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Community Mindfulness and Mentorship Preventive Intervention in Migrant Chinese Children: A Randomized Controlled Trial

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Dr. She and Prof. Tong shared first authorship of this work.

Objective: To test the feasibility and effectiveness of a mindfulness-based intervention in rural-to-urban migrant Chinese children using trained community volunteers.

Method: Migrant students ages 9 to 16 from 5 schools in Shanghai (N = 653) were randomly assigned to a mindfulness only group (n = 167), a mindfulness plus life skills group (n = 118), or a waitlist control group (n = 368). The first 2 groups received an 8-week mindfulness intervention delivered 1 hour weekly by trained community volunteers. The mindfulness plus life skills group received 8 additional hours of skills-based mentorship. Measurements on mindfulness, resilience, and anxiety and depression symptoms were collected before and after intervention. Multivariable regression analyses compared the intervention vs control groups.

Results: Before intervention, there were no significant demographic or outcome measure differences between groups except that students in the intervention groups were slightly older. Students had relatively low levels of mindfulness and prosociality difficulties and similar degrees of depression and anxiety symptoms compared with prior studies. After intervention, no statistically significant differences were found in mean scores for mindfulness, resilience, anxiety, or depression in the intervention vs control groups.

Conclusion: A volunteer-led mindfulness intervention did not significantly benefit migrant Chinese children after 8 weeks. More implementation research is needed for low-cost, scalable, and contextually effective mental health prevention programs.

Clinical trial registration information: Planting Seeds for Resilience—a Pilot Mindfulness and Mentorship Program in Migrant Chinese Children; http://www.chictr.org.cn; ChiCTR2100012027.

Diversity & Inclusion Statement: We worked to ensure that the study questionnaires were prepared in an inclusive way. We worked to ensure sex and gender balance in the recruitment of human participants. One or more of the authors of this paper self-identifies as a member of one or more historically underrepresented racial and/or ethnic groups in science. The author list of this paper includes contributors from the location and/or community where the research was conducted who participated in the data collection, design, analysis, and/or interpretation of the work.

Key words: China; mental health intervention; mindfulness; migrant children; resilience

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Mental health and substance use disorders are the leading cause of disability[1] in young people around the world. Half of these mental health problems appear before 14 years of age.[2] China is home to 1 in 7 young people in the world.[3]China today has 35 million rural-to-urban migrant children[4] who are at increased risk for developing mental health problems, including anxiety and depression, hyperactivity/inattention, and other psychosocial difficulties, compared with urban children.[5] These Chinese migrant children face 3 major systemic challenges. First, they grow up with shifting social support networks. Their parents often leave home to work in the cities for higher pay soon after they are born. They are cared for by other relatives until parents have secured a new home in the cities, which takes years, if not longer, leaving negative impacts on their perceived support and well-being.[6] Migrant children then are removed from their rural support networks abruptly to live with parents who have seen them very little over the years and to face blatant discrimination in new environments, putting them at risk for maladjustment.[7] Second, migrant children face unique educational challenges. They can often enroll only in designated migrant schools, often with fewer resources than neighboring urban schools[8] and lacking in social inclusion.[9]

Their parents face many logistical, financial, and legal challenges against registering them in urban settings due to policies aimed at securing limited public resources for urban-born children first and sometimes limited knowledge and time. Even when migrant children graduate from an urban high school, if their residence was not legally changed to the city, they must return to their rural legal residence to take the national college entrance examination.[10] Third, migrant children are at higher risk for being bullied at school.[11] These social inequities can hinder learning adaptability and educational performance and increase their risk for early dropout.[12]

Child migration and its challenges are not unique to China—the world has seen a 25% increase in migrations in the past 30 years.[13] Research on migrant child mental health is limited and heterogeneous in low- and middle-income (LMICs) countries.[14] Research on Chinese migrant child mental health can contribute to this gap in the literature by providing large-powered studies and evidence on culturally adapted interventions in a low resource per capita society, where mental health knowledge is limited, but stigma is high.[15] However, current high societal stigma means that parents fear labeling of their child as targeted by any mental health intervention. For example, programs containing the words "therapy," "cognitive," and "mental health" in Chinese languages may trigger negative attitudes and reactions from families regardless of their actual content.

