolescent anxiety and depression and improving parent-child relationships. Our findings revealed the potential benefits of brief online interventions for adolescents and parents, which may be scalable, destigmatized, and cost-effective alternatives to school-based programs. Future studies should focus on using mixed methods to evaluate outcome, and improve and amplify the effects of single-session interventions for adolescents. Clinical Trial: ClinicalTrials.gov NCT05493865

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Original Paper**Title Page**

i) **Title:** Effects of a Digital Parent-Child Single-Session Growth Mindset Intervention on Adolescent Depression and Anxiety Symptoms: A 3-Arm Waitlist Randomized Controlled Trial

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Trial registration: ClinicalTrials.gov NCT05493865

KEYWORDS

growth mindset; mental health; secondary school students; brief intervention; randomized controlled trial; parent-child interventions

Introduction

Depression and anxiety disorders are the primary contributors to disability and illness among

adolescents globally [1]. Globally, 34% of adolescents aged 10–19 are at risk of developing depression [2], while the 12-month pooled prevalence of anxiety disorders is estimated at 9.0% [3]. Despite the high prevalence of mental health needs, the majority of adolescents with mental disorders do not receive the help they need. In many low- and middle-income countries, the number of child mental health professionals is extremely limited, often fewer than 0.1 child psychiatrists per 100,000 youth, over 100 times fewer than in high-income countries (United Nations Children's Fund and World Health Organization, 2022). In Hong Kong, nearly one in four secondary school students report moderate to severe symptoms of depression or anxiety, with approximately one in twelve meeting criteria for a severe disorder [4, 5]. Yet 65% are unable to access mental health services because of long waiting time for public service, high costs of clinic-based care, or fears of stigma and discrimination [6]. Experiencing these disorders early in life can heighten the risk of suicide among young people and cause various psychological and occupational difficulties with lasting negative consequences, particularly if not properly treated or supported [7]. It is therefore important to implement accessible and effective interventions that are family-friendly, affordable, and non-stigmatizing, to provide early support and prevent these conditions from worsening.

Parents play a significant role in either increasing or protecting against adolescent anxiety and depression [8, 9]. First, both parental and child's attitudes and coping matter in the face of adversity [10], such as the structural stress factors like academic pressure [9]. A growing number of research emphasizes the significance of parent and child's growth mindset [11, 12]. Studies have shown that holding a fixed mindset—the belief that personal attributes cannot be changed—is a significant predictor of mental health issues in young people [13–17]. Conversely, interventions that encourage a growth mindset—the belief that attributes can be developed—have been found to effectively reduce symptoms of depression and anxiety in adolescents [18, 19]. Additionally, when parents maintain fixed mindsets about intelligence and emotions, these beliefs create a developmental cascade whereby children internalize similar perspectives about their own capabilities, leading to more internalized problems like depression and anxiety, as well as maladaptive coping with their mental health [19–23]. Children raised in fixed-mindset environments may develop psychological vulnerabilities characterized by ability doubt, less effective coping mechanisms, and heightened feelings of helplessness [13].

As mindset is a modifiable factor [24], an increasing number of mindset interventions are developed to help adolescents to reach their full potential and promote children and youth wellbeing [25, 26]. Growth mindset interventions focus on teaching that personal qualities like intelligence, personality, and emotions are changeable, and that improvement is possible through actions such as putting in effort, trying new strategies, learning from mistakes, and seeking help [18, 22, 25, 27]. These interventions, which typically last between 30 minutes and an hour, have produced varying effect sizes—from small for academic performance improvement in a large, diverse sample [28] to medium-to-large for anxiety reduction in randomized controlled trials (RCTs) [29]. Given their short duration and the observed effect sizes across different contexts and populations, brief mindset interventions show strong potential for scalable mental health prevention and early treatment.

The existing growth mindset interventions have primarily targeted growth mindsets in specific areas such as intelligence [25, 28], personality [19, 23, 30], and emotions [27] to enhance academic performance, build resilience, and alleviate mental health symptoms. While these domain-specific approaches have shown positive results, no intervention has yet combined multiple core growth mindsets into an integrated mindset program. Yeager and colleagues have found a synergistic effect of integrating stress mindset and growth mindset for stress management [25, 31]. This finding is particularly relevant given that the causes of youth depression and anxiety are multifaceted—involving academic pressure, life setbacks, uncertainty, and emotional challenges during adolescence—and may therefore require comprehensive intervention approaches. This study seeks to fill this gap

by developing and evaluating an integrated intervention that targets multiple growth mindsets to address internalizing symptoms in youth.

Parental mindsets significantly influence adolescents' own mindsets and their risk for internalizing problems like depression and anxiety [21, 22]. While parents are a primary source of support for teenagers, they can also contribute to stress if they hold a fixed mindset and view failure as harmful. For instance, when parents believe intelligence is unchangeable, their children are more likely to experience symptoms of depression and social anxiety due to increased worries about performance and fear of negative judgment [22]. Additionally, parents' attitudes toward failure shape how they respond to their children's setbacks [21]. Parents who see emotions as fixed and believe failure is damaging are more likely to prefer passive approaches to addressing their children's mental health concerns [23]. On the other hand, fostering beliefs in the potential for change regarding intelligence and emotions can help reduce family anxiety about failure and mental health issues, lessen stigma, boost feelings of control, encourage proactive help-seeking, and improve parent-child relationships. When families view abilities as developable rather than fixed, they are more likely to interpret setbacks as temporary challenges that can be overcome through effort, rather than as permanent deficits that define a child's capabilities. Given the important role parents play in preventing internalizing problems in children [32], joint growth mindset interventions for both parents and children hold promise for enhancing the well-being of families.

This study aimed to address three key gaps. First, most existing interventions target fixed mindsets in only one area—such as intelligence, personality, or emotions [19, 27] – and rarely combine multiple relevant mindset domains closely linked to youth mental health within a single program. Integrating several relevant mindset domains into one intervention could enhance its effectiveness. Second, we aim to develop a parent-child mindset intervention in the Chinese context. Given that Chinese parents often experience high levels of anxiety about their children's education [33] and that parental mindsets may have an even greater impact on children's mental health [34], a parent-child mindset intervention would address this significant need. Third, despite strong evidence supporting the benefits of preventive parenting programs, these interventions are often underutilized due to obstacles like scheduling conflicts and concerns about privacy [7]. It is thus crucial to develop brief, easily accessible, and non-stigmatizing interventions for both parents and children.

This study developed and evaluated an online parent and child single-session intervention on mindsets of intelligence, failure, and emotion (PC-SMILE; [35]). The goal is to provide a scalable and accessible intervention that can benefit children and parents. We aimed to examine the efficacy of the intervention among first-year secondary school students (Grade 7) as they are navigating increased academic and social challenges during a transitional period to middle school, while their parents are remaining highly engaged and collaborative in a parent-child intervention programme. The current study examined the efficacy of PC-SMILE for adolescents and their parents, compared to a child single-session intervention on mindsets of intelligence, failure, and emotion (C-SMILE) group and a waitlist control group.

Objectives

The primary objective was to test the efficacy of PC-SMILE in reducing depression and anxiety symptoms in secondary school students. The secondary objective was to evaluate the efficacy of PC-SMILE in a) reducing hopelessness and perceived parent performance (vs. learning) orientation and enhancing mental well-being and academic self-efficacy, and b) enhancing parent-child interactions and relationships.

Hypotheses

H1: The PC-SMILE and C-SMILE groups are more effective in the primary outcome (i.e., reducing anxiety and depression symptoms in student participants) than the waitlist control group, while PC-SMILE is more effective than C-SMILE.

H2: The PC-SMILE and C-SMILE are more effective in the secondary outcomes of (i) reducing hopelessness, (ii) enhancing mental well-being, (iii) enhancing academic self-efficacy, (iv) reducing perceived parent performance (vs. learning) orientation, and (v) enhancing parent-child relationships than waitlist control, and PC-SMILE is more effective than C-SMILE.

Methods

Ethical Considerations

Ethical approval was granted by the Institutional Review Board of the Hong Kong Polytechnic University (reference number: HSEARS20211009001). Participation was voluntary. Informed written consent was obtained from all participating parents and students. Participants were informed of their right to withdraw from the intervention or to decline to answer any questions on the questionnaire, and they were assured that their responses would remain confidential. Additional information for referral services was provided to participants with clinical-level mental health needs. The data were de-identified (for example, by removing school names and assigning unique codes) and kept in secure storage. Participants' personal data would not be disclosed in any publication or reporting.

Study design

This study was a three-arm cluster-RCT of adolescents aged 12-15 years and their parents in Hong Kong (**Fig. 1**). A study protocol was previously published [35]. The trial was registered at ClinicalTrials.gov (NCT05493865).

Classes in each eligible school were randomized (using computer-generated random numbers) into the PC-SMILE, C-SMILE, or waitlist control group. For the PC-SMILE group, both students and parents received the intervention, while for the C-SMILE group, only students received the intervention. The waitlist group were invited for the PC-SMILE intervention after the three-month follow-up survey. All student participants received regular educational activities and interventions in school. Three repeated assessments of the measures were conducted simultaneously for the children in the three groups at (i) baseline, (ii) two weeks post-intervention, and (iii) three months post-intervention. Parents in the three groups were measured at (i) baseline and (ii) three months post-intervention. Cluster randomization was conducted at the class level.

