

## Parental Attitudes, Behavior and Developmental Delays in Children Aged 18-30 Months: Evidence from Rural China

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### Abstract

The first years of life comprise a critical developmental period that has implications for lifelong outcomes. The overall goal of this paper is to provide an empirically-based overview of parenting in a developing country setting and to measure the correlation between parenting behavior and children's cognitive development. We randomly sampled 1442 infants aged 18–30 months living in 351 villages across 174 townships in nationally-designated poverty counties in rural areas of southern Shaanxi Province, China. Primary study outcomes include the Bayley Scales of Infant Development (BSID) and a household survey of demographic characteristics and the home parenting environment. Results show that caregivers do not regularly engage in positive parenting practices such as reading to, singing to, or using toys to play with their children. Our data further show that poor parenting behaviors are significantly and negatively correlated with cognitive and psychomotor development, as measured by children's scores on the BSID. Children with caregivers who did not engage in each of our focus activities (reading, singing, using toys to play) were significantly more likely to suffer from cognitive delay compared with their peers. We also find evidence of a lack of reliable parenting information available to rural caregivers. Government sources of information are largely non-existent or at least unused. Most caregivers rely solely on their own intuition in shaping their parenting behavior and strategies. Future interventions should attempt to address this information gap.

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**Keywords:** parenting behavior; early child development; cognitive development; rural China

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## **Evidence from Rural China**

### **1. Introduction**

The first years of life comprise a critical developmental period that has implications for lifelong outcomes (Currie & Almond, 2011). Due to rapid brain development and brain malleability during these early years (Knudsen, 2004; Knudsen, Heckman, Cameron & Shonkoff, 2006), this period is crucial for cognitive and psychosocial skill development (Huttenlocher, 1979; Thompson & Nelson, 2001). Investments in human capital accumulation during this period build a foundation for lifetime success (Heckman, 2008; Gertler et al., 2014).

The proven importance of this early development stage has induced researchers to delve more deeply into the underlying factors that may be associated with cognitive development during this period. As early as the 1990s, the literature had already extensively documented the link between poor nutrition and low levels of both cognitive and motor skills among infants and toddlers (Hsueh & Meyer, 1981; Goodwin, Goodwin & Garry, 1983; Behrman, 1996; Martorell, 1997; Grantham-McGregor et al., 1999). More recently, a number of studies have shown that the home learning environment that parents provide for their children is also significantly linked with children's social and cognitive performance (Chang, Park, Singh & Sung, 2009; Park, 2012; Anders et al., 2012). Specifically, a number of researchers have demonstrated the importance of having parents involved in their children's early childhood activities (Parker et al., 1999;

Rimm-Kaufman, Pianta & Cox, 2000). Reading, telling stories, and singing songs together have all been linked to early language acquisition and improved cognitive development (Bus, 2001; Evans, Shaw & Bell, 2000; Ciping, Silinskas, Wei & Georgiou, 2015).

While previous studies have made important contributions in demonstrating the importance of the home learning environment that parents provide for their children, almost all of the work has been done in the context of developed countries and, as such, little is known about the status of the home learning environment in developing settings. In the limited set of studies in developing country settings that do exist, research teams mostly have focused on ways of improving the home learning environment through targeted interventions (Mejia, Calam & Sanders, 2012; Aboud, Singla, Nahil & Borisova, 2013); there are few large-scale empirical studies that seek to document the status quo of parenting practices and attitudes. The few studies that do describe home learning environments have largely been based on small sample sizes, typically including only 60-120 families (Burgess, Hecht & Lonigan, 2002; Weigel, Martin & Bennett, 2005). No study in a developing country has sought to document both attitudes towards parenting and parental practices.