Mindfulness originated in Buddhism and Eastern philosophies, but has been studied in secular settings in the West in the past 3 decades for mental health prevention and treatment, teaching practitioners to intentionally focus attention on the present moment with an attitude of curiosity and acceptance.[16] In the Chinese context, it has a neutral meaning, and short mindfulness interventions have been shown in recent small studies to be acceptable and effective in reducing depression/anxiety in adults[17] and social anxiety and suicidal ideation in children.[18] Mindfulness interventions for adults have been shown for years to improve mental health and executive function.[19] In contrast, mindfulness interventions in children have been heterogeneous and less conclusive, and controlled trials are rare in LMICs.[20] Whether school-based mindfulness interventions for children are effective in these countries is unclear.[21]

Also lacking in the literature is implementation evidence on using community health workers to deliver global mental health interventions. Experts started advocating over a decade ago for more studies on task shifting toward lay providers in LMICs to fill the gap between available professionals and growing needs.[22] Recent studies showed that this task shifting can have a positive impact on mental health in LMICs,[23] provided that supportive conditions such as regular supervision and access to resources are available.[24]

The objective of this study was to test the feasibility and impact of a 1-hour weekly mindfulness program for school-age Chinese migrant children delivered over 8 weeks by trained community volunteers. We explored whether an additional 1 hour weekly of life skills–based mentorship could synergistically benefit these children, as some studies have shown that life skills learning could improve child mental health in LMICs,[25] and positive childhood experiences such as having a supportive mentor can improve long-term mental and relational health.[26] We hypothesized that mindfulness training delivered by trained community volunteers would improve mindfulness, depression/anxiety symptoms, and resilience in Chinese migrant children and that life skills mentorship could synergistically increase these benefits.

METHOD

Population

This study was approved by institutional review boards at Stanford University and the Fudan University School of Public Health. The study was entered into the Chinese Clinical Trial Registry (ChiCTR2100012027). Students were recruited through introductory meetings held at 5 schools with migrant student enrollment in urban Shanghai, where the principals had agreed to participate. To optimize representation of the migrant populations, we included both public and private schools. Invitations and consent forms were sent to the guardians of all students who had at some point legal residence outside of Shanghai city, planned to be in school for at least 6 months from study initiation, were between 9 and 16 years old, and had legal guardians consenting for participation. Students who had a psychiatric diagnosis that required active treatment by a professional (to minimize potential harm and interference with their current treatment), refused to consent (either themselves or their guardians), or withdrew due to pandemic-related issues were excluded. The age range was chosen based on existing reviews and our intention to start prevention early given half of mental health problems start before age 14, while estimating age-specific learning abilities to grasp a relatively abstract and unfamiliar practice of mindfulness. The last 2 years of high school (ages 17-18) are associated with unusually high pressures for the college entrance examination, and local school principals advised us not to recruit for this study during this period.

We calculated the sample size with Power Analysis and Sample Size version 15.0 (PASS 15; NCSS, LLC, Kaysville, Utah). The power calculations indicated that a

