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Parenting at Arm's Length: Early Development and the Absence of Interactive Parenting in Rural China

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Abstract

This study aims to explore parenting and developmental delays in the understudied context of rural China. A sample of 1,442 18-30 months old toddlers and their caregivers were randomly selected from poverty counties in Shaanxi Province. Results from the Bayley Scales of Infant Development show that the prevalence of motor delays is in the normal range but cognitive delays affect 42% of the sample toddlers. According to responses from primary caregivers, parenting in rural China does not focus on providing a stimulating environment and lacks interactive caregiver-toddler activities, such as reading, singing, or playing. Caregivers who reported that they engaged in these activities had better-performing toddlers. Caregivers also lack confidence in their parenting skills and rarely resort to the public health system for parenting advice.

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It has been well established that parenting plays an essential role in shaping a child's development (Bradley et al., 1989; M. Chang, Park, Singh, & Sung, 2009; Gutman & Feinstein, 2010; Walker et al., 2007). When a caregiver interacts suitably and sufficiently with their child, providing a high level of stimulation, the child's cognitive and motor functions develop more fully. In the absence of such early stimulation, a child is at risk of sustaining developmental delays, with consequences hindering their future education, productivity and overall well-being (Gertler et al., 2014; Heckman, 2013, pp. 30–31). Yet, only a few studies (Bornstein & Putnick, 2012; Nonoyama-Tarumi & Ota, 2011) report on parenting quality in low-resource settings, where almost 43% of children under 5 years do not develop to their full potential (Black et al., 2017). We help to fill this gap by considering the understudied context of rural China.

As the research agenda of Early Childhood Development (ECD) has shifted gears from nutrition and immunization to parenting and cognitive stimulation, two principal groups of findings have begun to emerge in relation to low-resource settings. The first pertains to the ECD gains that optimal parenting practices can provide in such settings. To identify such gains, many studies have evaluated parenting-related interventions, ranging from training mothers on caregiving techniques and how to interact with infants and toddlers; to providing toys and other stimulating material as well as increasing the accessibility and quality of pre-school education. The results have been consistently positive. Over the short-run, treated children exhibited higher cognition (Magwaza & Edwards, 1991), higher developmental quotients (Grantham-McGregor, Powell, Walker, & Himes, 1991), greater self-esteem (Kagitcibasi, Sunar, & Bekman, 2001) and better social-emotional development than children in control groups (Gardner, Walker, Powell, & Grantham-McGregor, 2003). The effect sizes were also consistently large, ranging from 0.5 to

1 standard deviation (SD) (Walker et al., 2007). Over the long run, some intervention effects lasted well into adulthood. For instance, twenty years after an intervention that trained mothers on cognitive stimulation skills, Gertler et al. (2014) documented that the earnings of their children, now adults, were 25% higher than the earnings of individuals in a control group.

While insightful on the potential of parenting interventions, this type of scholarship has limited external validity: nearly all of these studies specifically targeted disadvantaged subpopulations of children (pre-term, low birth weight infants, stunted and malnourished children, etc.) rather than the general population at large (Bao, Sun, & Wei, 1999; Gardner et al., 2003; Grantham-McGregor et al., 1991). As a result, their findings consider whether parenting can remedy specific disadvantages, but not whether parenting is a problem in and of itself.

A second group of studies addressed this latter question about population-level practices, mostly through use of the Multiple Indicator Cluster Surveys (MICS). The MICS started in 1995 to address issues pertaining to women and children, with more recent rounds incorporating an ECD component. The resulting studies found evidence that interactive parenting is indeed limited in low-income settings (Nonoyama-Tarumi & Ota, 2011; Walker et al., 2007). For instance, it is estimated that at most one third of caregivers in the developing world provide cognitively stimulating parenting to their children. This is consistent with the observation that optimal parenting requires resources – both monetary and time (Pinderhughes, Nix, Foster, Jones, & The Conduct Problems Prevention Research Group, 2001; Simons, Beaman, Conger, & Chao, 1993). Moreover, similar studies show that parenting quality declines as a country's Human Development Index decreases (Bornstein & Putnick, 2012), suggesting that constraints in income and education can stand in the way of optimal parenting.

