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EMPIRICAL ARTICLE

CHILD DEVELOPMENT

Parenting centers and caregiver mental health: Evidence from a large-scale randomized controlled trial in China

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Abstract

This study conducts an exploratory analysis of the impacts of a center-based early childhood development intervention on the mental health of caregivers, using data from a cluster-randomized controlled trial of 1664 caregivers (M_{age} = 36.87 years old) of 6- to 24-month-old children in 100 villages in rural China. Caregivers and children in 50 villages received individual parenting training, group activities and open play space in village parenting centers. The results show no significant overall change in caregiver-reported mental health symptoms after 1 year of intervention. Subgroup analyses reveal heterogeneous effects by caregiver socioeconomic status and identity (mother vs. grandmother). Findings suggest that early childhood development interventions without targeted mental health components may not provide sufficient support to improve caregiver mental health.

INTRODUCTION

A growing body of cross-disciplinary research has highlighted the importance of early childhood development (ECD) in the first 3 years of life. Research shows that the majority of brain development occurs during this period, meaning that environmental factors in early childhood have relatively large and wide-ranging effects on skills development and long-term life outcomes (Black et al., 2017). For instance, a stimulating childhood environment has been shown to improve child development in terms of cognition and language, as well as improve overall well-being as children grow (World Health Organization, 2020). Investing in disadvantaged children during the early childhood years also has been shown to be an efficient strategy for increasing human capital accumulation, which can prevent the intergenerational transmission of poverty (Schady et al., 2015; Shawar & Shiffman, 2017). In response to these findings, international agencies including the World Bank, the Inter-American Development Bank, the United Nations and the World Health Organization have made ECD-enriching interventions a highly prioritized policy goal (Black et al., 2015; Vargas-Barón, 2015; World Health Organization, 2020).

As caregivers shape a child's early experiences, researchers and practitioners have increasingly turned their attention toward the mental health of caregivers of young children. Although a small number of studies in low- and middle-income countries (LMICs) have

Abbreviations: DASS, Depression Anxiety and Stress Scale; ECD, early childhood development; HFPC, Health & Family Planning Commission; ITT, intention-to-treat; LATE, local average treatment effect; LMIC, low- and middle-income countries; RCT, Randomized Controlled Trial.

found no relationship between maternal mental health and child outcomes (Bhat et al., 2015), a preponderance of research suggests that poor maternal mental health is linked to impaired cognitive, social, and academic functioning (Gelaye et al., 2016; Yue et al., 2018; Zhang et al., 2018). These studies are not causal, however, and associations between maternal mental health and ECD outcomes may be due to genetics (Burke, 2003) or socioeconomic factors like poverty (Zhang et al., 2017). Yet, there is also evidence caregivers with mental health issues show reduced parental investment (engagement in stimulating parenting practices like storytelling, reading and singing) compared to caregivers without mental health issues (Yue et al., 2018; Zhang et al., 2018; Zhong et al., 2021). Maternal mental health issues also present a large burden to global public health in their own right (Gelaye et al., 2016), and improving maternal and caregiver mental health has also been promoted by researchers and practitioners as an important goal for ECD interventions (Jeong et al., 2018; World Health Organization, 2020).

Unfortunately, mental health issues are common among caregivers of young children around the world. According to the World Health Organization, about 13% of women worldwide experience a mental disorder after giving birth (World Health Organization, 2019). Studies in LMICs have found the rate of postpartum mental health issues to be even higher, at around 20% (Atif et al., 2015; Fisher et al., 2012). Many factors have been found to contribute to these mental health issues, including low socioeconomic status, the less valued social role of women, and a lack of social support for mothers (Atif et al., 2015; Fisher et al., 2012; Gelaye et al., 2016). Previous research has also suggested that women who are "left behind" in rural areas, especially those geographically isolated from major cities, are more likely to suffer from mental health issues (Wittink et al., 2016).

In rural China, research has found both high rates of ECD delays among young children and high rates mental health issues among their caregivers. A recent systematic review estimated that 45% of children under age three across rural China may be cognitively delayed (Emmers et al., 2021). Other recent studies have found that rural caregivers have rates of depression ranging from 23% to 40%, while rates for anxiety and stress are about 28% and 15%, respectively (Wang & Mesman, 2015; Zhang et al., 2018). Up to 40% of rural caregivers have at least one of these three mental health issues (Zhang et al., 2018), and cross-sectional studies have found mental health issues to be significantly associated with ECD delays among young children (Zhang et al., 2018; Zhong et al., 2021).

The particularly high prevalence of mental health issues among China's rural caregivers may result from the unique social and economic background of rural China. Increasing rural-to-urban migration and traditional cultural norms contribute to social isolation and a lack of social support (Li et al., 2015), which has been shown in the international literature to negatively impact mental health (Black & Dewey, 2014). A previous study in rural China also noted high rates of depression among caregivers and highlighted a lack of social support as a possible cause (Yue et al., 2018). They point out that communicating with others about negative feelings or family difficulties is stigmatized in rural China. Many mothers and grandmothers thought that they did not have any friends or family to talk to about such issues, and even for those who thought they could talk to someone, comfort seemed to be largely provided in the form of general phrases and sayings (Yue et al., 2018). These studies have demonstrated the vulnerability of China's rural caregivers to mental health issues, but their cross-sectional analysis has left open the question of how caregiver mental health issues change over time.

Recently, ECD interventions have been proposed to secondarily improve the mental health of caregivers. In this context, ECD interventions aim to increase child developmental outcomes by promoting psychosocial stimulation among caregivers, typically through a combination of interactive parenting lessons, one-on-one parenting training sessions (usually home visits), and group activities for caregivers and children (Aboud & Yousafzai, 2015). Although systematic reviews have found overall insignificant effects of ECD interventions on caregiver mental well-being (Jeong et al., 2018; World Health Organization, 2020), program effects on mental health have varied across studies and intervention designs.

ECD interventions in the literature can be grouped into three categories by their relation to caregiver mental health: (1) interventions with specific components targeting caregiver mental health; (2) interventions without targeted mental health components but which use mental health-friendly delivery strategies (e.g., avoiding undermining mothers' self-confidence; developing positive rapport with mothers); and (3) interventions having neither of the above. Among studies in which the intervention integrated specific components to target caregiver mental health, the majority (two of three) found significant improvements in mental health (Lakkis et al., 2020; Singla et al., 2015), whereas only one did not (Rockers et al., 2016). Similarly, among studies of interventions that did not include targeted mental health components but used mental health-friendly delivery strategies, three of four studies significantly decreased maternal depressive symptoms (Baker-Henningham et al., 2005; Gelfand et al., 1996; Hamadani et al., 2019), whereas only one study found no change (Mendelsohn et al., 2007). In contrast, among studies with neither targeted mental health components nor mental health-friendly delivery strategies, the findings are much more mixed: of ten studies, four found improvements in maternal well-being (Aboud et al., 2013; Andrew et al., 2020; Rahman et al., 2008), with the majority (six of ten) finding no significant impacts (Attanasio et al., 2014; Chang et al., 2015; Cooper et al., 2002; Kalinauskiene et al., 2009; Luoto et al., 2021; Nahar et al., 2014).