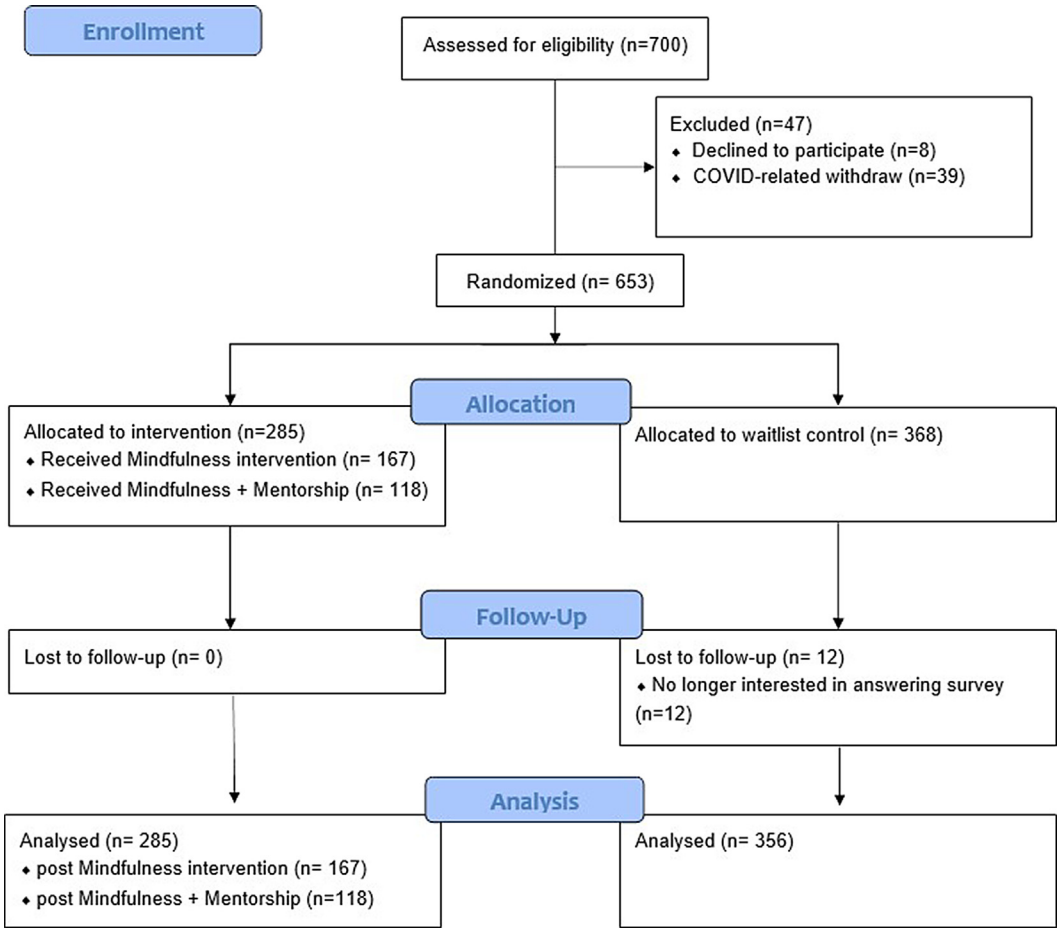
sample size of 548 students (137 in each intervention arm and 274 in the control arm) would detect a small-to-medium effect size of mindfulness (0.24) by a 2-tailed effect in favor of the intervention, with a power of 0.80 and a confidence level of 0.95. This expected effect size was chosen based on the range of $d = 0.16$-0.47 shown by a large meta-analysis of randomized controlled mindfulness-based intervention trials in pediatric populations.[20] To adjust for nonadherence, we arrived at a final sample size of 653 students in grades 4 to 8 (285 students in the 2 intervention arms and 368 students in the control arm) to allow 20% for loss to follow-up over 3 months. Students were recruited from 2 primary and 3 middle schools in Shanghai using a stratified 2-stage cluster sampling approach. In the first stage, we used cluster random sampling to select 2 primary schools and 3 middle schools out of all eligible schools in Shanghai. In the second stage, we used a stratified sampling approach to randomly select individual migrant students from grades 4 to 8 from each school.

As shown in the study flow chart (Figure 1), 700 students ages 9 to 16 were assessed for eligibility. After the initial screening for exclusion, 8 students did not have parental consent, and 39 withdrew due to COVID-19–related concerns. We did not have to exclude any recruited students due to reported active psychiatric treatment. The final sample size at allocation was 653, with 285 students randomly assigned to the intervention group and 368 randomly assigned to the waitlist-control group. The control group would receive the same intervention after study conclusion if benefits were seen through data analysis. Only 12 students were lost to follow-up in the control group between allocation and postintervention follow-up due to their inability to complete follow-up surveys.

Procedure

The preintervention assessment was conducted for all students in classrooms at the school. The waitlist-control groups received standard school curriculum until the study was completed. They were told that they were eligible

FIGURE 1 Study Flow Chart



for the next training if the results after 8 weeks indicated that it was beneficial for students. We then implemented an 8-week intervention of weekly 1-hour mindfulness group teaching (the same as a recent successful mindfulness intervention in Chinese children[18]) conducted by trained community volunteers among the 285 students in the intervention group. The students were asked to keep the course content private and not share it with other students during the 8 weeks to prevent spillover. In the intervention group, 167 students received mindfulness training alone, and 118 students received mindfulness training plus 8 weeks of 1-hour group mentoring by a subgroup of the volunteers trained in life skills mentorship.