Except for the 1995 round of the MICS – when ECD and parenting were yet to be integrated – the surveys did not include China. As a result, rural Chinese parenting remains limited to sociological investigations. In the next section, we review the relevant available literature and provide background to the regional focus of our study.

While China has now joined the ranks of middle-income countries, the country maintains substantial regional disparities, most important of which appear through the urban-rural divide (Xie & Zhou, 2014). According to official estimates, rural net income per capita was below 1,500 USD in 2014 (China Statistical Yearbook, 2015b). As a result, circumstances for impoverished families in rural China are in many ways similar to those in low-income countries. Nevertheless, as it pertains to parenting and ECD, rural China also presents some peculiarities: for example, because of the country's large population entails, investigating ECD in rural China has implications for about 6% of the world's youngest population and almost one third (29%) of all children born in less developed countries (calculation procedure available upon request). Almost 10 million babies are born in rural areas of China every year (Wu & Young, 2012) and as the country moves away from the One-Child policy, which officially ended in October 2016 (Feng, Gu, & Cai, 2016), even more children will be impacted by the early experiences they are subjected to. Among this large population, early nutritional deficiencies are commonplace: anemia affects over half of 6-11 month-old babies (Luo et al., 2014); stunting affects almost one quarter of one-year-old children; and zinc and calcium deficiencies are similarly prevalent (Wu & Young, 2012). Developmental delays among toddlers, however, have not been at the receiving end of much scholarship.

While exploring ECD in rural China could yield important policy insights, it is also arguable that studying parenting in this context is valuable in and of itself. Bornstein and Putnick

(2012) describe how parenting is informed partly by intuition, such as when parents talk to infants who do not yet communicate verbally, and partly by socially constructed notions of parenting, such as the knowledge passed from one generation to another on what constitutes good caregiving. This latter portion differs substantially from one cultural setting to another, making it important to document culturally-specific patterns of rural Chinese parenting. To our knowledge, only one study has investigated the home environment in relation to childhood development in rural China (Wei et al., 2015), finding a major dearth of learning opportunities for children and a high prevalence of depression among caregivers. While this study begins to describe the early experiences of children in rural China, more exploratory investigation is needed to understand how caregivers practice and perceive parenting.

With the overall objective of helping to fill this gap, the goal of this study is to answer three guiding questions. First, how prevalent are cognitive and motor developmental delays among young children living in Shaanxi Province? Second, how is parenting practiced in this region, and can suboptimal parenting practices explain compromised child development? Finally, is suboptimal parenting a byproduct of negative parental attitudes, lack of confidence, or lack of information? This last question is exploratory in nature and aims to provide a more contextual understanding for caregiving practices in rural China.

Methods

Sample selection

We conducted our study in 11 nationally designated poverty counties located in Shaanxi Province. From each of these 11 counties, all townships (the middle level of administration between county and village) were selected to participate in the study, with two exceptions: townships with only small villages (less than 800 residents per village), and the townships that hosts the county seat (which are often wealthier). We then randomly selected one village from each township to participate in the study and obtained a list of all registered births from the local family planning official in each village. If a village had fewer than five toddlers in our desired age range, we randomly selected an additional village from the same township until we selected five children per township. In total, we included 1,442 toddlers from 351 villages. Toddlers were 18-30 months (1.5-2.5 years) old during the data collection period in October, 2014.

Data description

We collected two types of information from each caregiver-toddler dyad: caregiver's responses to a parenting-oriented survey and the results from a direct assessment of early development which we administered to the toddler. In this section, we describe these two types of information in detail.

1. Measuring Parenting Quality

All caregivers were administered a general parenting-oriented survey. The survey questions were carefully adapted from two primary sources: the parenting module of the MICS survey (discussed earlier) and the National Survey of Early Childhood Health (NSECH), developed by the U.S. Centers for Disease Control and Prevention (CDC).