Alongside the relatively mixed findings, there are two major gaps in the literature to date. First, current studies have mainly focused on interventions using a home visit, group session, or a combined home visit and group format; in contrast, no studies have examined how parenting center ECD interventions could shape the mental conditions of caregivers. This format of ECD intervention uses centrally located parenting centers to train caregivers in interactive parenting practices through a combination of one-on-one sessions and group activities. Parenting centers are seen as a promising model for future ECD programs because they are less labor intensive and require fewer contact hours, without losing the intensity of the parenting training (Aboud & Yousafzai, 2015). The parenting center model is also currently being upscaled as part of national ECD programs in several countries, including Brazil (Primeira Infância Melhor), Mexico (Centro de Desarrollo Infantil), South Africa (Integrated Programme for Early Childhood Development), and Peru (Cuna Mas). Despite the popularity of this intervention format, however, the effects on caregiver mental health remain unclear.

This study examines the causal effects of a parenting center intervention on the mental health of caregivers in rural China. Our research team implemented a large-scale cluster-randomized controlled trial (RCT) in 100 rural villages, of which 50 were randomly chosen by the research team to establish ECD parenting centers. The intervention itself consisted of three components, all of which were provided in the parenting centers. First, caregivers received weekly one-on-one parenting lessons delivered by trained parenting trainers following a standardized parenting curriculum. Second, weekly group reading and play activities were led by the center managers, and all caregivers were encouraged to attend with their child. Third, the parenting centers offered free play space, toys and baby books for caregivers and children to use anytime they came to parenting centers, and caregivers were encouraged to visit the play space in the parenting centers with their children during open days (but could not leave their children alone in the centers). Although the primary purpose of the intervention was to improve ECD outcomes, the combination of individual coaching, group sessions and unstructured interaction time in the parenting centers may improve caregiver mental health as spillover effects.

After 1 year of intervention, the parenting center intervention significantly improved both child development outcomes and parental investments. Children in the treatment group had significantly higher cognitive scores (measured by the Bayley Scales of Infant Development) by around 0.2 *SD* relative to the control group; similarly, caregivers in the treatment group showed significantly greater time investments in stimulating parenting practices (interactive play, reading, storytelling, and singing). The main intervention evaluation and treatment effects are reported in full in Sylvia et al. (2021).

In this study, we conduct an exploratory analysis to understand whether the parenting centers had secondary effects on the mental health of caregivers, focusing on symptoms of depression, anxiety, and stress. We hypothesize that the parenting centers may improve caregiver mental health, as caregivers may organically give and receive unstructured peer support while attending the centers. To examine the effects of the parenting center intervention on caregiver mental health, we pursue three specific objectives. First, we examine the effect of parenting centers on caregiver mental health overall. Second, to account for uneven participation rates, we analyze the impact of the parenting centers on the subsample of caregivers who attended the centers relatively regularly (at least once per fortnight, on average). Finally, we estimate the effect of the parenting centers on different subgroups of caregivers, including mothers and grandmothers, caregivers of older and younger children, and caregivers with different socioeconomic status.

METHODS

Sampling and randomization

The data presented in this study come from a cluster RCT conducted in 20 rural counties, including 17 nationally designated poverty counties, in a province in northwestern China. In terms of GDP per capita, this province ranks 14 out of China's 31 provinces in 2017 (National Bureau of Statistics of China, 2017), and, at least in economic terms, can be considered representative of middle-income areas across China. At the same time, this province has the second highest number of nationally designed poverty counties in comparison with all provinces in China (National Bureau of Statistics of China, 2017). Additionally, over 99% of the population in the province is Han, the ethnicity in China that counts for 92% of the nation's overall population (National Bureau of Statistics of China, 2017). Therefore, although this province is not poor overall, the sample area can be considered representative of poor rural areas in the typical Chinese province.

We followed a three-step protocol to select the study sample (Figure 1). First, we included all townships in the sample counties, except (a) the one township in each county that housed the county seat; and (b) townships that did not have any villages with at least 800 people. These exclusion criteria were chosen to ensure a purely rural sample and increase the likelihood that sampled villages had a sufficient number of children in our target age range (6–24 months). After applying these two exclusion criteria, our final sample included 100 townships in 20 counties.