Participants

Eligible adolescents in Grade 7 and their parents were recruited from seven secondary schools through cluster-randomized sampling. The inclusion criteria for adolescent participants included (1) aged between 11–16 with one parent willing to participate, (2) Chinese youth who can read and write Chinese, (3) sufficient visual and auditory abilities to complete the intervention and assessment and (4) able to give consent to participate in the study. The exclusion criteria for adolescent participants included (1) no parental consent; (2) unable to remain focused to complete the intervention and the survey, which took approximately 45 and 25 minutes respectively; and (3) intellectual disability or severe illness or pain that could introduce significant bias in the students' health and mental health situation.

The inclusion criteria for parent participants were (1) living with the child participant, (2) Chinese-language proficiency and comfort with completing computer-based activities, (3) sufficient visual

and auditory abilities to complete the intervention and assessment, and (4) ownership of personal internet-equipped devices. The exclusion criteria for parent participants included (1) having mental illnesses as well as exclusion criteria (2) and (3) from the above criteria for adolescent participants.

Procedure

The school and student recruitment process included the following steps. First, study invitations were sent to schools chosen randomly from the secondary school list across Hong Kong Island, Kowloon, and the New Territories. Invitations stopped until seven schools agreed to participate and the targeted sample size was hopefully met. Second, three classes in Grade 7 were selected by a random number, and all students in the class were invited to join the study. Using random numbers, participants from each class were assigned to the PC-SMILE intervention group, the C-SMILE intervention group, and the waitlist control group. Although later we found the sample size was slightly below the targeted number, the school invitation and recruitment stopped due to school schedule.

Students and parents completed all study procedures via personal Internet-equipped devices. They received the link of research material and completed the Qualtrics-based baseline survey, intervention, and follow-up surveys independently. For student participants, the interventions were conducted in school classrooms or activity rooms which were equipped with sufficient computers or tablets, and headphones. All intervention activities were self-administered and delivered in a web-based format. The research team and trained research assistants remained in the intervention rooms to provide help if needed. Parent participants received a link with the baseline Qualtrics survey and the intervention (for the PC-SMILE group). The interventions for parents and students both lasted around 45 minutes but were different in terms of narrative and content. Between the 2-week and the 3-month follow-up survey, a total of 5 weekly booster messages with core intervention content were sent to the intervention groups every 2 weeks. After completing the three-month follow-up survey, parents in the C-SMILE or the control group who did not receive the intervention previously would receive the intervention link.

Each participating family received a HK\$100 ($\approx$ US\$12) supermarket voucher after the baseline assessment and the 3-month follow-up respectively, and the total compensation for each family was HK\$200 ($\approx$ US\$24).

Trial power and sample size

A small effect size (Cohen $d=0.33$) was assumed based on previous research [19]. With a power of 0.80 and an alpha of 0.05, a sample size of 438 dyads (146 per arm) was required to ensure that the sample size was sufficient to test the hypotheses. As the attrition rate from our previous study was very low [27], the baseline recruitment target was set at 450 participants (150 per arm). After excluding students absent or withdrawn from school and those who did not complete intervention, we got the ultimate 390 participants.

Measures

Participants were guided to read the instructions of the survey and complete the self-rated scales, which took approximately 25 minutes.

Content fidelity checking for both parent and student participants

Mindset about intelligence was measured using the three-item Implicit Theory of Intelligence Scale, which assesses beliefs about the malleability of intelligence [36, 37]. A sample item includes 'You have a certain amount of intelligence and there is really not much you can do to change it'. Each item was rated on a 6-point scale ranging from 1 (strongly disagree) to 6 (strongly agree). A higher mean score of the three items indicated a lower belief-in-change (a more fixed mindset) in one's

intelligence. The Cronbach's α of the scale in the current study was .85 for children and .90 for parents at baseline, showing good reliability.

Mindset about failure was measured by the six-item Implicit Theory of Failure Scale [21], which evaluates views of failure as enhancing or debilitating on a 6-point Likert scale ranging from 1 (strongly disagree) to 6 (strongly agree). An example item of an enhancing belief is '*The effects of failure are positive and should be utilised*', and an example item of a debilitating belief is '*The effects of failure are negative and should be avoided*'. Enhancing belief items were reverse-scored and a higher mean score of the six items indicated more debilitating beliefs. The Cronbach's α in the current study was .75 for children and .76 for parents at baseline.

Mindset about emotion was assessed using the validated Chinese version of the 12-item Mindset of Depression, Anxiety, and Stress Scale (MDASS) [38] to measure children's belief in the changeability of negative emotion states. Sample items include '*When you have a certain level of depression/anxiety/stress, you really cannot do much to change it*'. The Cronbach's α of the scale in the current study was .96 at baseline. Parents' mindset about emotion was measured by a 4-item adapted version of MDASS, which includes items such as '*If they want to, people can change the emotions they have*'. Each item was rated on a 6-point Likert scale ranging from 1 (strongly disagree) to 6 (strongly agree), and a higher mean score indicated a more fixed mindset regarding the changeability of negative emotional states. The Cronbach's α was .69 at baseline.

Primary outcome

Children's depression and anxiety symptoms were measured using the 25-item Revised Children's Anxiety and Depression Scale (RCADS-25) among both children and parents [39, 40]. Sample items measuring anxiety and depression include '*I/My child worry when I/My child think I/My child have done poorly at something*' and '*I/My child feel sad or empty*'. Each item was rated on a 4-point Likert scale ranging from 0 (never) to 3 (always), indicating the frequency over the past two weeks. The child survey has an overall score (range: 0-75), a total anxiety score from the anxiety subscale (range: 0-45; Cronbach's α =.88 at baseline), and a total depression score from the depression subscale (range: 0-30; Cronbach's α =.89 at baseline).

Secondary outcomes

Hopelessness was measured by the four-item Helplessness subscale of the Demoralization Scale [41] among the child participants. Each item was scored on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), with a higher mean score of the four items indicating a greater level of hopelessness. An example item is '*I feel hopeless*'. The Cronbach's α of the Chinese version of this Helplessness subscale was .91 at baseline in the current study.

Mental well-being was measured by the short Warwick-Edinburgh Mental Well-Being Scale [42, 43] among the child and parent participants. It contains seven items rated on a 5-point Likert scale ranging from 1 (none of the time) to 5 (all the time), with a higher total score of the seven items indicating a higher level of participants' mental well-being. A sample item is '*I have been feeling optimistic about the future*'. The Cronbach's α was .89 for children and .88 for parents at baseline.

Parent-child interactions were measured using three self-developed questions regarding the number of days per week that children spent more than 15 minutes per day engaging in activities with their parents. Children were asked to rate the frequency (the number of days) on an 8-point scale ranging from 0 (None) to 7 (seven days). The three items were about parenting activities including chatting, handing out, and watching TV/movies/videos. A higher mean score of the three items indicated greater parent-child interactions. The Cronbach's α was .71 at baseline.

Parent-child relationships were measured using three self-developed items in both children and parents. For children, the three items were ‘*I am very satisfied with the relationship between me and my parents*’, ‘*I proactively tell my family what had happened to me*’, and ‘*I proactively share my feelings with my family*’. The adapted items ‘*My child is very satisfied with the relationship between him/her and us*’, ‘*My child proactively tells us what has happened to him/her*’, and ‘*My child proactively shares his/her feelings with us*’ were used for parents. Each item was rated on a 4-point Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree) and a higher mean score indicated a better parent-child relationship. The Cronbach’s α was .87 for children and .86 for parents at baseline.

Academic self-efficacy were measured using an adapted five-item scale as part of the Patterns of Adaptive Learning Survey [44]. Children were asked to rate the extent to which they anticipated the skills taught in class could be mastered and the work could be done on a 6-point Likert scale ranging from 1 (strongly disagree) to 6 (strongly agree). A sample item is ‘*I’m certain I can master the skills taught in class*’. A higher mean score of the five items indicated a higher level of academic self-efficacy. The Cronbach’s α was .91 at baseline.

Perceived parent learning versus performance orientation were assessed in children with the eight items used by Haimovitz and Dweck [21]. Four items measured children’s perceptions of their parents’ performance orientation, and the other four measured their perceptions of their parents’ learning orientation. The scale asked children about the parents’ responses to a scenario when they got a poor grade on a quiz. A sample item of performance-orientation is ‘*My parents don’t like it when I make mistakes in school*’ and a sample items of learning-orientation is ‘*My parents want me to understand school concepts, not just do the work*’. All the items were rated on a 6-point Likert scale ranging from 1 (strongly disagree) to 6 (strongly agree). The learning-focus items were reverse-scored, and then responses to all items were averaged, with a higher mean score of the eight items indicating more agreement with a performance (vs. learning) orientation of parents in children’s perceptions. The Cronbach’s α in the current study was .75 for perceived parent learning orientation and .70 for perceived parent performance orientation at baseline.

The *motivation for applying the contents learned from the intervention* were assessed right after the intervention. Child participants were asked to rate the extent to which they would like to apply what was learned from the intervention to address future challenges and the extent to which they would like to improve their ability to cope with challenges. Parent participants were asked to rate the extent to which they would like to apply what was learned from the intervention to help their child to address future challenges and the extent to which they would like to improve the way they respond to their child. All motivation items were rated on a 6-point Likert scale ranging from 1 (not very likely) to 6 (very likely).

The *intervention feedback scale* was used to assess the acceptability of the parent and child interventions. The scale asked children and parents to indicate the extent to which they liked, understood, felt helped by, and would recommend the program, as well as the extent to which they found the program interesting and agreed with its message [45] on a 5-point scale (such as from 1=strongly disagree to 5=strongly agree). They were also prompted to provide written feedback about this program.