To train the volunteers, we hired 2 internationally certified Chinese-speaking mindfulness trainers with more than 10 years of experience to train 26 community volunteers. The trainers have been empirically adapting mindfulness-based interventions to the Chinese culture through their 10 years of teaching experience in adults and children. They cofounded the Inner Mindfulness Center, the first government-recognized mindfulness teaching center in the country. They have been continuously optimizing their methods based on feedback from many Chinese Fortune 500 companies, private schools, and other clients in China. We also used a translated and published Chinese version of the Still Quiet Place curriculum to supplement the guided practices and homework assignment, which was examined and approved by the 2 instructors. The Still Quiet Place curriculum was developed by Dr. Amy Saltzman and colleagues in the United States.[27] It is a mindfulness-based stress reduction program that therapists, teachers, and other professionals have used to help children and adolescents manage stress and anxiety and develop their natural capacities for emotional fluency.[28] It was first shown to be effective in a study of fourth- to seventh-grade students who completed 8 weeks of 1-hour weekly training and had higher ability of orienting their attention and lower levels of anxiety.[28] The Still Quiet Place curriculum includes a workbook and audio practices that have been translated and published in Chinese. In this curriculum, each week of training focused on a theme crucial to understanding and practicing mindfulness in an age-appropriate manner. For example, week 1 focused on mindful eating and breathing, and week 2 explored daily practice and paying attention to thoughts, feelings, and physical sensations.

The volunteers received 2 months of training (1 month of online self-paced learning plus 4 in-person weekly sessions) from the 2 instructors before teaching the migrant students. The online learning included 8 1-hour recorded modules with guided practices and self-reflection exercises. Each of the 8 modules had a theme, as follows: "physical sensations," "mindful breathing," "power of thoughts," "power of emotions," "mindful eating and other curiosities," "mindful communication," "power of compassion," and "power of gratitude." The 2 instructors provided timely feedback and answers to questions that emerged during this online training period. The in-person weekly sessions lasted 3 hours each, with the 8 themes grouped into 4 didactic classes (Table S1, available online) that included individual, pair-based, and group interactions; teaching technique demonstration; questions and answers; and guided meditations as well as take-home assignments. The community volunteers were recruited from Fudan University in Shanghai. More than 80 students and alumni applied to become volunteers, most of whom majored in psychology, medicine, or sociology. Many of the volunteers had previous experience teaching youth or working in mental health–related projects.

A subset of the volunteers (n = 10) was selected and trained to give additional life skills mentorship to the students. The life skills curriculum consisted of 8 weeks of 1-hour sessions conducted after each mindfulness training session. The volunteers were trained by a specialized global health pediatrician using a curriculum adapted based on a successful intervention project conducted in Chinese migrant children in 2014[29] and a review of evidence-based life skills interventions in school-age children in high- and low-income countries.[30,31] The training sessions (Table S2, available online) consisted of 5 to 10 minutes of review or introduction with an ice breaker game, followed by 20 to 30 minutes of explanation of core concepts and skills, and 10 to 20 minutes of interactive activities with the students. Pedagogical approaches and mentorship skills were reiterated through role plays during preintervention training. The 8 topics taught included team building skills, the art of communication, self-esteem and confidence, setting goals and planning for success, healthy relationships, informed choices, problem solving, and leadership skills. A summary of the curriculum is presented in Table S2 (available online). All students in the mindfulness plus life skills mentorship arm were encouraged to practice skills learned in their daily lives and were asked about their challenges and successes at the beginning of each mentorship session.

All students completed a baseline questionnaire including sociodemographic characteristics and 4 validated tools measuring mental health outcomes. Mindfulness was measured with the Mindfulness Attention Awareness Scale (MAAS), a 15-item Chinese version revised and validated in China.[32] Each item had a scale from 1 (almost always) to 6 (almost never). A mean performance score was calculated across all items, with higher scores representing better

mindfulness. Behavior and prosociality as indicators of resilience were measured with the Strengths and Difficulties Questionnaire (SDQ),[33] using a 25-item Chinese self-report version for 11- to 17-year-old respondents that has been validated in collaboration with the Centre for Clinical Trials and Epidemiological Research at the Chinese University of Hong Kong.[34] Each item is a statement that the participant can mark as "Not true," "Somewhat true," or "Certainly true." A summary score was calculated across all items, with higher scores signaling higher total difficulties. For an intervention to be considered successful in increasing resilience, the total difficulties score should be lower in the intervention arms compared with the control group after intervention. Anxiety was measured with the Multidimensional Anxiety Scale for Children (MASC), a scale that has also been validated in Chinese.[35] The MASC comprises 39 items in which the answer choices for each item include "Not at all," "Almost never," "Sometimes true," and "Often true." A summary score was calculated across all items to indicate higher risk for anxiety when the score is higher. Finally, depression was measured with the Center for Epidemiological Studies Depression Scale (CES-D), a scale originally designed for the general population that has been culturally adapted and validated in adolescents in China.[36] The CES-D scale is a self-report screener consisting of 20 Likert items measuring depressive symptoms in which a higher composite score means that there is a higher risk for depression. The same questionnaire was repeated in all students after the intervention period ended.