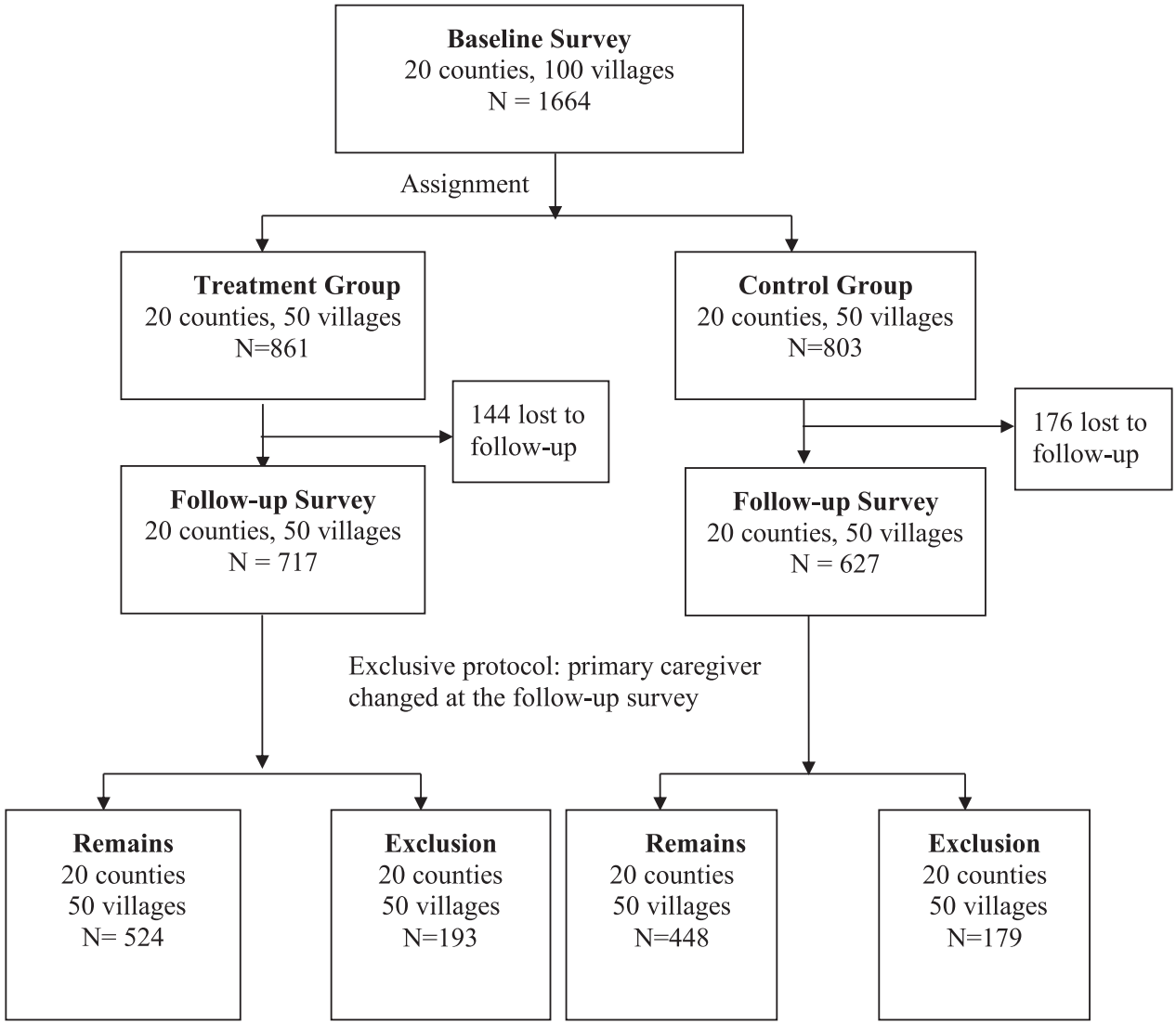

FIGURE 1 Trial profile

Second, within each township, we randomly selected one village for inclusion in our study, totaling 100 villages. To ensure that all sample villages would have the space to conduct our interventions, we excluded villages that could not supply to the project team a 60–80 m^2 space at no cost (e.g., an abandoned village school or village office space that was not being used). If a village did not have the available space, it was replaced with a randomly-selected village from within the same township.

Finally, after the selection of the sample villages, we selected sample families (i.e., young children and their caregivers) for participation in the study. To do so, we obtained a list of all registered births over the past 24 months from the local family planning official in each sample village. All children in our desired age range (6–24 months) and their primary caregivers were enrolled in the study. In total, our baseline sample included 1664 caregiver-child dyads from 100 villages in the 20 sample counties.

After sampling, we conducted a baseline survey of sampled caregivers and children. Following the baseline survey (described below), we randomly assigned 50 sample villages to the treatment group and 50 villages to the control group. Randomization was stratified within counties. Parenting centers were built in all villages assigned to the treatment group; villages assigned to the control group did not receive any intervention. We did not use a placebo in the control group for ethical and practical reasons, and caregivers were not aware that they were in an RCT. At the time of the baseline survey, neither villages nor enumerators were informed of either the overall design of the study or the nature of group assignment.

All subjects gave written informed consent in accordance with the Declaration of Helsinki. Before conducting the baseline and the follow-up survey, enumerators were required to introduce the contents of the survey to the subjects and obtain written consent from each subject. After the baseline survey and before the parenting

centers were opened, the research team introduced the parenting center program to households in each treatment village and obtained written consent of voluntary participation from each treatment child's primary caregiver.

Intervention and implementation

In each of the villages assigned to the treatment group, we constructed parenting centers using the space supplied by the local village leadership committee. The research team uniformly provided all parenting centers with a large play area, as well as toys, baby books, and child-friendly decorations (e.g., colorful walls, non-lead-based paint, and soft floors). The parenting centers were designed to be open 5 hours per day and 6 days per week. All caregivers living in the village with children aged 3–36 months were invited to visit centers at any time during the operating hours, but they were not allowed to leave their children alone in the parenting centers.

Each parenting centre was staffed by two parenting trainers from the local township-level Health & Family Planning Commission (HFPC), who conducted weekly one-on-one training sessions for caregivers and their children on interactive parenting practices to stimulate child development. Before the start of the intervention, all parenting trainers underwent comprehensive training in child development and the structured parenting curriculum used in this intervention, which was conducted by the Training & Communication Center of the National HFPC.

The week-by-week parenting training curriculum is derived from Reach Up and Learn, a curriculum developed and evaluated in Jamaica by Walker et al. (2010). The curriculum was adapted by child development experts in China to fit both child development needs and the local environment in rural China. The curriculum aims to teach caregivers how to engage in stimulating interactions with their children through the stage-based, age-appropriate activities. It consists of weekly interactive training sessions targeting caregivers of children aged 6 to 36 months (124 training courses in total). Each month consists of activities (involving both caregivers and children) designed to teach caregivers how to interact with their children in ways that stimulate development in four dimensions considered essential by child development experts: (1) cognitive, (2) psychomotor, (3) language, (4) social-emotional development. The length of each session varies from 30 to 40 min, depending on the content of the specific activity. This curriculum has previously undergone field testing and evaluation in rural China by the National HFPC and our research team, and has shown positive impacts on child development (Sylvia et al., 2018).

In addition to the weekly one-on-one parenting sessions, caregivers and children were offered a variety of activities any time the centers were open. Caregivers were encouraged to bring children to the centers frequently to explore, play, socialize with other children and participate in organized activities such as story time and singing. Although our intervention did not include any components to specifically target caregiver mental health, the parenting centers may have provided opportunities for caregivers to give and receive emotional support via informal interactions with other caregivers in the parenting centers. Research has suggested that people with similar experiences (such as caregivers of young children) can better relate to one another and therefore offer more authentic empathy and validation (Mead & MacNeil, 2006), which may positively impact mental health.

Each parenting center was administered by a full-time center manager, a local mother from the village who was responsible for daily center maintenance. Responsibilities included regularly disinfecting toys, tidying up, ensuring caregiver and child adherence to center rules, and leading weekly group reading and singing activities. The center manager was also responsible for recording program participation. For each visit to the parenting center, the center manager recorded the caregiver's name, the date, and the relationship between the caregiver and the child.