To assess interactive parenting, we asked questions about three focal practices: reading to the child, singing to the child, and playing with the child on the day prior to the survey. Our choice was based on the findings of psychological and biological literature that show these three indicators to be linked with development. Reading and talking to one's child increases both cognitive and early language development (Karrass & Braungart-Rieker, 2005; Murray & Egan, 2014; Raikes et al., 2006). Singing to infants has been shown to increase responsiveness (Shenfield, Trehub, & Nakata, 2003), capture attention (Nakata & Trehub, 2004), and elicit positive cognitive behavior (de l'Etoile, 2006). Children whose caregivers engage with them in interactive play and pretend play are more likely to have better cognitive development, even when verbal interaction is controlled for (Ginsburg, 2007; Tomopoulos et al., 2006).

We selected two additional indicators that describe parent-child interaction: the average daily time that the child spends playing alone (referred to henceforth as *time alone*) and the average daily time that the child spends watching TV or videos (referred to henceforth as *screen time*). While literature examining these two variables shows inconsistent results, they were included for the following reasons. The time alone indicator points to the absence of interactive caregiver-toddler behavior exemplified by the three focal practices. The screen time indicator does a similar job, as watching TV is associated with inhibiting caregiver-toddler interaction (Nathanson & Rasmussen, 2011). As some studies suggest, however, watching TV also embeds within it the varying effects of exposure to different content types (Courage & Setliff, 2009) and engaging in sedentary behavior (Byun, Dowda, & Pate, 2011). As such, interpreting results involving this variable should consider such effects.

In addition to parenting practices, we asked caregivers how they perceived their parenting responsibilities and skills as well as the sources from which they receive their parenting

knowledge. Some of these latter questions were adapted from the Incredible Years Project (IYP, n.d.). Finally, we collected basic demographic information from caregivers including their age, gender, educational attainment, number of children, and poverty status.

2. Measuring Child Development

All toddlers were administered the Bayley Scales of Infant Development (BSID), an internationally-recognized method of assessing cognitive and motor development (Bayley, 1969). More specifically, we conducted the BSID-I, which at the time of our survey was the only version of the test adapted to the Chinese language and environment (Shourong Yi, 1993) and had been used in child development studies throughout urban China (Bao et al., 1999; S. Chang, Zeng, Brouwer, Kok, & Yan, 2013; Wu, Sheng, Shao, & Zhao, 2011).

The BSID-I assesses the child's performance on a series of tasks and produces two standardized scores: the Mental Development Index (MDI), which addresses language and cognitive functions; and the Psychomotor Development Index (PDI), which evaluates motor development (Bayley, 1969). Each of these indices takes into account the child's gestational and chronological ages. Both indices are then scaled to have an expected mean of 100 and a standard deviation of 16. Scores on each index can range between 50 and 150 (Yi, 1995). Mild impairment for each index is defined as $70 \leq MDI < 80$ and $70 \leq PDI < 80$, while moderate or severe impairment for each index is defined as $MDI < 70$ and $PDI < 70$ (Yi, 1995). Toddlers failing to achieve the minimum MDI or PDI score (50) were assigned a score of 49 (Luo et al., 2015).

The test has an inter-rater reliability of 0.99 for each of the two sub-indices (Yi, 1995). The test-retest reliability is high, at 0.82 for MDI and 0.88 for PDI (Yi, 1995). The parallel forms reliability is also high, at 0.85 for MDI and 0.87 for PDI, indicating that the test scores are

consistent when there is a variation in the methods or instruments used in the test (Yi, 1995). This study represents one of the largest administrations of the BSID ever conducted in China, and to our knowledge, the only administration of the BSID ever conducted in rural communities in China's nationally-designated poverty counties.

Sample participants

Table 1 presents basic socioeconomic and demographic characteristics of the study participants. Of the 1,442 toddlers in this study, slightly over half (51.7%) were male – a ratio that mimics the overall gender imbalance in China (China Statistical Yearbook, 2015a). Around 5.2% of sample toddlers were born prematurely and 61.3% were only children. The mother was identified as the primary caregiver for 62.4% of the toddlers; for most of the other children, the grandmother was identified as such. Educational attainment was low overall, with the majority of the mothers (83%) having only completed a middle school education (9 years of schooling) or lower, and only 17% attaining a high school education or higher. Finally, about one-quarter (23.9%) of the sample households reported receiving Minimum Living Standard Guarantee Payments, a form of government welfare for the lowest income families nationwide.