Attention-Checking Items were included to check participant attention and ensure data quality. Two attention-checking items at all assessment points (baseline and follow-up surveys) and one item at the post-intervention survey for fidelity checking and intervention feedback were included for child participants. Attention-checking items were also included in the parent surveys: two items at baseline, one at post-intervention, and one at the three-month follow-up survey. These items asked participants to follow the instruction to select a specific option. A sample item is “Please select

‘strongly agree’ for this item.”

Socio-demographic information was collected, covering a range of characteristics of child participants (gender, age, ethnicity, if an only child, and if living with parents) and parent participants (relation with child, ethnicity, age range, marital status, education level, employment status, and household monthly income) at baseline to examine variability between groups.

Data analysis

An intention-to-treat analysis was conducted for any missing data. Participants who completed all assessments and passed all attention-checking items at every assessment point were classified as the per-protocol population. A per-protocol analysis was performed as a sensitivity analysis. All percentages and scores were presented with one decimal place. Generalised estimating equation (GEE) analyses were used to examine the group effect, time effect, and time*group interaction effect on outcome measures. A statistically significant interaction effect signified the effectiveness of the interventions. As the cluster unit is class, the effect of the cluster randomization of classes within the same school was accounted for [46]. In addition, the effect sizes using estimated marginal means were calculated. These effect sizes (Cohen’s *d*) compared mean gain scores reflecting changes in each outcome from baseline to the two follow-ups for child participants receiving the interventions vs waitlist controls. The effect sizes were also compared between participants in the PC-SMILE and those in the C-SMILE intervention group. For outcomes measured in parents, GEE analyses and effect size calculations were also conducted to examine the intervention effects, following the same procedure as above. Furthermore, for exploration, we tested the following moderators on the effectiveness of the interventions for the outcome measures: children’s depression and anxiety levels at baseline (high vs low, dichotomized by the median of the baseline RCADS-25 total score) and gender (boys vs girls). The corrected quasi-likelihood under the independence model criterion (QICC) values for the models with and without the moderator were compared, and a smaller QICC for the models including the moderator indicated evidence of a moderation effect. Multiple comparisons were not conducted, and a *P* value of < 0.05 indicated statistical significance. SPSS (version 26; IBM Corp.) was used for all statistical analysis.

Results

Recruitment and randomization

The CONSORT diagram of the recruitment and participation flow is depicted in **Fig. 2**. A total of 390 dyads were recruited and randomized into three groups, namely PC-SMILE (126, 32.3%), C-SMILE (138, 35.4%), and waitlist control (126, 32.3%). All parent-child dyads in the PC-SMILE group and children in the C-SMILE group received the interventions. Child participants were contacted for both the 2-week and 3-month follow-ups, and parent participants were followed-up at 3-month post-intervention. All participants were included in the intention-to-treat analysis.

Baseline characteristics of participants

The baseline characteristics of the 390 dyad participants were summarized in **Table 1**. 57.2% of the child participants were girls ($n = 223$). Only statistical difference in children’s age was found among groups. There were no statistical differences in other demographic characteristics of child participants or in any characteristics of parent participants. Additionally, there were no significant differences among groups in children’s mindsets, primary and secondary outcomes, or in parental mindsets and outcome measures.

Fidelity checking of mindsets

Fidelity checking results of mindsets right after intervention compared to baseline showed that students' mindsets of intelligence ($t(125) = 2.9$, $P = .004$ for PC-SMILE and $t(137) = 4.5$, $P < .001$ for C-SMILE) and mindsets of emotion ($t(125) = 3.1$, $P = .003$ for PC-SMILE and $t(137) = 3.3$, $P = .001$ for C-SMILE) significantly changed to be more growth after intervention; their mindsets of failure also turned to be more growth-oriented though not reaching significance ($t(125) = 2.0$, $P = .051$ for PC-SMILE and $t(137) = 1.6$, $P = .11$ for C-SMILE). For parental mindsets, their mindsets of intelligence ($t(123) = 4.8$, $P < .001$) and mindsets of failure ($t(123) = 4.5$, $P < .001$) significantly changed to be more growth after intervention (PC-SMILE), while mindsets of failure tended to be more growth as well though not reaching significance ($t(123) = 1.5$, $P = .13$).

Changes in primary and secondary outcomes of children

For the primary outcome of children's depression and anxiety symptoms measured by RCADS-25 (child version), we found a significant main effect of time ($P = .001$, $< .001$, $.024$ for the overall, anxiety and depression scores) but no significant main effect of group ($P = .50$, $.56$, $.48$ for the overall, anxiety and depression scores) or group-by-time interaction ($P = .62$, $.46$, $.76$ for the overall, anxiety and depression scores). Students in the PC-SMILE ($P < .001$) showed significant decrease in overall depression and anxiety symptoms at the 2-week follow-up, especially in anxiety symptoms ($P < .001$). However, significant relapses were also observed at the 3-month follow-up, especially in anxiety as well. Students in the C-SMILE group did not show significant decreases in overall or respective depression and anxiety symptoms at follow-ups (**Table 2; Fig. 3**). A significant decrease in depressive symptoms was observed in control group ($P = .04$). When comparing the changes from baseline to follow-ups between each pair of groups, the PC-SMILE intervention seemed to be more effective than C-SMILE and waitlist control in reducing overall depression and anxiety symptoms and respective anxiety symptoms, though the effect sizes ranged from very small to small (**Table 3**).

For the secondary outcomes, the main effects of time were significant for parent-child relationships ($P = .038$) and perceived parent performance (vs. learning) orientation ($P = .002$). However, the main effects of group and the interaction effects of group and time were all non-significant for all secondary outcomes. Students in the PC-SMILE group showed significant reduction in hopelessness ($P = .017$), and significant enhancement in well-being ($P = .037$) and parent-child relationships ($P = .003$) at the 2-week follow-up, and the enhancement in parent-child relationships sustained at the 3-month follow-up ($P = .004$) (see **Table 2; Fig. 4**). Students in the C-SMILE and waitlist control group did not show any significant changes at follow-ups in all secondary outcomes except perceived parent performance (vs. learning) orientation. The C-SMILE group showed significant reduction in perceived parent performance (vs. learning) orientation at the 2-week follow-up ($P = .033$) and the control group showed reduction at the 3-month follow-up ($P = .002$) (see **Table 2**). Moreover, the effect sizes all ranged from very small to small for the comparisons between groups on the changes from baseline to follow-ups. The effect sizes of some improvements were small, including hopelessness (PC-SMILE vs C-SMILE: 0.21, PC-SMILE vs Control: 0.27) and mental well-being (PC-SMILE vs C-SMILE: 0.22) at the 2-week follow-up, and parent-child relationships at the 3-month follow-up (PC-SMILE vs Control: 0.21). All other effect sizes were very small (see **Table 3**).

The sensitivity analysis conducted for the per-protocol population which contained only the PC-SMILE and C-SMILE groups, showed that significant group-by-time interaction effects only existed for academic self-efficacy ($P = .042$), as the C-SMILE group showed significant increase in self-efficacy at the 3-month follow-up compared to baseline ($P = .044$) while the PC-SMILE group did

not show significant changes. Students in both groups did not show significant changes at follow-ups in all other secondary outcomes and the PC-SMILE group showed marginal decreases in anxiety at both 2-week and 8-week follow-ups. The specific results of the sensitivity analysis can be seen in **Supplemental table 1**.

Changes in parental outcomes

For the outcomes measured in parents, the main effects of time were significant for parents' perceived children's depression and anxiety symptoms measured by RCADS-25: parent version (all P s < .001 for the overall, anxiety and depression scores), while the main effects of group and the interaction effects of group and time were all insignificant for all outcomes measured in parents. Parents in all 3 groups showed significant increase in perceived children's anxiety and depression symptoms (all P s < .001) at the 3-month follow-up while children reported non-significant changes of these symptoms at the 3-month post-intervention. Additionally, an interesting discrepancy emerged in parent-child relationship perceptions: while parents in the PC-SMILE group reported significant decrease in how positively they believed their children viewed the parent-child relationship ($P = .031$, see **Supplemental table 2**), children reported significant improvements in their actual parent-child relationship ($P = .003$, $P = .004$, see table 2). Parents in PC-SMILE group reported enhanced well-being ($P = .019$) at the 3-month follow-up. The effect sizes for the comparisons between groups on the changes from baseline to the 3-month follow-up were all very small (**Supplemental table 3**).

Moderation analysis

Moderation analyses were conducted based on children's depression and anxiety symptoms at baseline (high/low) and gender (boys vs girls) respectively. Including the moderator of children's depression and anxiety symptoms at baseline improved all model fit except for the outcome of perceived parent performance (vs. learning) orientation, as indicated by the decreases of QICC, ranging from 23.94 to 85149.01. Children with higher baseline depression and anxiety showed more improvement on these outcome measures overall (See **Supplemental table 4** for details). Including the moderator of gender improved model fit (the decreases of QICC ranged from 165.51 to 3635.98) for the outcomes of children's depression and anxiety symptoms and wellbeing, signifying that gender had moderating effects for children's depression and anxiety symptoms and wellbeing with girls showing more improvements on these outcome measures (See **Supplemental table 5**).

Intervention feedback

Participants' feedback to the interventions was detailed in **Table 4**. Around 70% of student participants and around 85% of parent participants indicated general acceptance of this course. Parent participants had more satisfactory feedback than child counterparts on basically all specific feedback items.

Discussion

The purpose of this study was to examine the efficacy of a web-based single-session parent-child intervention using multiple mindsets (PC-SMILE) among secondary school students. Using a three-armed RCT, this study compared the efficacy of PC-SMILE with two control groups, child participants only and a waitlist control. Fidelity checking indicated significant changes in mindsets. Parent-child joint intervention group (PC-SMILE group) saw mild improvement in depression and anxiety symptoms, hopelessness, and parent-child relationship among child participants. The effects mainly exhibited in the two-week follow-up and the effect size was very small. Although there were

no significant group differences, the effect sizes of the changes of PC-SMILE group were larger than those of C-SMILE and control group.