Data collection

The data presented in this study were collected in two survey rounds: a baseline survey beginning in December 2015, and a follow-up survey conducted 1 year after the baseline survey. Both surveys collected data in two blocks. In the first block, the research team collected information on caregiver mental health. All caregivers were administered the Depression Anxiety and Stress Scale-21 (henceforth, DASS-21), a shortened version of the DASS-42 Scale developed by Lovibond and Lovibond (Lovibond & Lovibond, 1995). The DASS-21 is a self-report questionnaire consisting of 21 items that measure distress levels over the previous week along three dimensions—depression, anxiety and stress. The DASS-21 cannot be interpreted as a tool for direct clinical diagnosis, but it is designed to be a quantitative measure of the severity of depression, anxiety, and stress symptoms. Studies have demonstrated the high construct validity of the DASS-21 and established the cross-cultural validity of the DASS-21 in China (Chan et al., 2012; Henry & Crawford, 2005; Wang et al., 2015).

Scores for each of the three DASS-21 subscales (depression, anxiety and stress) were derived by totaling the scores for each subscale and multiplying by 2. Final scores ranged from 0 to 42, with higher scores indicating increasing severity of depression, anxiety, or stress. We use these continuous scores as a measure of the severity of mental health issues among sample caregivers.

In addition, we created a binary variable to measure the prevalence of caregivers who were symptomatic of mental health issues (where 1 = symptomatic and 0 = not symptomatic). To do so, we used cutoff scores cited in previous studies (Chan et al., 2012; Wang et al., 2015), which consider someone to be symptomatic if they score 10 or above on the depression subscale, 7 or above on the anxiety subscale, and 14 or above on the stress subscale.

The second block of the survey collected detailed information on child, caregiver and household characteristics. Each child's primary caregiver was self-identified as the individual most responsible for the child's care (typically the child's mother or grandmother). The primary caregiver was then administered a survey of child characteristics including the child's gender, birth order, breastfeeding history, and how many times the child was ill in the past 2 weeks. Each child's age and birth weight were obtained from his or her birth certificate. In addition, nurses from Xi'an Jiaotong Medical School collected data on hemoglobin concentrations from all children. Hemoglobin concentrations were measured using HemoCue Hb 201+ finger-prick systems (HemoCue Ltd.). Child characteristics were included as control variables in our subsequent analyses.

We also collected information on the characteristics of each household. These include the primary caregiver's age and education level, grandmother's health status, whether the father and mother lived at home with the child, whether the household was receiving Minimum Living Standard Guarantee Payments (a form of government welfare for the lowest income families nationwide, henceforth referred to as welfare payments), and family asset value. Family asset value was determined using polychoric principal component analysis based on whether the household owned or had access to the following items: tap water, a toilet, a water heater, a washing machine, a computer, Internet, a refrigerator, an air conditioner, a motorcycle or electric bicycle, and a car.

In addition to the two blocks described above, the follow-up survey also collected parenting center participation records for children and caregivers in the treatment group. During the intervention, the center managers recorded each visit to the parenting center, including the caregiver's name, the date, and the relationship between the caregiver and the child. This information was used to determine the share of caregivers who took their child to the parenting centers at least once per week on average.

Balance

At baseline, a total of 1664 caregiver-child dyads were enrolled in our study, including 861 from 50 villages in the treatment group, and 803 from 50 villages in the control group. Of the 1664 caregiver-child dyads enrolled, 320 were lost to follow-up after 1 year of intervention, including 144 from the treatment group and 176 from the control group. In addition, 372 dyads (193 from the treatment group and 179 from the control group) were excluded after the follow-up survey due to change of the child's primary caregiver. This means that for 372 families, a different caregiver was interviewed and finished the DASS-21 questionnaire at the baseline and the follow-up surveys, which means that we were unable to collect mental health data from the same caregiver over the two survey waves. Our final sample therefore consists of 972 caregiver-child dyads (58.41% of the enrolled sample), including 524 children and their caregivers in the treatment group and 448 in the control group. Basic socioeconomic and demographic characteristics of the participants are reported in Table 1.

To ensure that group assignment remained balanced between the treatment and control groups after attrition and exclusion, we conducted a series of balance tests. First, we tested whether or not our assignment was balanced at the time of the baseline survey (Table 1). The balance analysis shows that there were no statistically significant differences between the treatment and control groups in terms of 18 child and household characteristics.

Second, we tested the balance between the treatment and control groups for the attrited sample of 320 caregiver-child dyads (Appendix A, Table A1) and the excluded sample of 372 dyads (Table A2). Among the attrited sample, we find that only one variable was unbalanced: grandmothers in the control group tended to be less healthy than grandmothers in the treatment group ($t(327) = -2.699$, $p = .007$). However, among the excluded sample, the two groups are balanced in all of the 18 variables measured. Additionally, when we test the balance of all dyads that were lost to follow up (both attrition and exclusion—Table A3), we find no significant differences between the treatment and control groups.

Finally, we conducted a balance test of the remaining sample after both attrition and exclusion (Table A4). The results show no significant differences between the two groups in any of the 18 variables. This means that exclusion and attrition did not create any bias in estimating the treatment effects of the parenting centers on caregiver mental health.

Power calculation for the remaining sample

We also calculated the power provided by the remaining sample after attrition. In the analytical sample, the intracluster correlation coefficient is .03 for depression, .06 for anxiety, and .04 for stress. The proportion of variation in follow-up mental health scores explained by the baseline scores is 30% for depression, 34% for anxiety, and 33% for stress. The average cluster size was 9.7 caregiver-child dyads in 50 pairs of treatment-control comparisons. Given these parameters, we calculated that we have 80% power to detect effects of 0.20 *SD* for depression, 0.21 *SD* for anxiety, and 0.21 *SD* for stress.

TABLE 1 Descriptive statistics and balance at follow-up (Obs. = 972)

	(1) Control (n = 524)	(2) Treatment (n = 448)	Difference (1)–(2)
	M (SD)	M (SD)	p-value
Child characteristics			
Age (months)	14.93 (5.48)	14.93 (5.37)	0.990
Male (1 = yes)	0.54 (0.50)	0.49 (0.50)	0.126
Low birth weight (1 = yes)	0.03 (0.16)	0.04 (0.21)	0.180
First born (1 = yes)	0.47 (0.50)	0.46 (0.50)	0.807
Ever breastfed (1 = yes)	0.90 (0.31)	0.86 (0.35)	0.123
Anemic (1 = Hb below 110 g/L)	0.42 (0.49)	0.41 (0.49)	0.954
Days ill past month (days)	3.20 (3.99)	2.85 (3.58)	0.213
Household characteristics			
Government welfare recipient (1 = yes)	0.11 (0.31)	0.12 (0.33)	0.806
Family asset index (PCA score)	−0.91 (1.25)	−0.76 (1.19)	0.354
Mother at home (1 = yes)	0.78 (0.42)	0.77 (0.42)	0.950
Father at home (1 = yes)	0.44 (0.50)	0.48 (0.50)	0.407
Mother is the primary caregiver at baseline	0.72 (0.45)	0.72 (0.45)	0.961
Grandmother is the primary caregiver at baseline	0.27 (0.46)	0.28 (0.46)	0.555
Caregiver age (1 = 30 years and above)	0.56 (0.50)	0.59 (0.49)	0.439
Caregiver education ≥9 years (1 = yes)	0.15 (0.36)	0.15 (0.36)	0.859
Grandmother health (1 = healthy)	0.54 (0.50)	0.60 (0.49)	0.215

Note: Data are presented in mean and standard deviation; no asterisks in the main body of the table indicates that none of the estimated coefficients are significant. PCA refers to principal components analysis.