Given the absence of a large empirical literature on parenting practices in developing countries, studies to further our understanding of the home environment-based determinants of cognition growth in developing countries would be useful for several reasons. First, research has shown that the share of children with cognitive delays is higher in developing countries (Grantham-McGregor et al., 2007; Emerson, Einfeld & Stancliffe, 2011). Additional research

describing the home learning environment might begin to provide insights into precisely which factors might be linked with these delays. Second, while several studies have shown that interventions to improve parental investments can be successful in developing settings (Attanasio et al., 2015; Grantham-McGregor, Fernald, Kagawa & Walker, 2014), little is known about the exact dimensions of the home learning environment—that is either attitudes/knowledge or practice or both—that are most in need of improvement. Research that illuminates these dimensions would be helpful in improving intervention targeting and refining future intervention designs.

In this paper, we aim to provide an empirically-based overview of parenting in a developing country setting and to measure the correlation between parenting behavior and children's cognitive development. To do so, we report on the findings of a large-scale survey (n=1,442) of the parents or other caregivers (henceforth, *caregivers*) of 18 to 30 month old children in rural China. Specifically, we measure the attitudes of caregivers towards their children as well as their willingness to provide a stimulating parenting environment. We seek to understand whether caregivers are willing to spend time engaging in activities that have been shown to improve their children's cognition, socio-emotional status, and home parenting environment. Next, we describe the actual parenting environment of households in poor areas of rural China, as measured by rates of caregiver-child play, reading, and singing behaviors (henceforth, *parenting behavior*). Finally, we measure the statistical correlations between parenting behavior and developmental delays.

## **2. Study sample and Methods**

### *2.1 Sample Selection*

Our study was conducted in 2014 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. There were two exceptions to this rule: we excluded the one township in each county that housed the county seat, and we excluded any townships that did not have any villages with a population of 800 or more. In total, according to these criteria, 174 townships were included in the study.

The sample villages were originally selected in April, 2013 as follows. To meet the power requirements of a larger, interventional study (not reported in this paper), we required a minimum of five children in each township. With this requirement in mind, we first randomly selected one village (with a population of 800 or more) from each township to participate. A list of all registered births over the past 12 months was obtained from the local family planning official in each village. All children in our desired age range (6–12 months) were enrolled in the study. If a village had fewer than five children in our desired age range, we randomly selected an additional village in the same township for inclusion in the study, and continued to randomly select additional villages until five children per township had been found.

The data used in this study were collected from sample households over a four-week period in October, 2014. At this time, the sample children were aged 18-30 months. Overall, our study uses data from 1,442 households in 351 villages across 174 townships.

## *2.2 Data Collection*

Teams of trained enumerators collected socioeconomic information from all households participating in the study. Each child's primary caregiver was identified and administered a detailed survey on parental and household characteristics, including each child's gender and birth order, maternal age and education, and whether the family was receiving Minimum Living Standard Guarantee Payments (a poverty indicator). The exact age of each child was obtained from his or her birth certificate. The primary caregiver (typically either the child's mother or grandmother) was individually identified in each family as the individual who carries the most responsibility for the child's care.

Our survey also included a series of questions about the parenting environment in the home. We asked two types of questions. First, we asked what parents thought about their relationship with their children, including their willingness to play with, spend time with, and show emotion/love/physical contact with their children. We also asked about time spent watching television. Next, we asked more objective questions about exactly how much time parents spent with their children, including playing, reading, and singing to them, as well as engaging in other activities. We also asked about the frequency of playing, reading, and singing over the previous 24 hours.

All children were also administered the Bayley Scales of Infant Development (BSID), an internationally-recognized, scaled test of infant and toddler cognitive and motor development (Bayley, 1974). This test is well recognized in the psychological literature and is listed by the American Psychiatric Association as a way to diagnose certain developmental disorders (American Psychiatric Association, 2000). The test was formally adapted to the Chinese language and environment in 1992 (Yi, Luo, Yang & Wan, 1993). Following the example of other published studies that use the BSID to assess infant development in China (Li et al., 2009; Chang et al., 2013; Wu, Sheng, Shao & Zhao, 2011), it was this officially adapted version of the test that was used in this study. The test has an inter-rater reliability of 0.99 for each of the two sub-indices, the Mental Development Index (MDI) and the Psychomotor Development Index (PDI) (Yi, 1995). (Both indices are described in more detail below.) 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).