The current findings highlight the importance of parental involvement in digital mental health interventions (DMHI) for adolescents. While most existing DMHIs mainly focus on adolescents, relatively few have involved structured parental education components. A recent systematic review found that parental involvement in digital cognitive behavioral therapy interventions for children aged 12 and under yielded beneficial effect for reducing anxiety; however, such benefits were not observed in psychoeducation-based programmes [47]. Consistently, the current study—a single-session parent-child psychoeducation programme—did not identify significant between-group differences in anxiety and depression outcomes. More studies, especially qualitative inquiry, should be conducted to examine the potential reasons and mechanisms, and improve the interventions and implementations.

Nonetheless, several noteworthy secondary findings emerged. First, dyads who participated together reported more positive changes and achieved higher retention rates at follow-ups than those in the control groups. Furthermore, the integrated mindset intervention, delivered jointly to parents and children, contributed to improvements in parent-child relationships which sustained over three months. Notably, parents themselves also reported improved well-being two weeks after the intervention. These results suggest that even when symptom reduction is not immediately evident, brief, collaborative digital interventions can enhance both individual outcomes and familial support systems, particularly when both parent and child are exposed to adaptive, growth-oriented messaging.

As mental health needs among adolescents are increasing [3], empowering parents becomes increasingly important [48]. Parents are best positioned to provide support. Joint parent-child interventions focusing on cultivating growth mindsets may simultaneously nurture children's resilience and adaptive coping skills, while alleviating anxiety in both parents and children. Ultimately, this approach has the potential to strengthen family functioning by enhancing parents' proximity and responsiveness to their children's emotional needs. Future studies can continue to refine and expand such interventions to improve parents' and children's wellbeing.

Moderation analyses revealed that the PC-SMILE intervention was particularly effective for adolescents with higher baseline anxiety and for girls. This aligns with prior research indicating that youth with greater initial symptom severity benefit more from digital mental health programmes, likely because such interventions address their most immediate needs [27]. The stronger effects among girls may reflect established gender differences in emotional openness, help-seeking, and responsiveness to psychosocial and family-focused interventions, with girls typically more engaged in such support [49]. These findings suggest that brief digital interventions like PC-SMILE may be especially valuable for high-risk groups, including those with elevated internalizing symptoms and female students, to maximize the effectiveness of school-based mental health strategies.

This study is the first to introduce a web-based, single-session parent-child intervention targeting multiple mindsets among secondary school students. Creating change in one brief session is challenging. While results show some promise, they also point to areas needing improvement in intervention design and implementation. First, parents had higher acceptance and satisfaction rates than children, suggesting the child version could be more engaging. Involving senior students in co-producing the program—using their experiences to help explain the science—may make the content

more relevant and appealing to younger peers. Second, the timing and environment for delivering the intervention matter: conducting classroom surveys for new students can be distracting and may reduce engagement. Alternatively, the intervention should be conducted in a more focused setting. Finally, enhancing the interactive element between parents and children could strengthen the intervention's impact. Providing opportunities for joint reflection and communication may help both parties better understand each other's perspectives on mindsets and support needs. Overall, refining these aspects could help maximize the effectiveness of brief, web-based parent-child interventions in schools.

This study's strengths include its rigorous RCT design conducted in a natural school setting, a relatively large sample size, the active involvement of a youth advisory group and the co-production with key stakeholders and participants. However, a notable limitation is that, despite web-based single-session interventions being inherently accessible and scalable, the current experiment setting did not encourage both students and parents to re-access intervention materials, which may have hindered the potential for sustained benefit. Future research should encourage repeated access to intervention content to enhance engagement and long-term impact. Moreover, future studies can further explore the program's relevance for various age groups and levels of symptom severity. Additionally, incorporating more interactive parent-child components may strengthen intervention effectiveness.

Conclusions

In summary, this study provides the first evidence on the feasibility and potential of a web-based, single-session parent-child mindset intervention among secondary school students in a real-world school setting. While the intervention showed modest improvements in depression, anxiety, and parent-child relationships—particularly among youth with higher baseline anxiety and among girls—the overall effects were small. High parental acceptance suggests promise for further development. Future work should focus on boosting child engagement, allowing repeated access to materials, incorporating more interactive parent-child components, and adapting the program for younger and more diverse populations to maximize impact and scalability.

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Data Availability

Data are not publicly available but can be obtained for proper purposes by contacting the corresponding author.

Conflicts of Interest

None declared.

Abbreviations

CONSORT: Consolidated Standards of Reporting Trials

C-SMILE: child single-session intervention on mindsets of intelligence, failure, and emotion

DMHI: digital mental health interventions

GEE: Generalized Estimating Equations

MDASS: Mindset of Depression, Anxiety and Stress Scale

PC-SMILE: parent and child single-session intervention on mindsets of intelligence, failure, and emotion

QICC: Corrected Quasi Likelihood under Independence Model Criterion

RCT: randomized controlled trial

RCADS-25: 25-item Revised Children's Anxiety and Depression Scale

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Table 1. Baseline characteristics of participants.

Variables/child	PC-SMILE (n=126)	C-SMILE (n=138)	Control (n=126)	Overall (n=390)	P value
Age					.022
Mean (SD)	12.3 (0.5)	12.3 (0.6)	12.5 (0.8)	12.4 (0.6)	
Range	12.0 to 14.0	12.0 to 15.0	12.0 to 15.0	12.0 to 15.0	
Gender, n (%)					.28
Male	49 (38.9%)	57 (41.3%)	61 (48.4%)	167 (42.8%)	
Female	77 (61.1%)	81 (58.7%)	65 (51.6%)	223 (57.2%)	
Ethnicity, n (%)					.46
Chinese	123 (97.6%)	134 (97.1%)	125 (99.2%)	382 (97.9%)	
Other	3 (2.4%)	4 (2.9%)	1 (0.8%)	8 (2.1%)	
If an only child, n (%)					.46
Yes	40 (31.7%)	35 (25.4%)	39 (31.0%)	114 (29.2%)	
No	86 (68.3%)	103 (74.6%)	87 (69.0%)	276 (70.8%)	
If living with parents, n (%)					.91
Living with both parents	106 (84.1%)	119 (86.2%)	112 (88.9%)	337 (86.4%)	
Living with mother	13 (10.3%)	11 (8.0%)	10 (7.9%)	34 (8.7%)	
Living with father	3 (2.4%)	3 (2.2%)	1 (0.8%)	7 (1.8%)	
Living with neither parent	4 (3.2%)	5 (3.6%)	3 (2.4%)	12 (3.1%)	
Mindset about intelligence (1-6), mean (SD)	3.3 (1.2)	3.6 (1.3)	3.6 (1.2)	3.5 (1.2)	.056
Mindset about failure (1-6), mean (SD)	3.0 (0.8)	3.0 (0.9)	3.0 (0.9)	3.0 (0.9)	.85
Mindset about emotions (1-6), mean (SD)	3.1 (1.1)	3.2 (1.3)	3.2 (1.4)	3.2 (1.3)	.86
RCADS-25: child version-overall (0-75), mean (SD)	18.8 (13.6)	19.2 (13.3)	19.9 (14.9)	19.3 (13.9)	.81
RCADS-25: child version-anxiety (0-45), mean (SD)	11.8 (8.8)	11.8 (8.2)	12.1 (8.9)	11.9 (8.6)	.95
RCADS-25: child version-depression (0-30), mean (SD)	7.0 (5.5)	7.4 (5.8)	7.8 (6.7)	7.4 (6.0)	.57
Hopelessness (1-5), mean (SD)	2.3 (1.0)	2.2 (1.0)	2.1 (1.1)	2.2 (1.0)	.47
Mental well-being (7-35), mean (SD)	23.9 (5.5)	24.3 (5.5)	23.6 (6.2)	23.9 (5.7)	.53
Parent-child interactions (0-7), mean (SD)	3.4 (1.9)	3.3 (1.9)	3.6 (2.1)	3.4 (2.0)	.49
Parent-child relationships (1-4), mean (SD)	2.9 (0.8)	2.9 (0.8)	3.0 (0.8)	2.9 (0.8)	.54
Academic self-efficacy (1-6), mean (SD)	4.2 (1.0)	4.1 (1.0)	4.2 (1.2)	4.2 (1.1)	.55
Perceived parent	3.3 (0.7)	3.4 (0.7)	3.5 (0.6)	3.4 (0.7)	.28