Data source: Authors' survey.

Statistical approach

Our statistical analysis consists of three parts. First, we estimated the impact of the parenting centers on caregiver mental health using intention-to-treat (ITT) analysis. We conduct an adjusted analysis to increase statistical power by controlling for baseline child, caregiver and household characteristics, caregiver mental health status at baseline, and interviewer fixed effects. Child characteristics include the child's gender and age in months, whether the child had a low birth weight, whether the child was ever breastfed, whether the child is anemic, and number of days the child was ill in the last 2 weeks. Household characteristics include whether the mother was the primary caregiver, whether the caregiver was 30 years old or above, whether the caregiver completed at least 9 years of education, whether the grandmother was healthy, whether the mother was at home, whether the father was at home, whether the household received welfare payments, and family asset index.

The ITT model captures the effect of being offered the chance to participate in the program. However, some caregivers attended the parenting centers frequently, while others attended the parenting centers relatively infrequently. Therefore, the second part of our analysis examines the effect of the intervention on caregivers who regularly attended the parenting centers using local average treatment effect (LATE) analysis. Specifically, in this paper, our LATE analysis scales up the treatment effect to examine only the subsample of caregivers who attended the parenting centers at least once per fortnight, on average, so as to better understand the true impacts of the treatment on the treated. Although non-primary caregivers were allowed to attend parenting centers with their child (and many did), only primary caregivers are considered here, as only primary caregivers were administered the DASS-21 at baseline and follow-up. Participation records show that primary caregivers account for about 80% of all visits.

In addition to our main analysis, we also conduct a subgroup analysis to estimate differential program effects on mental health based on caregiver characteristics. To do this, we conducted a review of the literature to identify potential factors related to caregiver mental health. Based on this review, created subgroups by family asset value (quartiles), caregiver education level (≥9 years or <9 years), grandmother's health status (whether the grandmother is healthy or unhealthy), child age (6–15 months or 15–24 months), and identity of the primary caregiver (mother or grandmother). We then re-conducted our ITT and LATE analyses for each subgroup.

Analysis was conducted using STATA 14.2 (StataCorp). All analyses calculated robust standard

errors to adjust for clustering at the village level. *p*-values below .05 are considered statistically significant.

RESULTS

Prevalence of caregiver mental health issues

Table 2 presents the prevalence of caregiver mental health issues in the treatment and control groups at baseline and at follow-up. The data show that 19.8% of caregivers in the treatment group and 20.8% of the caregivers in the control group showed depressive symptoms at baseline, and the prevalence became 19.8% and 21.8% at the time of the follow-up survey, respectively. About 25.5% of treatment caregivers and 25.6% control caregivers had anxiety symptoms at the baseline survey, while 26.4% and 29.1%, respectively, had anxiety symptoms at follow-up. Finally, 11.7% of treatment caregivers and 13.1% of control caregivers showed stress symptoms at the baseline survey; the prevalence was 13.3% and 15.9% at the follow-up survey, respectively. The results show no significant differences in the prevalence or severity of mental health issues between the treatment and control groups at either baseline or follow-up.

TABLE 2 Description of caregiver mental health problems at baseline and follow-up ($N = 972$)

	(1) Treatment ($n = 524$)	(2) Control ($n = 448$)	Difference (2)–(1)
Panel A: Prevalence of caregivers with symptoms			
Depression symptoms (1 = yes)			
Baseline	0.198 (0.406)	0.208 (0.399)	−0.010
Follow-up	0.198 (0.413)	0.218 (0.399)	−0.020
Anxiety symptoms (1 = yes)			
Baseline	0.255 (0.437)	0.256 (0.436)	−0.001
Follow-up	0.264 (0.455)	0.291 (0.441)	−0.027
Stress symptoms (1 = yes)			
Baseline	0.117 (0.338)	0.131 (0.322)	−0.014
Follow-up	0.133 (0.358)	0.159 (0.340)	−0.026
Any symptoms (1 = yes)			
Baseline	0.331	0.331	0.000
	(0.471)	(0.471)	
Follow-up	0.368	0.351	0.017
	(0.482)	(0.478)	
Panel B: Standardized mental health scores			
Depression scores			
Baseline	−0.053 (0.954)	−0.103 (0.937)	0.050
Follow-up	−0.078 (0.887)	−0.026 (1.021)	−0.052
Anxiety scores			
Baseline	−0.085 (0.883)	−0.063 (0.954)	−0.022
Follow-up	−0.028 (0.957)	−0.031 (1.043)	0.003
Stress scores			
Baseline	−0.067 (1.002)	−0.133 (0.934)	0.066
Follow-up	−0.022 (0.966)	0.020 (1.044)	−0.042

Note: Data are presented in mean and standard deviation; no asterisks in the main body of the table indicates that none of the estimated coefficients are significant.

Data source: Authors' survey.

Effect of parenting centers on caregiver mental health

Table 3 shows the ITT estimated treatment effects of the parenting centers on depression, anxiety, and stress symptoms among caregivers. For each outcome, we report the impact estimates on standardized depression, anxiety and stress scores using ordinary least squares regressions. We find that the treatment effects on depression, anxiety and stress are not statistically significant. We also examine the ITT effects of the parenting centers on the prevalence of depression, anxiety, and stress symptoms using logit regressions (Appendix B, Table B1). The results similarly find no significant impacts on the prevalence of mental health symptoms among caregivers in the treatment group.

However, the data show that compliance with the treatment was not perfect, with only 56.44% of the caregivers in the treatment group attending the parenting centers at least once per fortnight. To account for the imperfect compliance in our sample, we conduct an LATE analysis of treatment effects on caregivers who attended the parenting centers at least fortnightly (Table 4). Similar to the ITT effects, we find that for this group of caregivers who regularly participated in the ECD intervention, the intervention had no significant effects on the prevalence of depression, anxiety or stress symptoms.