Results

Cognitive and Psychomotor Development

We first consider whether child development is compromised in rural China using descriptive statistics of the study sample. BSID-I measures were available for all 1,442 children and show that the mean MDI score for the sample was 83.7, a full standard deviation below the mean for same age children in China, and the mean PDI score was 105.2.

Table 2 presents the fraction of sample toddlers exhibiting developmental delays, with a breakdown of the delay type and severity. In total, 42.0% of the sample toddlers had MDI scores below 80, indicating some degree of impairment in their cognitive development. Overall, 14.6% of the sample exhibited mild cognitive delays, and over one quarter (27.4%) of the sample exhibited moderate or severe cognitive delays. Psychomotor delays were relatively lower, affecting only 10% of our sample, with 6.0% exhibiting mild delays and 4.2% exhibiting moderate or severe delays.

Parenting practices in rural China

Having established that child development is compromised in rural China, we now describe the rates of stimulating parenting practices followed by caregivers in our sample (Table 3). We find that 67.4% of caregivers did not read to their child; 62.5% of caregivers did not sing to their child; and 60.8% of caregivers did not use toys to play with their child on the day prior to survey administration. On average, children spent around two and a half hours (155 minutes) each day playing alone, and more than one hour (67.6 minutes) per day watching TV.

Can suboptimal parenting practices explain compromised development?

How are parenting skills associated with child development in our sample? To answer this question, we first report a set of bivariate correlations that examine whether toddlers whose caregivers engaged in more stimulating parenting practices were similar to toddlers whose caregivers did not follow the practices (Table 4). The results show significant differences (a threshold for significance is set at $p = 0.05$ for all analyses). The toddlers' MDI and PDI scores are both higher when caregivers read, sang, and played with them, with differences ranging between 3.6 to 9 points (or 0.24 to 0.60 SD). Moreover, toddlers who spent more time alone (relative to the sample average of 155 minutes) had lower MDI scores but comparable PDI

scores to toddlers who spent less than the average time alone. Finally, daily screen time did not mark any developmental differences.

To verify whether these associations are robust, we ran a multivariate analysis model, adjusting for toddler and caregiver characteristics (Table 5). Toddler characteristics include gender, age, premature birth, and whether the child has siblings. Caregiver characteristics include whether the mother is the primary caregiver, maternal educational level and age (regardless of whether she is the primary caregiver), and whether the household received government welfare (a proxy for poverty status).

Our three focal practices maintained consistent associations with the MDI and PDI in the multivariate regression (Table 5). In particular, children scored higher on the MDI by 7.62 points (0.48 SD) on average when their caregivers read to them, 8.16 points (0.51 SD) when their caregivers sang to them, and 5.45 points (0.34 SD) when their caregivers played with them. Similarly, PDI scores were higher by 3.15, 4.38, and 2.94 points (0.20, 0.27, and 0.18 SD) when their caregivers engaged with them in reading, singing, and play activities respectively. As for our two additional indicators, we find that the correlation between time alone and the MDI score loses significance when adjusting for toddler and caregiver characteristics. On the other hand, daily screen time becomes positively associated with the PDI with a low effect size of 1.21 points (0.08 SD).

Examining the parenting landscape in rural China

Given the strong association we find between our three focal parenting practices and developmental outcomes, we next aim to better understand the parenting landscape in rural China. Specifically, we investigate the attitudes of caregivers towards their role as parents, their

confidence in parenting skills, as well as their primary sources of parenting knowledge, with the aim of identifying factors leading to the suboptimal parenting levels we observe.

1. Caregiver attitudes

Caregiver attitudes towards parenting are shown in Table 6 and indicate that a large share of caregivers (88.6%) reported that they enjoyed spending time with their children. Almost all caregivers (91.1%) reported that they generally got along well with their child, and that they found playing with their children to be fun and interesting (83.7%). Tellingly, nearly all (94.9%) of caregivers believe that it is their responsibility to help children learn about the world around them.