Using Stata 16.0 (StataCorp LLC, College Station, Texas), we performed descriptive t tests to examine the differences between the treatment groups and the control group before and after intervention. We also tested the 2 treatment groups against the control group at each time point for all outcome measures. The associated sociodemographic factors including student's age, sex assigned at birth, parental education, and annual household income were adjusted for in the multivariable regression models. We also conducted an intention-to-treat analysis that did not alter the direction of the results. The adjusted t and p values are presented in Tables 1 and 2. The statistical significance level was set at $p < .05$.

RESULTS

The baseline participant sociodemographic characteristics by assignment group are shown in Table 1. No significant differences were found in terms of the variables that measured sex assigned at birth, household income, parental education, or number of siblings across the control group and intervention arms. Male students were slightly more numerous than female students across all groups. The intervention arms had a significantly higher percentage of students in higher grades compared with the control group despite randomization by chance. Most of the families had a total annual income in the $7,900 to $15,700 range (US dollars). For reference, the average household income for a dual-income household was approximately $12,438 in Shanghai in 2020.[37] Approximately 70% of the parents had a high school education across the groups. For reference, in China, about 37% of adults have achieved only high school qualification or above, with about half of them going on to college or higher levels.[38] More than half of the students had one sibling; approximately 1 in 4 had more than 1 sibling.

Table 2 shows the mean scores before and after intervention in mindfulness (MAAS), resilience (SDQ), depression (CES-D) and anxiety (MASC) in all groups. Age, sex assigned at birth, household size, household income, and parental education were adjusted for in the multivariable regression models. During the preintervention phase of the study, there were no significant differences between groups using $p < .05$ as the cutoff for significance (omitted p values due to space limitation). After intervention, there were also no statistically significant differences comparing the 2 intervention arms vs the control group. For the SDQ scores, the subscales of social competence and prosociality did not show differences just as with the overall scores. The intervention arm that received both mindfulness and mentorship had a near-significant improvement in posttest resilience (mean difficulties scores of 7.32 vs 7.76 in the control group, $p = .06$). This is also the only group that saw a slight improvement in resilience over time.

DISCUSSION

To our knowledge, our study is the largest randomized controlled trial in China that aimed to use a mindfulness-based intervention for mental health prevention among migrant children. Three prior trials in Chinese migrant children exist with sample sizes of less than 100 students[18,39,40] who were trained by certified mindfulness instructors for the intervention. Both the small size and the resource intensity of these studies make them hard for scale-up in low-resource settings given the large population in need (35 million migrant children in China) and the relative paucity and expense of hiring certified, experienced instructors with experience in China. Our study is also the first mindfulness study in China that used trained community volunteers to explore the possibility of larger-scale

TABLE 1 Baseline Participant Sociodemographic Characteristics

	Total participants		Control group		M arm[a]		MM arm[b]			
	n	(%)	n	(%)	n	(%)	n	(%)	χ^2	*p*
Sex assigned at birth										
Male	360	(56.25)	204	(57.30)	94	(56.63)	62	(52.54)	0.83	.661
Female	280	(43.75)	152	(42.70)	72	(43.37)	56	(47.46)		
Grade										
4	132	(20.21)	90	(24.46)	28	(16.77)	14	(11.86)	27.44	.001*
5	102	(15.62)	58	(15.76)	29	(17.37)	15	(12.71)		
6	172	(26.34)	107	(29.08)	36	(21.56)	29	(24.58)		
7	142	(21.75)	68	(18.48)	45	(26.95)	29	(24.58)		
8	105	(16.08)	45	(12.23)	29	(17.37)	31	(26.27)		
Annual household income (US dollars)										
≤ $7,900	84	(13.48)	42	(11.97)	20	(12.58)	22	(19.47)	14.62	.147
$7,900-$15,700	153	(24.56)	90	(25.64)	38	(23.90)	25	(22.12)		
$15,700-$23,600	117	(18.78)	68	(19.37)	24	(15.09)	25	(22.12)		
$23,600-$31,400	106	(17.01)	61	(17.38)	33	(20.75)	12	(10.62)		
$31,400-$47,100	92	(14.77)	51	(14.53)	29	(18.24)	12	(10.62)		
> $47,100	71	(11.40)	39	(11.11)	15	(9.43)	17	(15.04)		
Paternal education										
Elementary	35	(5.48)	19	(5.26)	7	(4.35)	9	(7.69)	1.87	.759
High school	463	(72.46)	265	(73.41)	117	(72.67)	81	(69.23)		
College or higher	141	(22.07)	77	(21.33)	37	(22.98)	27	(23.08)		
Maternal education										
Elementary	57	(8.95)	30	(8.36)	15	(9.26)	12	(10.34)	2.20	.699
High school	456	(71.59)	265	(73.82)	111	(68.52)	80	(68.97)		
College or higher	124	(19.47)	64	(17.83)	36	(22.22)	24	(20.69)		
Number of siblings										
0	130	(20.44)	74	(20.67)	35	(21.6)	21	(18.10)	4.06	.398
1	356	(55.97)	197	(55.03)	97	(59.88)	62	(53.45)		
>1	150	(23.58)	87	(24.30)	30	(18.52)	33	(28.45)		
Total	653	(100)	368	(56.36)	167	(25.57)	118	(18.07)		