Subgroup analysis

Table 5 reports the results of our subgroup analysis using the ITT model. We find mixed treatment effects on depression for caregivers with different family asset levels: whereas the prevalence of depression decreased for caregivers in the top quartile of family assets, the prevalence increased for caregivers in the upper-middle and bottom quartiles. Specifically, for caregivers in the top 25% of family assets, the parenting centers decreased the prevalence of depression by 12.5% ($p = .031$). However, for caregivers in the upper-middle family asset quartile (top 50%–75%), the parenting centers increased the prevalence of depression by 12.5% ($p = .021$). The negative effects of the parenting centers were even greater for caregivers in the bottom 25% of family assets: for this subgroup, the intervention increased the prevalence of depression by 15.5% ($p = .011$). The effects of the intervention on mental health among caregivers in the lower-middle family

TABLE 3 Effect of parenting centers on caregiver mental health, intention-to-treat analysis

	Depression		Anxiety		Stress	
	Standardized score[a]	At risk (1 = yes)[b]	Standardized score[a]	At risk (1 = yes)[b]	Standardized score[a]	At risk (1 = yes)[b]
Treatment (1 = yes)	0.008 (0.054)	0.037 (0.025)	0.071 (0.062)	0.055 (0.028)	−0.009 (0.061)	0.025 (0.020)
Mental health status at baseline	Yes	Yes	Yes	Yes	Yes	Yes
Child characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Family characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Village fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	963	963	963	963	961	961

Note: Data are presented in coefficients and standard errors.

[a]Standard score is the DASS-21 standardized score in each subscale.

[b]At risk is a dummy variable that takes the value of 1 if a caregiver shows symptoms of depression, anxiety, or stress, correspondingly and 0 if not.

Data source: Authors' survey.

TABLE 4 Effect of parenting centers on caregiver mental health, local average treatment effect analysis

	Depression		Anxiety		Stress	
	Standardized score[a]	At risk (1 = yes)[b]	Standardized score[a]	At risk (1 = yes)[b]	Standardized score[a]	At risk (1 = yes) [b]
Treatment (1 = yes)	0.013 (0.081)	0.060 (0.037)	0.116 (0.093)	0.082 (0.043)	−0.015 (0.091)	0.040 (0.030)
Baseline mental health status	Yes	Yes	Yes	Yes	Yes	Yes
Child characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Family characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Village fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	963	963	963	963	961	961

Note: Data are presented in coefficients and standard errors.

[a]Standard score is the DASS-21 standardized score in each subscale.

[b]At risk is a dummy variable that takes the value of 1 if a caregiver shows symptoms of depression, anxiety, or stress, correspondingly and 0 if not.

Data source: Authors' survey.

asset quartile (25%–50%) are not statistically significant, and we find no significant heterogenous treatment effects by family asset value on caregiver anxiety or stress. In addition, we find that the parenting centers had a significant negative impact on the prevalence of anxiety among caregivers who are mothers. For mother caregivers, the parenting centers increased the prevalence of anxiety by 5.8% (p = .036). However, the treatment effect on grandmothers was not statistically significant.

As a robustness check, we also conducted a moderation analysis by interacting the demographic characteristics on the treatment in our ITT model (Appendix C, Table C1). Similar to the subgroup analysis, caregivers show varying impacts by family asset index and primary caregiver identity. The prevalence of depression increased among caregivers in the bottom 25% of family assets but decreased for those in the lower-middle and upper quartiles. The prevalence of anxiety also increased for mothers, but not for grandmothers.

Table 6 reports the results of our subgroup analysis on compliers (using the LATE model). The effects by family asset quartile are consistent with the results of our ITT analysis in Table 5. Specifically, attending parenting centers fortnightly or more decreased the prevalence of depression by 22.2% among caregivers in the top 25% of family assets (p = .005), yet increased the prevalence of depression by 21.0% among caregivers in the upper-middle quartile (top 50%–75% of family assets) and by 25.5% among caregivers in the bottom 25% of family assets (p = .003; p = .004). The LATE estimations of the treatment effects by primary caregiver type were similarly consistent with our ITT estimations in Table 5. We find that among caregivers who attended the parenting centers at least fortnightly, the intervention increased the prevalence of anxiety for mother caregivers by 9.5% (p = .016), and the prevalence of stress for mother caregivers by 5.9% (p = .023), but it had no significant effects on grandmother caregivers. There were no significant effects on depression

TABLE 5 Effect of parenting centers on mental health by caregiver subgroups, intention-to-treat analysis

	Depression		Anxiety		Stress	
	Standardized score[a]	At risk (1 = yes)[b]	Standardized score[a]	At risk (1 = yes)[b]	Standardized score[a]	At risk (1 = yes)[b]
Family asset quartiles						
1st (n = 267)	0.151 (0.141)	0.155 (0.059)*	0.259 (0.167)	0.083 (0.079)	0.166 (0.152)	0.003 (0.061)
2nd (n = 216)	−0.218 (0.175)	−0.089 (0.087)	−0.114 (0.160)	−0.033 (0.092)	−0.228 (0.168)	−0.049 (0.060)
3rd (n = 248)	0.110 (0.138)	0.125 (0.052)*	0.087 (0.133)	0.092 (0.067)	−0.010 (0.150)	−0.050 (0.060)
4th (n = 232)	−0.163 (0.120)	−0.125 (0.056)*	0.108 (0.155)	0.067 (0.063)	−0.114 (0.166)	−0.010 (0.039)
Primary caregiver						
Mother (n = 691)	0.021 (0.049)	0.032 (0.026)	0.076 (0.050)	0.058 (0.029)*	0.032 (0.059)	0.036 (0.020)
Grandmother (n = 267)	−0.082 (0.228)	0.003 (0.078)	0.066 (0.244)	0.096 (0.077)	−0.185 (0.211)	−0.039 (0.065)
Caregiver education						
≥9 years (n = 145)	−0.133 (0.163)	−0.015 (0.111)	−0.018 (0.214)	−0.047 (0.120)	−0.287 (0.250)	0.003 (0.085)
<9 years (n = 818)	0.005 (0.065)	0.040 (0.029)	0.049 (0.072)	0.047 (0.034)	−0.025 (0.069)	0.019 (0.024)
Grandmother health						
Unhealthy (n = 415)	0.044 (0.118)	0.070 (0.050)	0.104 (0.116)	0.061 (0.057)	0.097 (0.117)	0.011 (0.035)
Healthy (n = 548)	0.008 (0.071)	0.025 (0.034)	0.014 (0.074)	0.032 (0.039)	−0.102 (0.082)	−0.019 (0.031)
Child age						
6–15 months (n = 493)	0.015 (0.076)	0.057 (0.040)	0.103 (0.084)	0.030 (0.040)	0.029 (0.091)	0.034 (0.028)
16–24 months (n = 470)	0.019 (0.096)	0.043 (0.045)	0.067 (0.090)	0.057 (0.044)	−0.041 (0.097)	0.024 (0.041)

Note: Data are presented in coefficients and standard errors; every pair of coefficient and standard error stands for an independent regression.