performance (vs. learning) orientation (1-6), mean (SD)					
Variables/parent	PC-SMILE (n=126)	C-SMILE (n=123)	Control (n=121)	Overall (n=370)	
Relation with child, n (%)					.79
Mother	100 (79.4%)	101 (82.1%)	101 (83.5%)	302 (81.6%)	
Father	24 (19.0%)	19 (15.4%)	19 (15.7%)	62 (16.8%)	
Other caregivers	2 (1.6%)	3 (2.4%)	1 (0.8%)	6 (1.6%)	
Ethnicity, n (%)					.14
Chinese	124 (98.4%)	123 (100.0%)	121 (100.0%)	368 (99.5%)	
Other	2 (1.6%)	0 (0%)	0 (0%)	2 (0.5%)	
Age range, n (%)					.16
<30	1 (0.8%)	0 (0%)	2 (1.7%)	3 (0.8%)	
30-40	41 (32.5%)	27 (22.0%)	27 (22.3%)	95 (25.7%)	
41-50	74 (58.7%)	79 (64.2%)	73 (60.3%)	226 (61.1%)	
51-60	10 (7.9%)	17 (13.8%)	16 (13.2%)	43 (11.6%)	
61-70	0 (0%)	0 (0%)	2 (1.7%)	2 (0.5%)	
>70	0 (0%)	0 (0%)	1 (0.8%)	1 (0.3%)	
Marital status, n (%)					.71
Single	5 (4.0%)	2 (1.6%)	1 (0.8%)	8 (2.2%)	
Divorced	7 (5.6%)	9 (7.3%)	7 (5.8%)	23 (6.2%)	
Married/Cohabiting	106 (84.1%)	106 (86.2%)	107 (88.4%)	319 (86.2%)	
Widowed	0 (0%)	1 (0.8%)	1 (0.8%)	2 (0.5%)	
Declined to disclose	8 (6.3%)	5 (4.1%)	5 (4.1%)	18 (4.9%)	
Education level, n (%)					.49
Primary and below	1 (0.8%)	3 (2.4%)	5 (4.1%)	9 (2.4%)	
Middle School	75 (59.5%)	69 (56.1%)	72 (59.5%)	216 (58.4%)	
College/University and above	50 (39.7%)	51 (41.5%)	44 (36.4%)	145 (39.2%)	
Employment Status, n (%)					.43
Full-time job	60 (47.6%)	61 (49.6%)	55 (45.5%)	176 (47.6%)	
Part-time job	30 (23.8%)	22 (17.9%)	20 (16.5%)	72 (19.5%)	
Unemployed/At home	36 (28.6%)	40 (32.5%)	46 (38.0%)	122 (33.0%)	
Household Monthly Income (HKD), n (%)					.92
<3000	1 (0.8%)	3 (2.4%)	2 (1.7%)	6 (1.6%)	
3000-12000	13 (10.3%)	15 (12.2%)	13 (10.7%)	41 (11.1%)	
12001-20000	27 (21.4%)	23 (18.7%)	28 (23.1%)	78 (21.1%)	
20001-35000	34 (27.0%)	30 (24.4%)	37 (30.6%)	101 (27.3%)	
35001-50000	21 (16.7%)	23 (18.7%)	20 (16.5%)	64 (17.3%)	
50001-90000	22 (17.5%)	18 (14.6%)	12 (9.9%)	52 (14.1%)	
>90000	8 (6.3%)	11 (8.9%)	9 (7.4%)	28 (7.6%)	
Mindset about intelligence (1-6), mean (SD)	3.2 (1.0)	3.3 (1.2)	3.3 (1.2)	3.2 (1.1)	.69
Mindset about failure (1-6), mean (SD)	2.7 (0.6)	2.6 (0.7)	2.7 (0.8)	2.6 (0.7)	.57
Mindset about emotions (1- 6), mean (SD)	2.4 (0.7)	2.4 (0.7)	2.4 (0.7)	2.4 (0.7)	.66
RCADS-25: parent version- overall (0-75), mean (SD)	11.1 (7.5)	12.0 (7.1)	11.7 (7.5)	11.6 (7.4)	.68
RCADS-25: parent version- anxiety (0-45), mean (SD)	5.7 (4.4)	6.0 (4.2)	6.1 (4.3)	5.9 (4.3)	.76
RCADS-25: parent version- depression (0-30), mean (SD)	5.4 (3.7)	5.9 (3.7)	5.6 (4.1)	5.6 (3.8)	.57
Mental well-being (7-35), mean (SD)	25.2 (4.8)	25.4 (3.6)	25.8 (4.8)	25.5 (4.4)	.55
Parent-child relationships	3.1 (0.5)	3.0 (0.5)	3.2 (0.6)	3.1 (0.6)	.27

(1-4), mean (SD)

Note. PC-SMILE: parent and child single-session intervention on mindsets of intelligence, failure, and emotion; C-SMILE: child single-session intervention on mindsets of intelligence, failure, and emotion; RCADS-25: 25-item Revised Children's Anxiety and Depression Scale.

Table 2. Generalized estimating equation results for child participants, intention-to-treat population (estimated marginal means (standard error)).

Outcome variables	Baseline	2-week follow-up	3-month follow-up	P-value (Baseline vs 2-week follow-up)	P-value (Baseline vs 3-month follow-up)	P-value (2-week vs 3-month follow-up)
RCADS-25: child version-overall						
PC-SMILE	18.8 (1.3)	15.2 (1.1)	17.8 (1.5)	<.001	.35	.034
C-SMILE	19.3 (1.2)	18.1 (1.4)	19.2 (1.4)	.29	.91	.24
Control	19.9 (1.4)	17.4 (1.3)	19.0 (1.4)	.037	.36	.13
<i>P</i> _{PC-SMILE vs C-SMILE}	.75	.074	.47	<i>P</i> -value (interaction)	.62	
<i>P</i> _{PC-SMILE vs Control}	.55	.18	.54			
<i>P</i> _{C-SMILE vs Control}	.75	.67	.91			
RCADS-25: child version-anxiety						
PC-SMILE	11.7 (0.8)	9.0 (0.7)	10.8 (0.9)	<.001	.18	.023
C-SMILE	11.8 (0.8)	10.8 (0.8)	11.6 (0.8)	.15	.77	.15
Control	12.1 (0.8)	10.7 (0.8)	11.4 (0.8)	.053	.29	.26
<i>P</i> _{PC-SMILE vs C-SMILE}	.95	.067	.52	<i>P</i> -value (interaction)	.46	
<i>P</i> _{PC-SMILE vs Control}	.78	.096	.65			
<i>P</i> _{C-SMILE vs Control}	.81	.89	.85			
RCADS-25: child version-depression						
PC-SMILE	7.0 (0.5)	6.2 (0.5)	6.9 (0.6)	.042	.84	.13
C-SMILE	7.5 (0.5)	7.3 (0.6)	7.6 (0.6)	.73	.84	.55
Control	7.8 (0.6)	6.7 (0.5)	7.6 (0.6)	.040	.58	.080
<i>P</i> _{PC-SMILE vs C-SMILE}	.51	.13	.43	<i>P</i> -value (interaction)	.76	
<i>P</i> _{PC-SMILE vs Control}	.32	.48	.46			
<i>P</i> _{C-SMILE vs Control}	.68	.44	.99			
Hopelessness						
PC-SMILE	2.3 (0.1)	2.1 (0.1)	2.2 (0.1)	.017	.42	.059
C-SMILE	2.2 (0.1)	2.2 (0.1)	2.2 (0.1)	.97	.83	.86
Control	2.1 (0.1)	2.2 (0.1)	2.2 (0.1)	.49	.42	.92
<i>P</i> _{PC-SMILE vs C-SMILE}	.48	.31	.95	<i>P</i> -value (interaction)	.25	
<i>P</i> _{PC-SMILE vs Control}	.21	.36	.81			
<i>P</i> _{C-SMILE vs Control}	.56	.89	.85			
Mental well-being						
PC-SMILE	23.6 (0.5)	24.5 (0.6)	24.0 (0.6)	.037	.39	.32
C-SMILE	24.0 (0.5)	23.7 (0.5)	23.4 (0.6)	.51	.18	.66
Control	23.4 (0.6)	24.2 (0.6)	23.6 (0.6)	.18	.70	.34
<i>P</i> _{PC-SMILE vs C-SMILE}	.53	.27	.45	<i>P</i> -value (interaction)	.29	
<i>P</i> _{PC-SMILE vs Control}	.78	.64	.63			

<i>P</i> _{PC-SMILE vs Control}	.38	.54	.81			
Parent-child interactions						
PC-SMILE	3.3 (0.2)	3.4 (0.2)	3.4 (0.2)	.68	.39	.70
C-SMILE	3.3 (0.2)	3.2 (0.2)	3.1 (0.2)	.85	.18	.26
Control	3.5 (0.2)	3.5 (0.2)	3.5 (0.2)	.79	.75	.98
<i>P</i> _{PC-SMILE vs C-SMILE}	.91	.63	.17	<i>P</i> -value (interaction)	.61	
<i>P</i> _{PC-SMILE vs Control}	.35	.57	.76			
<i>P</i> _{C-SMILE vs Control}	.29	.31	.11			
Parent-child relationships						
PC-SMILE	2.9 (0.1)	3.0 (0.1)	3.0 (0.1)	.003	.004	.52
C-SMILE	2.8 (0.1)	2.8 (0.1)	2.8 (0.1)	.72	.98	.71
Control	2.9 (0.1)	3.0 (0.1)	2.9 (0.1)	.22	.55	.094
<i>P</i> _{PC-SMILE vs C-SMILE}	.67	.053	.069	<i>P</i> -value (interaction)	.15	
<i>P</i> _{PC-SMILE vs Control}	.44	.88	.35			
<i>P</i> _{C-SMILE vs Control}	.24	.079	.45			
Academic self-efficacy						
PC-SMILE	4.1 (0.1)	4.1 (0.1)	4.1 (0.1)	.78	.86	.91
C-SMILE	4.0 (0.1)	4.0 (0.1)	3.9 (0.1)	.82	.45	.36
Control	4.2 (0.1)	4.2 (0.1)	4.2 (0.1)	.96	.70	.70
<i>P</i> _{PC-SMILE vs C-SMILE}	.42	.67	.27	<i>P</i> -value (interaction)	.89	
<i>P</i> _{PC-SMILE vs Control}	.72	.63	.49			
<i>P</i> _{C-SMILE vs Control}	.28	.38	.098			
Perceived parent performance (vs. learning) orientation						
PC-SMILE	3.4 (0.1)	3.3 (0.1)	3.3 (0.1)	.45	.33	.89
C-SMILE	3.4 (0.1)	3.3 (0.1)	3.3 (0.1)	.033	.052	.95
Control	3.5 (0.1)	3.4 (0.1)	3.3 (0.1)	.11	.002	.23
<i>P</i> _{PC-SMILE vs C-SMILE}	.27	.96	.84	<i>P</i> -value (interaction)	.64	
<i>P</i> _{PC-SMILE vs Control}	.12	.34	.84			
<i>P</i> _{C-SMILE vs Control}	.66	.37	1.0			

Note. RCADS-25: 25-item Revised Children's Anxiety and Depression Scale. PC-SMILE: parent and child single-session intervention on mindsets of intelligence, failure, and emotion; C-SMILE: child single-session intervention on mindsets of intelligence, failure, and emotion.