All BSID enumerators attended a week-long training course on how to administer the BSID, including a 2.5 day experiential learning program in the field. The test was administered one-on-one in the household using a set of standardized toys and a detailed scoring sheet. The BSID takes into consideration each infant's age in days, as well as whether he or she was a premature birth. These two factors, combined with the infant's performance on a series of tasks using the standardized toy kit, contribute to the establishment of two independent, internationally

standardized scores: the Mental Development Index (MDI), which evaluates memory, habitation, problem solving, early number concepts, generalization, classification, vocalizations and language to produce a measure of cognitive development; and the Psychomotor Development Index (PDI), which evaluates gross muscle groups (rolling, crawling and creeping, sitting, standing, walking, running and jumping) and fine motor manipulation to produce a measure of psychomotor development (Bayley,1969). 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.

#### *2.4 Statistical analysis*

Our main variables defining parenting behavior are: Did the caregiver (or any other family member) read books to the child yesterday? Did the caregiver (or any other family member) sing songs to the child yesterday? Did the caregiver (or any other family member) use toys to play with the child yesterday? Over the past two days, about many times did the caregiver hug and kiss or otherwise show affection to your baby? In a typical day, about how many minutes does the child spend watching TV or videos? How much time did the child spend playing by himself yesterday?

BSID scores were broken down into scores on the MDI and the PDI. Both indices are 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  $70 \leq \text{MDI} <$

80 and  $70 \leq \text{PDI} < 80$ , while moderate or severe impairment for each index is defined as  $\text{MDI} < 70$  and  $\text{PDI} < 70$  (Yi, 1995). Children failing to achieve the minimum MDI or PDI score (50) were assigned a score of 49 (Moore et al., 2012).

All statistical analyses were performed using STATA 12.0. P-values below 0.05 were considered statistically significant. The statistical significance of differences in parenting behavior, MDI and PDI by subgroups was assessed using ANOVA in STATA. STATA's multiple linear regression model was used to conduct the multivariate analysis. We included the following variables as potential confounders in the multivariate analysis: child's gender, child's age, whether the child was born prematurely, whether the child is an only child, whether the child's mother was identified as the primary caregiver, maternal educational level and age, whether the family received Minimum Living Standard Guarantee Payments, and Bayley score in baseline survey.

### **3. Results**

The basic socioeconomic and demographic characteristics of study participants are reported in Table 1. Of the 1442 child in this study, slightly over half (51.7%) were male. Around 5.2% of sample children were born prematurely; 61.3% do not have a sibling. The mother is the primary caregiver for 62.4% of the children in the sample; in the case of most of the rest, the grandmother is the primary caregiver. The majority of the mothers (83%) have completed fewer than 9 years of schooling; 51.5% are over 25 years of age. About one-quarter

(23.9%) of sample families report receiving Minimum Living Standard Guarantee Payments, a form of government welfare for the lowest income families nationwide.

### *3.1 Parenting attitudes and behaviors*

Caregiver attitudes towards parenting are shown in Table 2. The data show that large shares of caregivers in the sample report that they enjoy spending time or are willing to spend time with their children (88.6%). Almost all caregivers (91.1%) report that they generally get along well with their child (91.1%), and that they find playing with their children to be fun and interesting (83.7%). Only 10.3% of caregivers report being irritated by their child over the past week, while only 21.5% report that spending time with their child was stressful. Tellingly, nearly all (94.9%) of caregivers believe that it is their responsibility to help children to learn about the world around them.

Also according to the survey data, while caregivers are willing to spend time with their children and find play with their children is interesting, it is also the case that only 42.7% of caregivers self-report that they “know how to relate to my child on his / her level.” In addition, just half (50.0%) know how to read with their child. Some caregivers (15.9%) actually report not knowing how to play with their child at all.