[a]Standard score is the DASS-21 standardized score in each subscale.

[b]At risk is a dummy variable that takes the value of 1 if a caregiver shows symptoms of depression, anxiety, or stress, correspondingly and 0 if not.

*p < .05.

Data source: Authors' survey.

for mothers or grandmothers. In addition, our LATE analysis finds a significant effect on stress by caregiver education level. Specifically, the parenting centers decreased standardized stress scores by 0.72 points for caregivers with at least 9 years of education (p = .046). We do not find any other significant effects of the intervention on caregiver subgroups in either the ITT or the LATE analysis.

DISCUSSION

We find widespread mental health issues among caregivers in rural China, especially depression and anxiety. The share of caregivers with depression symptoms in our sample was between 19.8% and 21.8%, while between 25.5% and 29.1% of caregivers had symptoms of anxiety. The prevalence of stress symptoms was between 11.7% and 15.9%. These results are close to not only previous studies conducted in the same region of rural China, but also the prevalence of mental health issues across LMICs, which research has found to be 19.8% (Fisher et al., 2012; Zhang et al., 2018). Moreover, our findings indicate that mental health issues do not significantly decrease with child age. This is also consistent with current studies, which suggested persistence of mental health issues among caregivers during the early child-rearing years beyond the postpartum period (Mclennan et al., 2001).

This study initially hypothesized that the parenting center intervention may, as a spillover effect, reduce the prevalence of caregiver mental health issues. However, the ITT analysis did not find a significant impact on the mental health of caregivers in the treatment group. The LATE analysis of caregivers who attended parenting centers at least fortnightly on average found similar results for depression and stress, indicating that the insignificant effects of the parenting centers on caregiver mental health were not due to a lack of participation. In fact, this is consistent with the findings of other pure ECD interventions, which have also found null effects on caregiver mental health (Attanasio et al., 2014; Chang et al., 2015; Nahar et al., 2014).

Although the literature to date is unable to conclusively answer why certain ECD interventions have significantly improved caregiver mental health while the others have not, suggested mechanisms include social support and improved ECD outcomes (Jeong et al., 2019;

TABLE 6 Effect of parenting centers on mental health by caregiver subgroups, local average treatment effect analysis

	Depression		Anxiety		Stress	
	Standardized score[a]	At risk (1 = yes)[b]	Standardized score[a]	At risk (1 = yes)[b]	Standardized score[a]	At risk (1 = yes)[b]
Family asset quartiles						
1st (n = 267)	0.247 (0.180)	0.255 (0.084)***	0.423 (0.221)	0.135 (0.100)	0.271 (0.201)	0.005 (0.076)
2nd (n = 216)	−0.318 (0.178)	−0.129 (0.084)	−0.168 (0.161)	−0.048 (0.093)	−0.332 (0.175)	−0.071 (0.060)
3rd (n = 248)	0.185 (0.173)	0.210 (0.068)***	0.145 (0.164)	0.153 (0.086)	−0.017 (0.183)	0.083 (0.072)
4th (n = 232)	−0.290 (0.154)	−0.222 (0.071)***	0.193 (0.207)	0.119 (0.084)	−0.194 (0.207)	−0.017 (0.048)
Primary caregiver						
Mother (n = 691)	0.034 (0.071)	0.052 (0.037)	0.124 (0.072)	0.095 (0.042)**	0.052 (0.085)	0.059 (0.029)**
Grandmother (n = 267)	−0.131 (0.273)	0.004 (0.093)	0.106 (0.294)	0.152 (0.095)	−0.295 (0.250)	−0.062 (0.077)
Caregiver education						
≥9 years (n = 145)	−0.355 (0.277)	−0.045 (0.193)	−0.046 (0.304)	−0.118 (0.171)	−0.723 (0.359)**	0.008 (0.134)
<9 years (n = 818)	0.008 (0.095)	0.065 (0.043)	0.080 (0.105)	0.076 (0.050)	−0.040 (0.100)	0.030 (0.035)
Grandmother health						
Unhealthy (n = 415)	0.068 (0.150)	0.109 (0.064)	0.161 (0.145)	0.094 (0.071)	0.150 (0.147)	0.018 (0.045)
Healthy (n = 548)	0.013 (0.104)	0.042 (0.050)	0.024 (0.108)	0.054 (0.056)	−0.170 (0.118)	0.031 (0.044)
Child age						
6–15 months (n = 493)	0.029 (0.121)	0.065 (0.058)	−0.062 (0.122)	0.035 (0.052)	−0.062 (0.122)	0.035 (0.052)
16–24 months (n = 470)	0.027 (0.113)	0.100 (0.059)	0.050 (0.136)	0.059 (0.042)	0.050 (0.136)	0.059 (0.042)

Note: Data are presented in coefficients and standard errors; every pair of coefficient and standard error stands for an independent regression.

[a]Standard score is the DASS-21 standardized score in each subscale.

[b]At risk is a dummy variable that takes the value of 1 if a caregiver shows symptoms of depression, anxiety, or stress, correspondingly and 0 if not.

**p < .01.; ***p < .001.

Data source: Authors' survey.

Pitchik et al., 2020). Although parenting centers in our study increased child cognitive development (Sylvia et al., 2021), a lack of sufficient social support may contribute to the overall null effects. As we elaborated in the introduction section, ECD interventions are more likely to improve the mental well-being of caregivers when they include specific components of mental health or when they deliver the interventions in mental-friendly ways. The parenting centers in our study did not include any components specifically targeting mental health, and although the intervention format may have provided caregivers with opportunities to interact and communicate with each other, mental health-friendly delivery strategies were not thoroughly developed, which may explain why we see no significant treatment effects. Parenting interventions might successfully improve mental health by integrating esteem-enhancing instructional techniques that support the emotional well-being of caregivers and by incorporating methods and practices that specifically target caregiver mental health.