Table 3. Effect sizes (Cohen's *d* (standard error)) of the treatments on child participants, intention-to-treat population.

Outcome variables	2-week follow-up, Cohen's <i>d</i> (SE)	3-month follow-up, Cohen's <i>d</i> (SE)
RCADS-25: child version-overall		
PC-SMILE vs C-SMILE	-0.17 (0.14)	-0.06 (0.14)
PC-SMILE vs Control	-0.08 (0.14)	-0.01 (0.15)
C-SMILE vs Control	0.09 (0.18)	0.05 (0.18)
RCADS-25: child version-anxiety		
PC-SMILE vs C-SMILE	-0.20 (0.15)	-0.08 (0.15)

PC-SMILE vs Control	-0.16 (0.15)	-0.03 (0.15)
C-SMILE vs Control	0.05 (0.18)	0.05 (0.18)
RCADS-25: child version-depression		
PC-SMILE vs C-SMILE	-0.11 (0.14)	-0.03 (0.14)
PC-SMILE vs Control	0.04 (0.14)	0.02 (0.15)
C-SMILE vs Control	0.15 (0.17)	0.05 (0.17)
Hopelessness		
PC-SMILE vs C-SMILE	-0.21 (0.15)	-0.08 (0.14)
PC-SMILE vs Control	-0.27 (0.15)	-0.12 (0.15)
C-SMILE vs Control	-0.05 (0.17)	-0.05 (0.18)
Mental well-being		
PC-SMILE vs C-SMILE	0.22 (0.15)	0.18 (0.15)
PC-SMILE vs Control	0.03 (0.15)	0.03 (0.16)
C-SMILE vs Control	-0.19 (0.18)	-0.14 (0.18)
Parent-child interactions		
PC-SMILE vs C-SMILE	0.04 (0.14)	0.14 (0.14)
PC-SMILE vs Control	0.05 (0.14)	0.08 (0.14)
C-SMILE vs Control	0.01 (0.17)	-0.06 (0.17)
Parent-child relationships		
PC-SMILE vs C-SMILE	0.18 (0.14)	0.16 (0.13)
PC-SMILE vs Control	0.11 (0.14)	0.21 (0.14)
C-SMILE vs Control	-0.07 (0.17)	0.05 (0.17)
Academic self-efficacy		
PC-SMILE vs C-SMILE	-0.04 (0.14)	0.06 (0.16)
PC-SMILE vs Control	-0.02 (0.15)	-0.05 (0.15)
C-SMILE vs Control	0.02 (0.17)	-0.10 (0.18)
Perceived parent performance (vs. learning) orientation		
PC-SMILE vs C-SMILE	0.13 (0.16)	0.11 (0.16)
PC-SMILE vs Control	0.07 (0.16)	0.16 (0.16)
C-SMILE vs Control	-0.06 (0.17)	0.05 (0.18)

Note. RCADS-25: 25-item Revised Children's Anxiety and Depression Scale. PC-SMILE: parent and child single-session intervention on mindsets of intelligence, failure, and emotion; C-SMILE: child single-session intervention on mindsets of intelligence, failure, and emotion. Effect size values were calculated by subtracting the latter group's mean gain score from the former group's mean gain score for each outcome from baseline to the 2-week and 3-month follow-ups, then dividing by the pooled standard deviations of all participants at baseline.

Table 4. Feedback on the intervention.

Variables/child	PC-SMILE (n=125), n (%)	C-SMILE (n=138), n (%)	Overall (n=263), n (%)
Like this course	66 (52.8%)	74 (53.6%)	140 (53.2%)
Understand this course	86 (68.8%)	84 (60.9%)	170 (64.6%)
This course is useful	86 (68.8%)	87 (63.0%)	173 (65.8%)
Attitude towards adversity improved after this course	72 (57.6%)	83 (60.1%)	155 (58.9%)
Complete this course very seriously	87 (69.6%)	98 (71.0%)	185 (70.3%)
Recommend this course to others	73 (58.4%)	86 (62.3%)	159 (60.5%)
This course is interesting	72 (57.6%)	71 (51.4%)	143 (54.4%)
Agree with this course	86 (68.8%)	87 (63.0%)	173 (65.8%)
More confident towards challenges in life after this course	73 (58.4%)	79 (57.2%)	152 (57.8%)
Burden in joining this course	7 (5.6%)	13 (9.4%)	20 (7.6%)
Affect other arrangement due to joining this course	8 (6.4%)	15 (10.9%)	23 (8.7%)
General acceptance to this course	85 (68.0%)	98 (71.0%)	183 (69.6%)
Variables/parent			
	PC-SMILE (n=124), n (%)		
Like this course	95 (76.6%)		
Understand this course	109 (87.9%)		
This course is useful	109 (87.9%)		

This course provides some references to help me communicate with my child in daily life	113 (91.1%)
Complete this course very seriously	117 (94.4%)
Recommend this course to other parents	100 (80.6%)
This course is interesting	87 (70.2%)
Agree with this course	112 (90.3%)
More confident towards helping my child face the challenges in life after this course	92 (74.2%)
Burden in joining this course	7 (5.6%)
Affect other arrangement due to joining this course	10 (8.1%)
General acceptance to this course	105 (84.7%)

Note. PC-SMILE: parent and child single-session intervention on mindsets of intelligence, failure, and emotion; C-SMILE: child single-session intervention on mindsets of intelligence, failure, and emotion.

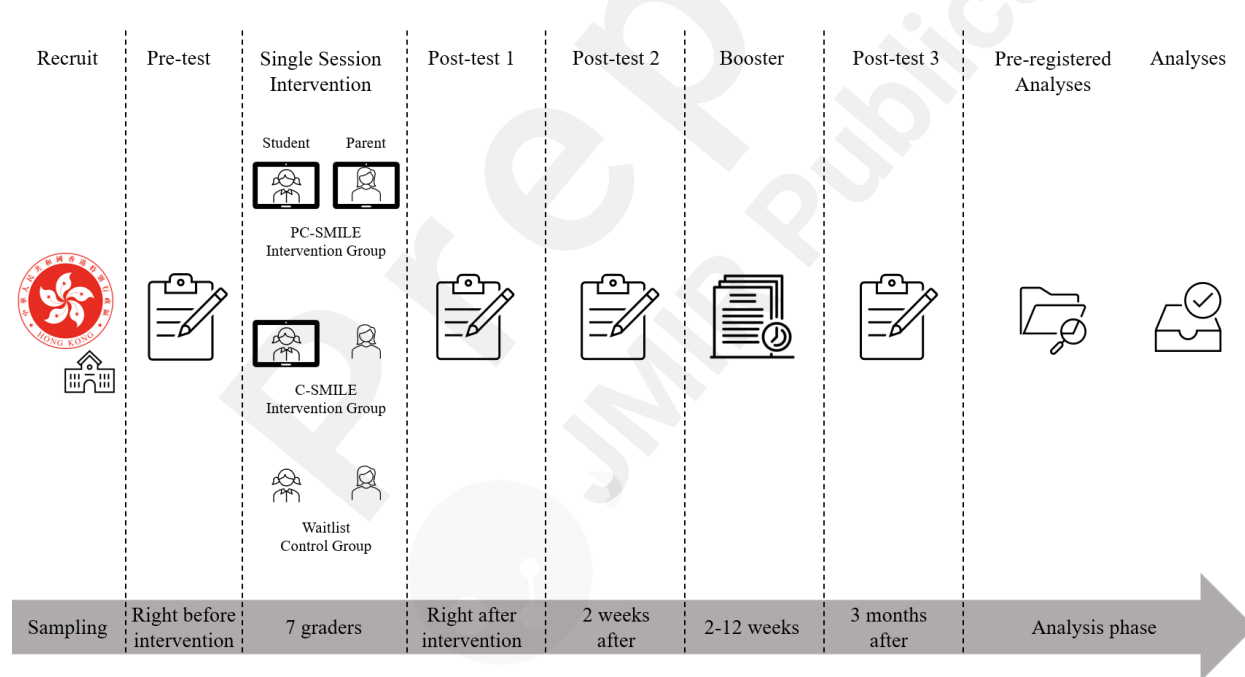


Fig. 1. Design of the three-arm waitlist randomized controlled trial. *Notes.* PC-SMILE: parent and child single-session intervention on mindsets of intelligence, failure, and emotion; C-SMILE: child single-session intervention on mindsets of intelligence, failure, and emotion.