In Table 3, we present data on the levels and types of interaction between caregivers and their children. When we asked how many times caregivers hugged or kissed or otherwise showed affection to their child over the past two days, 38.5% reported doing so 5-10 times. However, when we asked the number of books in their house, we found that 54.4 percent of households do

not own any children's books, while an additional 36.2% of households have fewer than three books. Children spent an average of 67.6 minutes watching TV or videos. On average, children spent 155 minutes per day playing alone. We find that 67.0% of caregivers did not read to their children on the day prior to the survey being administered. Similarly, 62.5% of caregivers did not sing to their children on the day prior to survey administration. We further find that 60.8% of parents did not use toys to play with their children on the day prior to survey administration. Most sample households (65.8%) do not have a designated play area for the child in the home.

The survey also asked caregivers about the sources of their parenting knowledge and practices (Table 4). According to the findings, most caregivers (25.2%) obtained information about parenting practices from their own experiences. Many also obtained information from family members (43.4%) or friends (9.2%). Fewer than 12% of caregivers in our sample received information about parenting practices from physicians, government personnel at the local family planning agency, or the official village-level representative of the National Women's Federation.

### *3.2 Links between parenting behavior and socioeconomic factors*

Table 5 presents the bivariate associations between parenting behavior and selected child and household characteristics. We find no difference in parenting behavior either by gender ( $p=0.41$ ) or according to whether the child was an only child ( $p=0.13$ ). When the child's mother was identified as the primary caregiver, the rates of reading to, singing to, and using toys to play with the child were all significantly higher ( $p<0.01$  in all cases). The rate of reading to the child was lower among children whose mothers had 9 years of schooling or less ( $p<0.01$ ).

### *3.3 Cognitive and motor development*

BSID measures were available for all 1,442 children. The mean MDI score for the sample was 83.7, and the mean PDI score was 105.2 (Table 6). A total of 395 children (27.4%) had an MDI score below 70, thereby classifying them as moderately or severely impaired in their cognitive development. Around 14.6% of children had an MDI score between 70 and 80, indicating mild cognitive impairment. In total, 42.0 percent of sample children had MDI scores below 80, indicating some degree of impairment. A total of 4.2% of sample children were moderately or severely impaired in their psychomotor development ( $PDI < 70$ ) and 6.0 percent were mildly impaired.

### *3.4 Links between parenting behavior and cognitive and motor development*

Table 7 presents the bivariate associations between parenting behavior and child development. In families where the caregiver reported reading to her child yesterday, the MDI and PDI scores were significantly higher than in those households where caregivers did not read to their children yesterday ( $p < 0.01$ ). Similar positive correlations were found between caregivers' singing and the child's MDI and PDI scores ( $p < 0.01$ ), and between caregivers' using toys to play with the child and the child's MDI and PDI scores ( $p < 0.01$ )

### *3.5 Multivariate analysis*

The results of the multivariate analysis are consistent with the findings of the bivariate analysis (Table 8). In households where the caregiver (or another member of the household) reads to the child, the child's MDI score is higher than it is for children from households without

reading ( $p < 0.01$ ). More precisely, our analysis shows that caregivers' reading to their children is associated with a 7.04 point gain on the MDI. We also find a significant positive correlation between singing or using toys to play with the child and the child's MDI score ( $p < 0.01$ ). Finally, we find a significant positive association between time spent playing alone per day and MDI score ( $p < 0.05$ ). We found no significant link between either time spent watching TV ( $p = 0.13$ ) or displays of parental affection ( $p = 0.23$ ) and child development. We find a significant positive correlation between singing or using toys to play with the child and the child's PDI score ( $p < 0.01$ ). We find no differences in PDI score across the other parenting behaviors.