Conversely, only small fractions of caregivers reveal negative attitudes regarding parenting. For example, only 10.3% of caregivers report being irritated by their child over the past month. Moreover, only 21.5% agree with the statement that spending time with their child has been stressful.

2. Confidence in parenting skills

The caregivers in our sample show mixed results as to their self-assessed competence in parenting-related skills (Table 7). Even though play activities seem to be easily accessible for a large fraction of the caregivers (69.0%), only half (50.0%) report knowing how to read to their child, and even less (42.7%) report being able to relate to their child.

3. Sources of parenting information

Where do caregivers obtain their knowledge on parenting? Table 8 shows that family members (43.4%) were the most commonly cited source of parenting information. Family was then followed by books or internet (34.6%) and TV (33.1%). Around one quarter of sample caregivers (25.2%) also rely on their own experiences, learning how to parent through trial and

error. Fewer than 12% of caregivers in our sample received information about parenting practices from official health institutions, including physicians, government personnel at the local family planning agency, or the official village-level representative of the National Women's Federation.

Discussion

The goal of the present study is to explore parenting practices in connection to ECD in the context of underprivileged rural China. To meet this goal, we collected unique data on 1,442 caregiver-toddler dyads and examined the prevalence of developmental delays, how parenting practices contribute to delays, caregivers' attitudes and skills, and sources of parenting knowledge.

The Status of ECD and parenting in rural China

Forty-two percent of toddlers in our sample exhibited cognitive delays, while 10.2% exhibited psychomotor delays. One way to understand the magnitude of these delays is through the scaling of the BSID itself. The Chinese adaptation of the BSID-I was scaled using a sample of optimally-functioning children from urban China. Given a normal distribution of the BSID scores in that sample, it is expected that, for each delay type, around 10.6% of the population will be below the 80-point cutoff (which is equivalent to 1.25 SD below the mean). While the rate of psychomotor delays in our rural sample appears to be similar to the optimal urban rate, the rate of cognitive delays is about four times as high. Despite this stark discrepancy, the observed rural rate is in keeping with previous research. For example, using the parent-completed Ages and Stages questionnaires, Wei et al. (2015) detected similar cognition problems, particularly in the problem-solving domain.

Perhaps not surprisingly (given the high share of toddlers that are suffering cognitive delays), we find that there are low rates of adopting optimal parenting practices. As a comparison, we consider the results from Bornstein and Putnick (2012) who analyzed the adoption of similar parenting practices among a sample of mothers spanning 28 developing countries. They find that 25% of the mothers engaged in reading activities with their children, 50% in singing, and 60% in playing (compared to 12.6%, 37.5% and 39.2% in our sample). While a part of the difference can be attributed to the different age ranges of the two examined populations (their sample included children up to five years old, while ours up to two and a half years) and the different recall periods (up to three days in their case, and only one day in the present study), it is unlikely that these two factors contribute to the entire magnitude of the difference. As such, it can be argued that the prevalence of interactive parenting practices in rural China is comparatively lower than that in many developing countries.

We further find that toddlers in our sample are left to play alone for over two and a half hours per day. While no available studies report the equivalent duration of alone time from other countries, leaving the child alone for more than one hour per day is sometimes considered as a proxy for suboptimal care (Bornstein & Putnick, 2012).

Finally, we find that rural Chinese toddlers spend an average of 1.13 hours each day watching TV or videos. Such an average is comparable to its counterpart in other countries: 1.12 hours in neighboring Taiwan (Lin, Cherng, Chen, Chen, & Yang, 2015) and 1.21 hours in South Korea (Byeon & Hong, 2015). Nevertheless, it is substantially higher than the recommendation by the American Academy of Pediatrics, which recommends that toddlers and infants under two years should not be exposed to any television (AAP, 2016).

The Parenting-ECD connection

Our findings identify low levels of interactive parenting as one important factor behind the documented levels of compromised child development in rural China. In our sample, parenting is strongly correlated with cognitive development. In particular, holding toddler and caregiver characteristics constant, each of our three focal parenting practices (reading with the child, singing with child, playing with the child) is associated with an increase in the MDI of 5.45 to 7.62 points (equivalent to 0.34-0.47 SD) and a more modest increase in the PDI of about 2.94-3.15 (equivalent to 0.18-0.27 SD). The direction of these associations is consistent with the previously mentioned studies, which document developmental benefits from the three focal practices in particular, as well as from improved parenting quality in general.