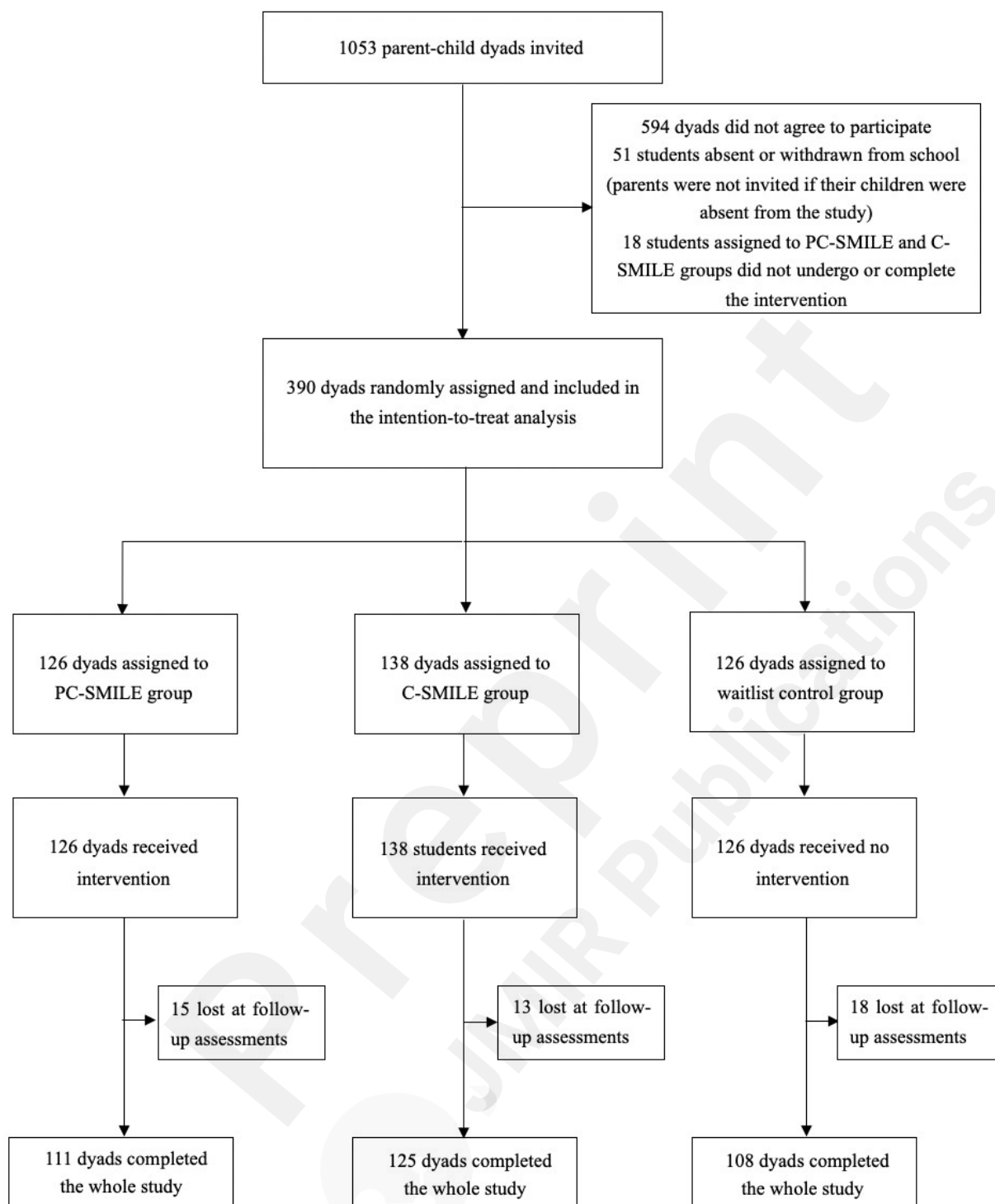


Fig. 2. CONSORT (Consolidated Standards of Reporting Trials) flowchart. *Notes.* PC-SMILE: parent and child single-session intervention on mindsets of intelligence, failure, and emotion; C-SMILE: child single-session intervention on mindsets of intelligence, failure, and emotion.

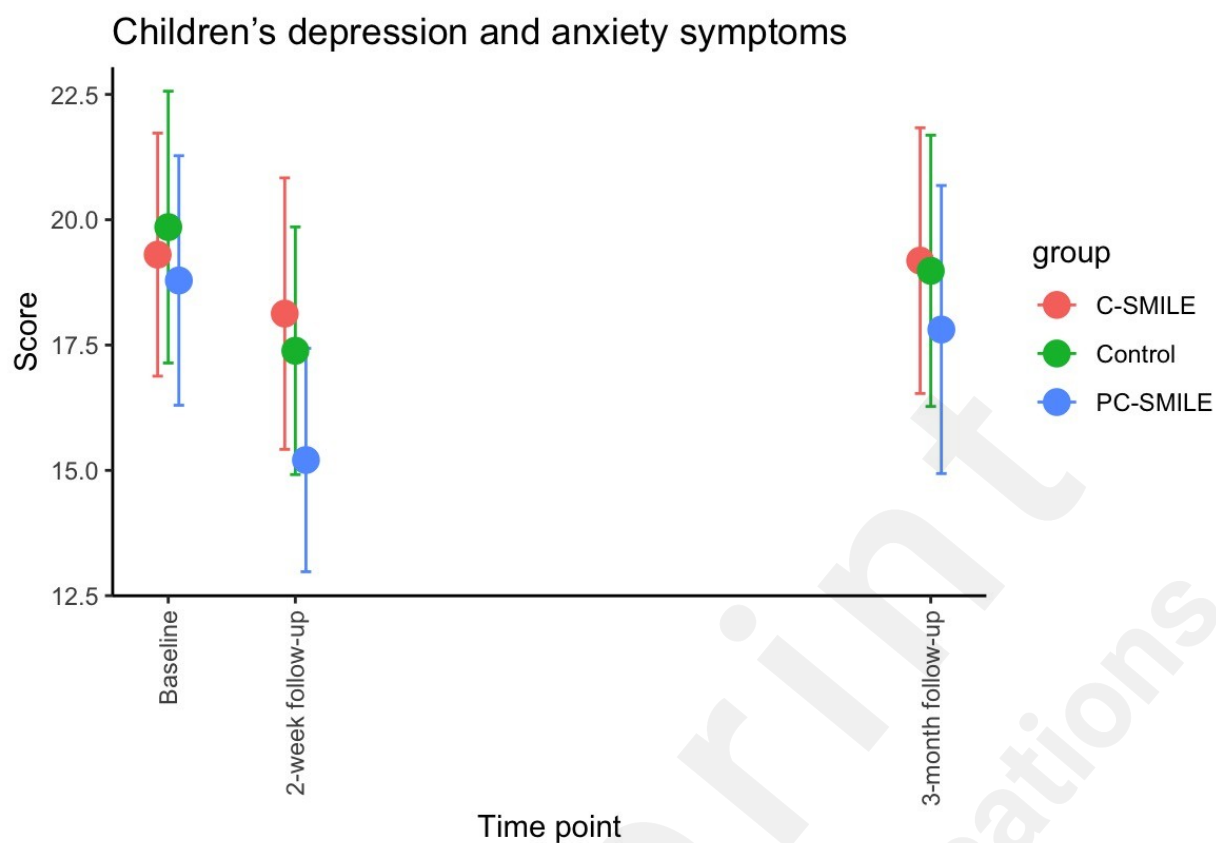


Fig. 3. Children's depression and anxiety symptoms change over time. Each dot represents the mean score of each group at each time point. Each line around the dot represents the 95% Wald Confidence Interval of the mean.



Fig. 4. Parent-child relationships change over time. Each dot represents the mean score of each group at each time point. Each line around the dot represents the 95% Wald Confidence Interval of the mean.

Supplementary Files

Supplemental tables.

URL: <http://asset.jmir.pub/assets/87abc7eb0221544559e66ff0fdef7c6b.docx>

Figures

Fig. 1. Design of the three-arm waitlist randomized controlled trial. Notes. PC-SMILE: parent and child single-session intervention on mindsets of intelligence, failure, and emotion; C-SMILE: child single-session intervention on mindsets of intelligence, failure, and emotion.