#### **4. Discussion**

##### *Parenting Environment in Rural China*

One of the main objectives of this study is to document the attitudes and practices of parenting in rural China. In the paper it is shown the while caregivers deeply care about their children and self-report that they want to do a good job of raising their children, practice falls short. To our knowledge, there have been no other large-scale empirical studies of the parenting environment in rural China. However, there have been more qualitative research using small samples (all  $< 100$  participants) that find similar relatively sterile home-learning environment in rural China (Gu, Gao, Li & Wei, 2009; Liu & Wang, 2003; Yang et al., 2007). The findings in this paper also validate the observations in these previous studies that in most rural households children experience only limited exposure to any form of parent-child stimulation. Due to the

nature of the research approaches of these previous studies, none was able to use data to establish a correlative link between parenting and cognition.

More specifically, in this study, we show that a high fraction of caregivers of 18-30 month old children living in low-income areas of rural China do not regularly engage in positive parenting practices such as reading to, singing to, or using toys to play with their children. When asked directly about their behaviors in the day prior to survey administration, rates of engaging in these behaviors ranged from a high of 37.5% for singing, to a low of 12.6% for reading.

What are the underlying reasons behind caregivers' failure to engage in these behaviors? Looking at caregiver attitudes towards engaging with their child, we see that parents seem to be eager to spend time with their children and have high expectations for their children's future success. Nearly all (94.9%) caregivers believe that it is their responsibility to "help children to learn about the world around them," but only 42.7% reported that they "know how to relate to my child on his / her level," and only half (50.0%) know how to read with their child. We therefore surmise that poor parenting behaviors are not a result of caregiver indifference to their children, nor a result of parental unwillingness to take responsibility. Rather, we suspect that caregivers in rural China simply lack a reliable source of good information about how to parent their children. Most of the caregivers we surveyed reported learning about parenting from their own experiences, from family members, or from friends. Only 11.7% of caregivers reported getting their information from more authoritative, government-sanctioned bodies/individuals.

Our data further show that poor parenting behaviors are significantly and negatively correlated with cognitive and psychomotor development, as measured by children's scores on the Bayley Scales of Infant Development (BSID). Children with caregivers who did not engage in each of our focus activities (reading, singing, using toys to play) were significantly more likely to suffer from cognitive delay compared with their peers. These findings are consistent with findings from developed country settings (Gibbs & Forste, 2014; Park, 2012).

One limitation of the study is its cross-sectional design, which does not allow us to identify causal relationships. Moreover, since our data on the parenting environment is based on caregiver recall, we cannot rule out the possibility of recall bias. Another possible source of bias stems from the fact that our study children were identified based on a list of registered children provided by the village family planning official, thus systematically excluding all unregistered children. The number of unregistered children has drastically declined in recent years, due to a combination of naturally declining fertility rates and loosening government policies. Indeed, a 2010 survey found the rate of unregistered children to be only around 0.12% (National Bureau of Statistics, 2011). We therefore believe that this bias is negligible.

## **5. Conclusions**

Our study has several important implications. First, our data show that parenting behavior in rural China is indeed not up to international standards, and given the correlations we observe between each of the individual parenting factors and child development, these behaviors

may be at least partly responsible for high rates of cognitive delays in developing settings, including China. Therefore, if the government hopes to identify policies that can improve child development outcomes, one effective strategy may be to take steps to improve the ways in which parents interact with their children.

Our data further indicate that the parenting areas most lacking in rural China seem to be reading and playing, although rates of singing are also low. In other words, during the time period in which verbal engagement has been shown to be crucial for a child's cognitive development, rural Chinese caregivers rarely read, play, or sing to their children. In many developed countries, caregivers of young children engage in parenting activities and even parenting training sessions that teach them how to engage with their children in such a way as to stimulate their children's cognitive abilities (Gutman & Feinstein, 2010; Bradley et al., 1989). China's rural areas may benefit from the adoption of a similar model of parental training and engagement.