Our multivariate analysis shows no evidence that the duration of solitary play is associated with developmental outcomes. On one hand, as we mention earlier, unstructured time that the toddler spends alone is time in which they do not engage in any verbal or stimulating interaction. On the other hand, some studies have documented a beneficial aspect to unstructured play time. Among other things, solitary play can be educational and may lead to improvements in processing social information as well as increasing imagination and divergent thinking (Lloyd & Howe, 2003; Luckey & Fabes, 2005). It is thus arguable that these two competing effects can make it challenging to detect a clear net effect.

We find a small but surprising association between TV exposure and motor development. Since the correlation is positive, it is possibly mediated by an omitted socioeconomic status effect; wealthier families are likely to spend more time watching TV and are also more likely to have well-developed toddlers.

Overall, we conclude that the often-documented link between parenting practices and children's developmental well-being applies to our sample of rural Chinese caregiver-toddler dyads. The three focal practices of this study – which emphasize interactive behavior – are strongly and positively correlated with the toddlers' cognitive and motor development. Moreover, cognitive development appears to be more sensitive to such practices than motor development.

Parenting landscape: attitude, skills, and sources of information

Two broad conclusions can be drawn from our investigation of the parenting landscape in rural China. First, we find that low levels of interactive parenting does not appear to stem from caregiver indifference or negative attitudes towards their responsibilities. Most of the sample caregivers acknowledge their responsibility toward the well-being of their children and to a large extent enjoy what this responsibility entails.

The absence of acquired parenting skills, however, seems to be the most likely candidate behind the low prevalence of optimal parenting. For example, two in five caregivers reported not knowing how to relate to their children. Doing so requires parenting techniques on how to talk, interact, and play with a toddler. Moreover, one in three caregivers reported not knowing how to read with their child. One part of this problem may be caregiver illiteracy or their lower levels of education. As literacy and education continue to spread in rural China, this part of the problem may arguably self-resolve over time. Yet, reading with toddlers and infants is also a specific skill. To engage the child while reading, a caregiver has to point at illustrations, ask questions, name different colors, etc (National Education Institution, n.d.). As a result, reading with the toddler is not merely inhibited by illiteracy but also the lack of awareness of such techniques.

The second main conclusion about the parenting landscape points to a lack of a systemic role of public health institutions in addressing ECD in rural China. Only one in ten caregivers in

our sample have cited doctors or family planning bureaus as sources of parenting information, suggesting that there is room for misinformation that can spread either among caregivers or be inherited from one generation to the next. Moreover, this finding communicates that a clear understanding and a better appreciation of the importance of early development is still lacking among governmental institutions. It is important to note here that this recognition of ECD is theoretically present in China's major laws and guidelines. (For a summary of these regulations, see Wu and Young (2012, pp. 33–37)). However, a review of these regulations suggests that emphasis is often placed on health and nutrition, rather than psychosocial stimulation and parenting. Moreover, our findings show that rural areas are yet to benefit from such regulations.

Policy Implications

According to our findings, parenting in rural China remains primarily a private domain. One important implication of this feature is that there is no official platform for caregivers to obtain accurate parenting and ECD information. We suggest that the healthcare system, generally, and the Health and Family Planning Commission (HFPC), specifically, extend its services to include a parenting education component. The HFPC is the government agency historically responsible for the enforcement of China's one-child policy. Since the ending of the policy in 2016, however, this role is being replaced, and its new focus on *quality* of children rather than quantity may be rewarding. Moreover, as one of the largest bureaucracies in the world, the HFPC already has a considerable experience doing village outreach and running informational campaigns. Such history makes them well-positioned to take on the responsibility of creating a better parenting culture.