Note: [a]*M arm = mindfulness intervention arm.*
[b]*MM arm = mindfulness plus mentorship intervention arm.*
*p < .05.

implementation at a low cost and involving interested local community members to model positive relationships and social inclusion.

Our intervention did not produce measurable benefits in self-reported mindfulness, resilience, or anxiety or depression symptoms after intervention. These results concur with a few large-scale youth mindfulness studies that found no significant improvement in anxiety[41] or depression symptoms.[42] The largest randomized controlled trial to date using school-based mindfulness training had mostly null findings.[42] Notably, these recent large trials all came from high-resource countries. Our findings differ from the 3 prior small mindfulness trials in migrant Chinese children who were shown to have improved student mindfulness[39] and anxiety[18] as well as parental stress.[40] Our results also differ from a few recent studies citing mindfulness as promising in improving global youth anxiety,[43] depression[44] symptoms, and resiliency.[45]

Our preintervention outcome scores were partly comparable to prior smaller studies in Chinese children. The pretest scores of anxiety and depression symptoms, for example, were similar to prior data in Chinese children.[35,36] The pretest SDQ scores, however, seem relatively low compared with another Chinese study.[46] The pretest scores of mindfulness also seem relatively low compared with another migrant student study in Beijing, the capital of China.[47]We think that, at baseline, our students did not

TABLE 2 Mental Health Variables Before and After Intervention for Intervention and Control Groups

	Control group				M arm[a]				Posttest difference		MM arm[b]				Posttest difference	
	Pretest		Posttest		Pretest		Posttest		M arm vs		Pretest		Posttest		MM arm vs	
Variable	Mean	(SD)	Mean	(SD)	Mean	(SD)	Mean	(SD)	Control	p^c	Mean	(SD)	Mean	(SD)	Control	p^d
MAAS	62.73	(0.75)	62.64	(0.80)	63.68	(1.12)	62.95	(1.21)	0.30	.83	63.42	(1.37)	60.62	(1.65)	−2.03	.23
SDQ	7.62	(0.11)	7.76	(0.11)	7.65	(0.15)	8.07	(0.15)	0.31	.11	7.80	(0.17)	7.32	(0.21)	−0.44	.06
CES-D	10.04	(0.67)	10.56	(0.74)	9.08	(0.86)	11.09	(1.20)	0.53	.70	10.34	(1.13)	12.96	(1.28)	2.40	.11
MASC	40.22	(1.16)	40.84	(1.23)	39.93	(1.48)	41.49	(1.99)	0.64	.78	41.72	(2.04)	43.04	(2.59)	2.19	.41

Note: *CES-D = Center for Epidemiological Studies Depression Scale; MAAS = Mindful Attention Awareness Scale; MASC = Multidimensional Anxiety Scale for Children; SDQ = Strengths and Difficulties Questionnaire.*
[a]*M arm = mindfulness intervention arm.*
[b]*MM arm = mindfulness plus mentorship intervention arm.*
[c]*p value for the postintervention difference in means (t test) between the control group and the mindfulness intervention arm.*
[d]*p value for the postintervention difference (t test) in means between the control group and the mindfulness plus mentorship intervention arm.*
*$p < .05$.

show as many behavioral/prosociality problems as measured by SDQ, which may make it difficult to show benefits from a short-term preventive intervention such as ours. However, they did have relatively low levels of mindfulness at baseline compared with other populations, and our intervention did not significantly change that after 8 weeks. We think that the relatively young age distribution may have made it difficult for students to translate the mindfulness teaching into practice as well as older children and adults, especially when taught by community volunteers who have not had much experience practicing and teaching it themselves. It is also worth noting that most of our students were enrolled in elementary school (62.17%), and their perspective may differ from the other students who already attend secondary school regardless of age.