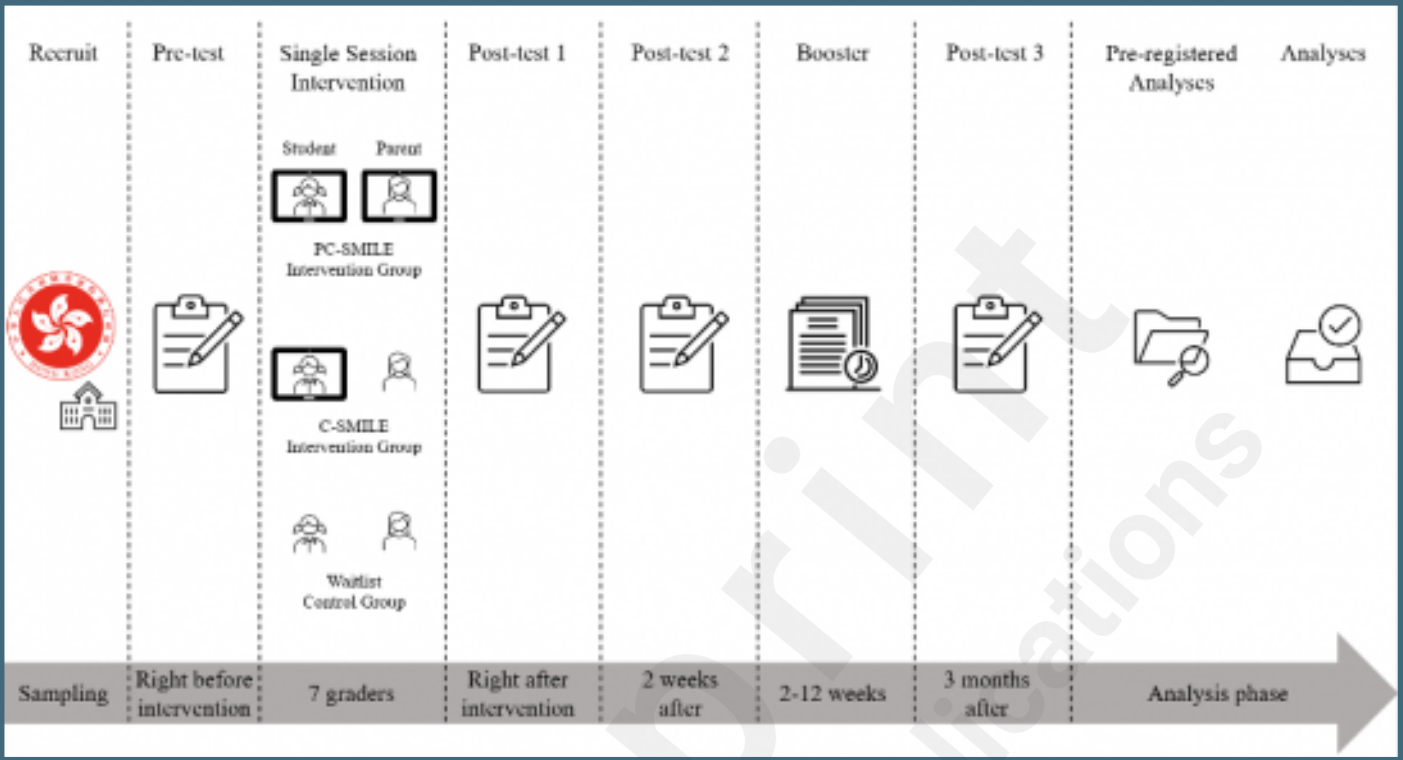


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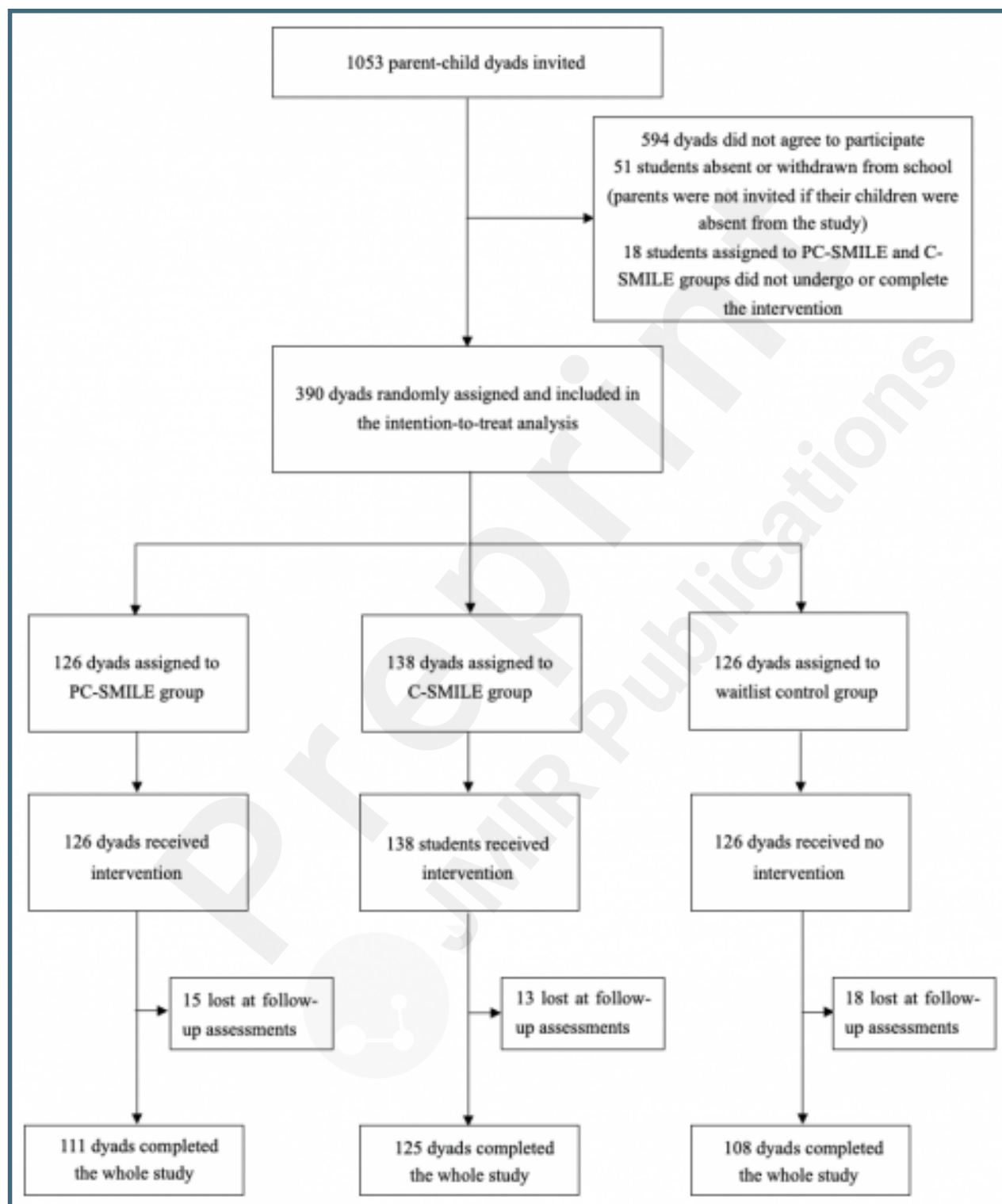


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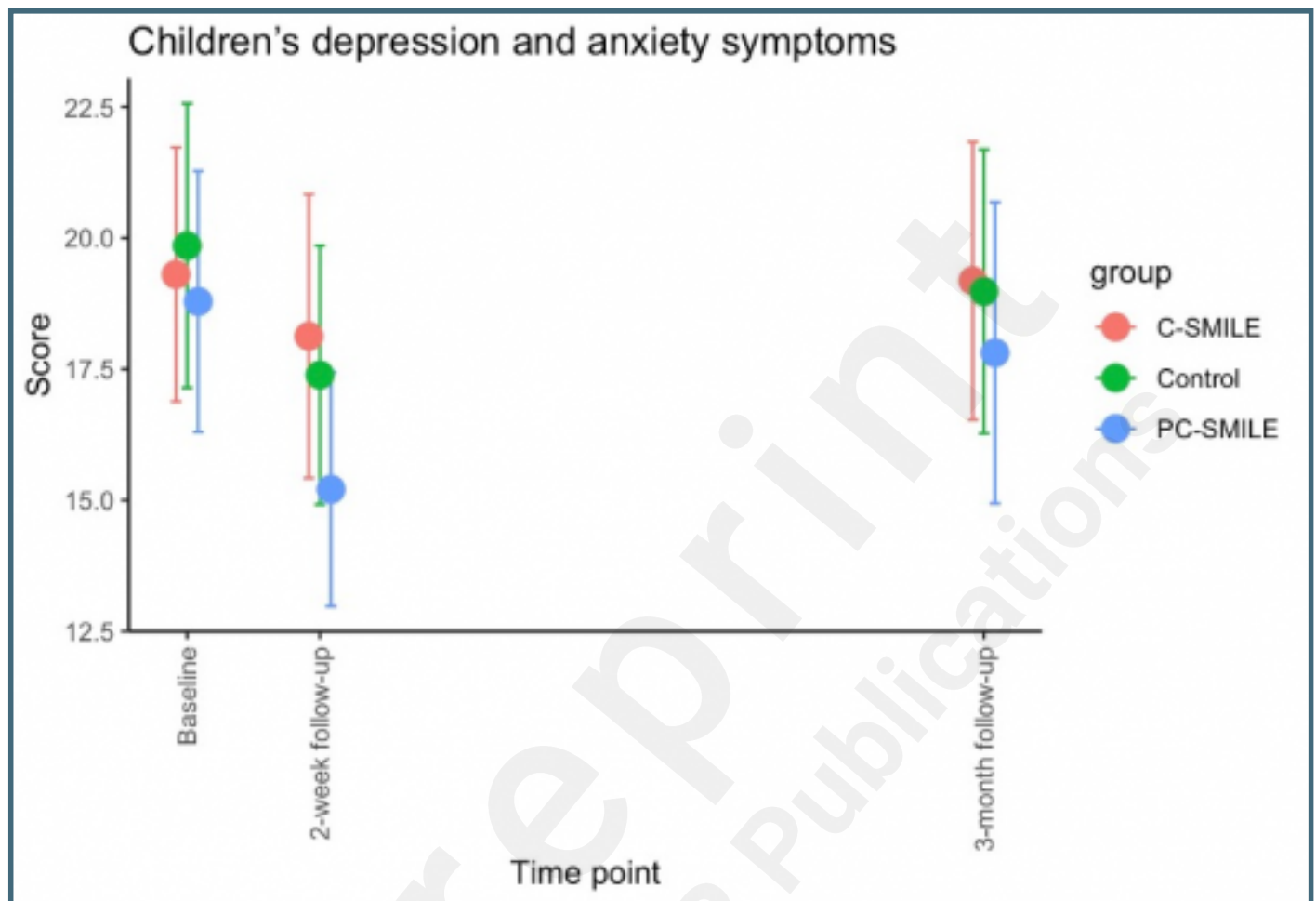


Fig. 4. Parent-child relationships change over time. Each dot represents the mean score of each group at each time point. Each line around the dot represents the 95% Wald Confidence Interval of the mean.