Limitations and future research directions

We acknowledge a few limitations to this study. First, one part of our analysis examines whether the often documented association between parenting practices and developmental outcomes holds in our rural Chinese sample. However, the cross-sectional nature of our dataset does not allow us to discern whether this association is causal. For our three focal parenting practices, this concern is alleviated by biological studies showing the neurological response to interactive caregiver-toddler practices (Shonkoff & Bales, 2011) as well as longitudinal and randomized studies that document how improved parenting leads to better developmental outcomes (Raikes et al., 2006; Walker et al., 2007). For the two additional indicators (screen time and time alone), caution is warranted when interpreting these associations.

Second, our use of BSID-I warrants a discussion of its validity. While many studies in western countries have used the re-standardized BSID-II and BSID-III (Fernald, Kariger, Engle, & Raikes, 2009), the first BSID was the only version adapted for use in China at the time of our study. Some studies show that in comparison to its newer adaptations, the BSID-I distribution overestimates the MDI and as such, our estimates of cognitive delays in rural China may be conservative (McGrath, Wypij, Rappaport, Newburger, & Bellinger, 2004). Moreover, it is arguable that administering the BSID at home – rather than in a controlled laboratory setting – could result in a different testing environment for each toddler in our sample. Nevertheless, as concluded by other studies (Van Den Dries, Juffer, van IJzendoorn, & Bakermans-Kranenburg, 2010), the benefits of administering the test at home outweigh the costs involved in establishing a common test setting. For instance, it precludes a long and inconvenient trip to a laboratory, which could result in exhaustion or anxiety for the toddler. Moreover, the scarce transportation in

our context was very likely to discourage caregivers from bringing their children to a testing center at all.

Finally, our indicators for parenting quality are unstandardized. Even though a standardized composite – such as the Parenting Sense of Competence Scale (Coleman & Karraker, 2003) or the Teti Maternal Self-efficacy Scale (Caldera et al., 2007) – could allow comparability with other studies, it occludes the specific mechanisms that may cause such a composite to be linked to developmental outcomes. As a result, we choose to include specific practices emphasized by developmental literature and included in international and national surveys on parenting quality (such as the MICS and the NSECH described earlier).

Given our findings, there are two broad directions for future research. The first pertains to the large numbers of cognitively delayed toddlers in rural China. Preschool cognitive skills have been shown to be good predictors of higher educational attainment and adult labor productivity (Engle et al., 2011; Gertler et al., 2014). Assuming this holds true in the rural Chinese context, our findings have serious implications for the future of China's labor force. Further research is needed to identify interventions to remedy cognitive delays.

The second research direction should consider how to design and upscale programs that can prevent these cognitive delays from affecting future cohorts of infants and toddlers. Since our study finds that suboptimal parenting is a major factor behind these delays, such programs would likely require a teaching component where caregivers learn optimal parenting strategies and techniques. In previous evaluation studies conducted elsewhere, this training component has taken the form of visits to parents by healthcare aides or through mother training courses. The results of such programs were encouraging (Kagitcibasi et al., 2001; Powell, Baker-Henningham,

Walker, Gernay, & Grantham-McGregor, 2004; Super, Herrera, & Mora, 1990); however, such programs have yet to be evaluated, or scaled up if successful, in rural China.

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Tables

Table 1. Descriptive statistics of sample toddlers and caregivers

Characteristic	Percent	Observations
Gender of Infant		
Male	51.7	746
Female	48.3	696
Infant is pre-mature		
No	94.8	1,367
Yes	5.2	75
Only-child		
No	38.7	558
Yes	61.3	884
Mother is primary caregiver		
No	37.6	542
Yes	62.4	900
Maternal educational level		
Middle school or lower	83.0	1,197
High school or higher	17.0	245
Maternal age		
25 years or younger	48.5	700
older than 25 years	51.5	742
Family receives welfare		
No	76.1	1,098
Yes	23.9	344

Table 2. Mental and psychomotor development of sample toddlers

	Percent	Observations	95% CI
Cognitive delay (MDI < 80)	42.0	606	[0.39, 0.45]
Moderate or severe (MDI<70)	27.4	395	[0.25, 0.30]
Mild (70 ≤ MDI<80)	14.6	211	[0.13, 0.16]
Psychomotor delay (PDI<80)	10.2	147	[0.09, 0.12]
Moderate or severe (PDI<70)	4.2	60	[0.03, 0.05]
Mild (70 ≤ PDI<80)	6.0	87	[0.05, 0.07]

Note: CI represents the 95% confidence interval for the fraction of sample children.