A second follow-up analysis from our study 3 months after intervention and a qualitative analysis of focus group feedback from students are under way. Most community volunteers who delivered the intervention gave us highly positive anecdotal feedback regarding their experiences as mindfulness trainers and mentors. Several volunteers highlighted participating in this research project as "the best part of 2020" despite being unpaid and having to travel weekly to migrant schools. Many students described instances where they used mindfulness and life skills learned in stressful situations at school and at home. Many volunteers expressed interest in participating in similar studies in the future and their perception that youth mental health is an urgent, underaddressed issue among all youth in China and not just among migrant children.

Our findings have several possible alternative explanations that can help guide future research (summarized in Table 3). First, the implementation of a mindfulness intervention using community volunteers in developing countries is novel and culturally acceptable, but needs optimization. We intentionally used trained community volunteers in this study because China currently has fewer than 2 full-time pediatric psychiatrists per 1 million children younger than age 15, while the prevalence of pediatric mental health disorders is approximately 20%.[48] While more mental health professionals are needed to deliver treatments, effective preventive programs using community health workers could bridge the gap into full access to professional services. Systematic reviews showed that community health workers can deliver mental health interventions that reduce symptoms in low-resource settings.[49] However, evidence on pediatric interventions in low-resource settings is lacking. We intended for this study to explore the feasibility of training community health workers in pediatric mental health prevention. In retrospect, most of our trained volunteers had no prior experience teaching mindfulness. Per protocol, all volunteers underwent a 2-month intensive mindfulness training taught by 2 experienced and internationally certified mindfulness instructors. Although this training was rigorous, it may have been insufficient for volunteers to teach mindfulness to students effectively without more experience. No universal criteria exist regarding the length of training that is required to train a mindfulness trainer, but some authors have argued that a mindfulness teacher needs "a deep understanding of mindfulness and must also embody its qualities,"[50] which may take months to years to achieve. Another factor to consider is the age of students. In our study, we included children and adolescents with a relatively large age range (ages 9-16). There is growing evidence that older adolescents (ages 15-18), with higher levels of self-reflection and

TABLE 3 Possible Explanations of Null Results and Recommendations for Future Research

Explanation	Recommendations
Using trained community volunteers to deliver mindfulness training to a relatively wide age range of students may not have been effective.	Optimizing and standardizing train-the-trainers curriculum and process, measure training outcomes, and incorporate feedback before further school-based interventions. Narrow target student age range for future large implementation studies, optimizing age-appropriate curricula.
External educational and social stressors may have overwhelmed intervention effects.	Conduct more research on multilevel interventions and systems capacity building through involving schools, parents, and community support. Include longer length of intervention and follow-up. Involve students, families, and teachers from the design phase to increase engagement.
Study outcome measures may not have been capturing the true intervention effects, especially because increased awareness of negative feelings and thoughts may increase apparent self-report of depression/anxiety symptoms.	Explore additional self-reported and physiological measurements could be explored, eg, knowledge, attitude, self-efficacy; other physiological measurements, whenever culturally acceptable for collection, could help provide objective data tracking, eg, heart rate variability, blood pressure, sleep quality, academic functioning, cortisol levels. Explore qualitative data to understand the barriers to successful and efficacious implementation and provide evidence for future improvement and scale-up.

metacognition, may benefit from mindfulness training more than younger students.[51]

Second, a short-term school-based intervention using one modality may have been overwhelmed by external educational and societal stressors. Having anticipated this, in addition to the mindfulness training, we trialed adding a weekly group mentorship arm teaching life skills to half of the students receiving mindfulness training. However, the mindfulness course plus mentorship meetings did not produce overall significant effects in mindfulness, resilience, or anxiety or depression symptoms after intervention. There was a marginal improvement in resilience approaching statistical significance that is worth further investigation. Moving forward, we will perform stratified analysis and mediation analyses to further dissect the potential mediator effects. Multilevel interventions through schools, parents, and community centers to help students more effectively deal with external pressures may help in future implementation research[52] because child resilience develops through interactions of multiple biological and sociocultural factors over time.[53] In addition, future interventions may need to be delivered during longer periods.