When we examined the effects of the parenting centers on different caregiver subgroups, we found a small number of significant treatment effects. Our subgroup analyses using ITT and LATE models showed that the parenting centers decreased the prevalence of depression among caregivers from families with relatively higher asset values yet increased the prevalence of depression among caregivers from families with lower asset values. The results of our LATE analysis also found that when caregivers came to the parenting centers at least once per fortnight on average, the intervention decreased the stress levels of caregivers from families with mid-range asset values, as well as caregivers with education levels above middle school.

Although the exact mechanisms are unclear, one possible reason for these findings may be that the parenting center format the intervention highlighted socioeconomic disparities among caregivers. Since the parenting centers bring together caregivers from different family asset quartiles and education levels (two main aspects of socioeconomic status), perceived differences in socioeconomic status may affect the self-esteem of caregivers, which may in turn have influenced mental health. Self-esteem, referring to confidence in

one's own worth or ability, has been found to have significant and positive associations with socioeconomic status (MacDonald et al., 2003). High self-esteem may protect against depression, while low self-esteem is a symptom of depression and may be linked to depression onset (Orth & Robins, 2013). It is possible that caregivers from poorer families (with lower family asset levels) compared themselves negatively to caregivers from wealthier families (with higher family asset levels), leading to lower self-esteem. In contrast, caregivers from wealthier families may have developed more positive self-esteem by comparing themselves favorably to poorer families. Visible disparities among caregivers attending the parenting centers thus may have contributed to reduced depression among wealthier and more educated caregivers and increased depressive symptoms among poorer caregivers.

Our intervention appears to have increased the anxiety of mothers in both the full treatment group and among regular attendees, as well as stress among regularly attending mothers, while the mental health of grandmothers showed no significant changes. One possible explanation for this unexpected finding is that experiences in the parenting centers, either during parenting training sessions or group activities, may have led mothers to develop new worries regarding the quality of their parenting. Indeed, worry can lead to disordered or maladaptive anxiety and stress (Clark, 1999; Gana et al., 2001). Because parenting centers educate caregivers on appropriate parenting practices, mothers may perceive direct or implied criticism about their parenting, either from other mothers or from parenting trainers who do not use esteem-enhancing instruction. Negative interactions with trainers or other caregivers in the parenting centers may also cue mothers to worry about their parenting mistakes, contributing to the observed higher rates of anxiety and stress among mothers in our sample. These negative consequences further reinforce the need for parenting interventions to provide well-defined treatment components that target caregiver mental health, such as esteem-enhancing techniques and assessments of the strengths and needs of each caregiver that reinforce rather than undermine their mental health.

In contrast, additional experience of childrearing might give grandmother caregivers relatively more confidence in their parenting, which keeps them from being psychologically affected by the intervention. On the other hand, it is also possible that grandmother caregivers may not be as engaged in childrearing for other practical or physiological reasons. Grandmother caregivers usually have more responsibilities in the home, and often take on the role of primary caregiver only when a child's parents have out-migrated. This suggests that grandmothers in our sample do not cohabitate with the child's mother, who would be able to reduce the burden of childcare and housework. Moreover, a simple lack of energy and divided attention between more family members may present issues for aging grandmother caregivers. Given these additional home responsibilities, grandmothers may not have the energy to reflect on the quality of their parenting, leading to no effects on anxiety.

Taken together, although parenting centers did not improve caregiver mental health in general, the findings in this study provide valuable information on how to advance future ECD interventions. Specifically, the results suggest that future ECD interventions should incorporate components targeting the mental health of caregivers. Given the success of past interventions that have targeted mental health, future studies can consider the following ways to improve their interventional formats. First, future interventions can offer structured social and emotional support through group activities for caregivers to share their feelings and experiences. Second, parenting interventions can employ encouraging language and teaching styles to avoid placing unnecessary mental pressure on caregivers and to improve their self-esteem. Finally, the heterogeneous effects by family assets on depression and by education level on stress show that parenting centers might widen inequalities of mental well-being among populations with different social gradients, which should be taken into account.

This study makes three key contributions to the literature on ECD interventions and caregiver mental health issues in LMICs. First, ours is the first study to analyze the effects of parenting centers on the mental health of caregivers of children under age three. Our parenting center intervention differs from previous studies of ECD interventions in LMICs, which have typically used home visiting or group parental training formats to deliver the intervention. The parenting center model for ECD interventions is being upscaled by policymakers in China and internationally, and our paper provides important information on how this specific format of ECD interventions can affect the well-being of participants. Importantly, we provide evidence that parenting center programs can have mixed effects on caregiver mental health, drawing attention to the potential unintended consequences of ECD interventions for caregiver well-being, despite benefits to child development. In addition, the design of our study offers important information about scaling up interventions. We delivered our one-on-one parenting lessons via government public health workers, which has been suggested as an effective method to accelerate scale-up (Richter et al., 2017). Moreover, we used local government resources and local community members to implement our intervention, which has been suggested an effective way to promote programs (Black et al., 2017). Finally, we provide evidence that parenting center programs may have heterogenous effects on caregiver mental health, showing potential unintended consequences of ECD interventions on caregiver mental health.

Despite these strengths, our study has three significant limitations. First, although our final sample was balanced across treatment arms and achieved enough statistical power, the combined rate of attrition and exclusion (42%) is high. Second, although we can offer some suggestive evidence, we are still unable to definitively explain why the parenting center intervention was ineffective at improving caregiver mental health in general, and why some specific subgroups responded negatively to the intervention. Future studies should collect implementation data to understand the potential mechanisms that drive these unintended consequences of the intervention on caregiver mental health. Finally, although the parenting centers offered opportunities for caregivers to interact and provide social support to each other, we do not know exactly how much each caregiver interacted and communicated with other caregivers. For this reason, we cannot draw conclusions on the amount of social support necessary to improve the mental health of caregivers. Further studies are necessary to document and analyze social interactions among caregivers in parenting center interventions.

In summary, our results show that there is a high prevalence of mental health issues among caregivers of young children in rural China. Although the parenting centers are a promising intervention for improving ECD, they did not improve the mental health of caregivers. Given high rates of mental health issues among rural caregivers, there is an urgent need for effective strategies to promote caregiver mental health in China's rural areas. Future ECD interventions should identify drivers of poor mental health among caregivers and develop components to target caregiver mental health within ECD interventions or within the existing maternal and child health infrastructure. Without effective intervention, ongoing mental health issues among caregivers may limit a large fraction of China's rural children from reaching their full potential.

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ETHICAL APPROVAL

Ethical approval for this study was granted by the Stanford University Institutional Review Board (IRB; Protocol ID 35921) and Sichuan University Institutional Review Board (IRB; Protocol ID 2013005-01). All subjects gave written informed consent in accordance with the Declaration of Helsinki.

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