Table 3. Parenting Indicators

	Mean	Observations
Focal indicators		
Caregiver read to the child	0.126	182
Caregiver sang to child	0.375	541
Caregiver used toys to play with child	0.392	565
Additional indicators		
Daily time when child plays alone, in minutes	155	--
Daily screen time, in minutes	67.6	--

Table 4. Bivariate correlations of MDI and PDI with parenting indicators

	Observations	MDI score		PDI score	
		Mean ± SD	P-value	Mean ± SD	P-value
Caregiver read to child					
Yes	182	91.4 ± 21.4	< 0.05	108.6 ± 19.5	< 0.05
No	1,260	82.6 ± 20.9		104.7 ± 20.8	
Caregiver sang to child					
Yes	541	89.4 ± 21.5	< 0.05	108.1 ±19.4	< 0.05
No	901	80.4 ± 20.2		103.5 ± 21.7	
Caregiver played with child					
Yes	565	87.4 ± 21.5	< 0.05	107.4 ± 20.4	< 0.05
No	877	81.4 ± 20.6		103.8 ± 20.4	
Daily time alone					
Below average time	872	84.8 ±21.5	< 0.05	105.6 ±20.4	> 0.05
Average time or higher	570	82.1 ±20.6		104.6 ±20.5	
Daily screen time					
Below average	1,003	83.7 ±21.1	> 0.05	104.9 ±20.7	> 0.05
Average time or higher	439	83.8 ±21.3		105.8 ±19.9	

Note: The sample average is 155 minutes for daily time alone, and 67.4 minutes for the daily screen time.

Table 5. Association between parenting behavior and child development

	MDI score			PDI score		
	β	95% CI	p-value	β	95% CI	p-value
Read to child	7.62	[4.55, 10.70]	< 0.05	3.15	[-0.03, 6.34]	= 0.05
Sang to child	8.16	[6.04, 10.28]	< 0.05	4.38	[2.16, 6.60]	< 0.05
Used toys to play with child	5.45	[3.16, 7.74]	< 0.05	2.94	[1.00, 5.05]	< 0.05
Daily time alone, in hours	-0.33	[-0.78, 0.11]	> 0.05	0.01	[-0.40, 0.43]	> 0.05
Daily screen time, in hours	0.75	[-0.20, 1.71]	> 0.05	1.21	[0.34, 2.08]	< 0.05

Note: Regression estimates from multiple linear models adjusted for gender, age, whether the toddler was born prematurely, whether the toddler is an only child, whether the toddler's mother was identified as the primary caregiver, maternal educational level and age, and whether the family received government welfare. Clustering is at the village level.

Table 6. Caregiver attitudes towards parenting

Statement	Agreement with statement		
	Disagree	Unsure	Agree
Positive attitudes			
I really enjoy being with my child.	5.5	5.9	88.6
Last month, my child and I have gotten along very well.	4.0	4.9	91.1
Playing with my child is fun and interesting.	8.6	7.7	83.7
Helping children to learn about the world around them is the responsibility of their parents or caregivers.	2.9	2.2	94.9
Negative attitudes			
Last month, I got irritated with my child.	76.5	13.2	10.3
Last month, the time I have spent with my child has been very stressful.	68.9	9.6	21.5

Table 7. Caregiver's assessment of their parenting skills

Statement	Agreement with statement		
	Disagree	Unsure	Agree
I know how to read with my child.	33.9	16.1	50.0
I know how to play with my child.	15.9	15.1	69.0
I know how to relate to my child.	38.0	19.3	42.7

Table 8. Sources of information about parenting practices

Information source	Percent	Number
Family members	43.4	626
Books or internet	34.6	498
TV	33.1	476
Own experiences	25.2	364
Local doctor, local bureaus of family planning, or Women's representative	11.7	168
Friends	9.2	133