Third, our outcome measures may have been inadequate in capturing the true effects of the intervention. For example, the MAAS is one of the most broadly used tools for measuring mindfulness but has some limitations. The main criticism is that it does not always fully capture a nonjudgmental acceptance of one's experiences or present awareness,[54] both of which are central to the practice of mindfulness. In addition, increased awareness of negative emotions can lead to higher scores in self-reported depression, anxiety, and difficulties as reported by some studies.[55] In the future, other physiological measurements such as heart rate variability and blood pressure, along with sleep quality and academic functioning, should be considered.[56]

Overall, more mental health prevention and implementation research is needed in China, especially among more vulnerable rural and migrant children. There is also an opportunity for this type of research to contribute to the global mental health literature, especially in low-resource settings. Mental health problems affect up to 1 in 5 young people worldwide.[57] Of these affected youth, 90% live in LMICs where lack of professional help can lead to later unemployment, disability, and deaths, but only 10% of evidence comes from these countries.[58] In China, children face many systemic challenges, such as rapid urbanization with increased competition; loosening family structure; and widening urban-rural health inequities starting from perinatal care, to water and sanitation, to nutrition and education.[59] The government has been trying to require school-based psychological counseling since 2015, but has had limited achievements concentrated in richer, more developed provinces and in less than 1% of all elementary and middle schools due to severe educational budget disparities across provinces.[60] In 2019, the Chinese Health Commission, Ministry of Education, and other departments announced a mental health mandate that by 2022 all schools should set up student mental health services and 60% of larger hospitals should provide related outpatient

services, but research, resources, and guidance to achieve these policy goals are still needed.

Focusing on prevention is especially important in low-resource populations such as Chinese migrant children. Recent research on positive childhood experiences and their independent association with improved adult mental health[26] correlates with neuroscience evidence on the ability of positive life events to strengthen brain connectivity, emotion regulation, and resilience against depression.[61] Preventive interventions that increase positive childhood experiences by providing mentorship and by teaching students how to process everyday experiences can in theory benefit youth mental health outcomes in the long term. In the future, multilevel and multimodality interventions can be considered. Given that the Chinese government already mandates that by all schools set up student mental health services, yet few evidence-based curricula exist in China, there is an urgent need for implementation research and dedicated funding for adapting evidence-based interventions in the local context before large-scale replication. Given that engagement from overburdened teachers and younger students can be challenging in universal implementation, we recommend that future interventions involve students and teachers early on during the design phase and employ multilevel strategies involving families, teachers, and communities. Stigma reduction interventions are needed to increase acceptability of therapeutic modalities such as cognitive-behavioral therapy. Systems strengthening and research capacity building are also needed to implement sustainable, practical ways to task shift and support specialists.[58] A recent review in pediatric mental health highlighted the limited evidence in LMICs, most of which supports positive youth development programs, but other interventions such as school-based mental health promotion, peer outreach, and digital interventions should be further explored.[62]

Our study has 4 methodological limitations. First, though it was a randomized controlled trial, it was not blinded, and the randomization was not stratified by age. Second, the measures of the main outcome variables relied on self-reported outcome measures that could be susceptible to recall bias and social desirability bias. Third, due to limited funding, we were not able to involve teachers or parents, who may have been able to reinforce the practice of the intervention to improve effectiveness. Fourth, all students were rural-to-urban migrant Chinese children living in the affluent city of Shanghai, so results may not be generalizable to others.

In conclusion, an 8-week randomized controlled trial of school-based mindfulness training using community volunteers that was adapted from Western literature did not significantly impact immediate postintervention resilience, mindfulness, depression, or anxiety measures in migrant Chinese children in Shanghai. Given the recent national policy changes regarding mandated mental health support in all schools, implementation research is urgently needed, especially aimed toward community participatory design, age-specific curriculum optimization, training standardization, multilevel capacity building, objective outcome measures, qualitative data analysis, and long-term follow-up.

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Dr. H. Wang served as the statistical expert for this research.

Author Contributions
X.S. conceptualized and designed the study, interpreted data, drafted the initial manuscript, and approved the final manuscript as submitted. L.T. conceptualized and designed the study, coordinated and supervised data collection, revised the manuscript critically for important intellectual content, and approved the final manuscript as submitted. L.L. conceptualized and designed the study, performed data collection, carried out the initial analyses, revised the manuscript critically for important intellectual content, and approved the final manuscript as submitted. H.W. conceptualized and designed the study, performed data analyses, interpreted data, revised the manuscript critically for important intellectual content, and approved the final manuscript as submitted. C.A., M.W., M.K.S., and S.R. conceptualized and designed the study, interpreted data, revised the manuscript critically for important intellectual content, and approved the final manuscript as submitted. All authors agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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