Finally, our study underlines the stark lack of parenting information available to rural Chinese caregivers. Government sources of information are largely non-existent or at least unused. Most caregivers rely solely on their own intuition in shaping their parenting behavior and strategies. Future interventions should attempt to address this information gap. China's rural areas still lack the telecommunication resources for internet-based information sharing; however, most villages have ample locally-based resources in the form of village doctors, family planning workers, and Women's Federation representatives. All of these representatives already draw a

government salary, and are responsible for tasks that bring them into contact with local families. One strategy for filling the information gap might be to harness these individuals and train them to disseminate parenting information and training to village households.

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Table 1 Basic characteristics of sample children in rural Shaanxi Province (n =1,442)

Characteristics	Frequency (n)	Percentage (%)
Gender		
Male	746	51.7
Female	696	48.3
Is the infant premature?		
No	1,367	94.8
Yes	75	5.2
Only-child		
Yes	884	61.3
No	558	38.7
Mother is primary caregiver		
No	542	37.6
Yes	900	62.4
Maternal educational level		
<=9 years	1,197	83.0
>9 years	245	17.0
Maternal age		
Age<=25	700	48.5

Age>25		742	51.5
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Families	receive	Minimum	Living
Standard Guarantee			
No		1,098	76.1
Yes		344	23.9
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Note: Data are presented as frequency and percent for all children.

Table 2. Caregiver attitudes towards parenting (N=1,442)

	Disagree	Unsure	Agree
Thinking back over the last month, do you agree or disagree with the following statements:			
I really enjoyed being with my child.	5.5	5.9	88.6
Playing with my child was fun and interesting.	8.6	7.7	83.7
My child and I have gotten along very well.	4.0	4.9	91.1
I got irritated with my child.	76.5	13.2	10.3
The time I have spent with my child has been very stressful.	68.9	9.6	21.5
My child ignored me when I talked to him / her.	64.4	15.7	19.9
I didn't know how to relate to my child on his / her level.	42.7	19.3	38.0
In general, how much do you agree or disagree with the following statements:			
Helping children to learn about the world around them is the responsibility of their parents / caregivers.	2.9	2.2	94.9
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

Note: Data are presented as percent for all children.

Table 3 Parental behavior of sample children in rural Shaanxi Province (N=1,442)

Characteristics	Number or Percent (n)	
Over the past two days, about many times do you hug and kiss or otherwise show affection to your baby? (times)		
0	6.1%(88)	
1-5	36.5%(526)	
6-10	38.5%(555)	
Eleven or higher	18.9%(273)	
How many children's books are in your house, including library books?		
0	54.4%(784)	
1-5	36.2%(522)	
6-10	5.96%(86)	
Eleven or higher	3.5%(50)	
In a typical day, about how many minutes does (CHILD) spend watching TV or videos? (minutes)	67.6(1,442)	
How much time did your child spend playing by himself yesterday? (minutes)	155(1,442)	
	Yes (%)	No (%)
Did caregiver (or any other family member) read to the child	12.6	87.4

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yesterday?

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Did caregiver (or any other family member) sing to the child 37.5 62.5

yesterday?

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Did caregiver (or any other family member) use toys to play with the 39.2 60.8

child yesterday?

Does the child have his own designated play area? 34.2 65.8

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Note: Data are presented as number or percent for all children.

Table 4: Sources of information about parenting practices (N=1,442)

Information source	Frequency (n)	Percent (%)
Own experiences	364	25.2
Family members	626	43.4
Friends	133	9.2
Local doctor, local bureaus of family planning, or Women's representative	168	11.7
Books, TV or Internet	639	44.3

Note: Data are presented as frequency and percent for all children.

Table 5 Link between parenting behavior and child and household characteristics in rural Shaanxi Province (N=1,442)

Infant characteristics	Does caregiver (or any other family member) read to the child yesterday? (Yes=1; No=0)			Does caregiver (or any other family member) sing to the child yesterday? (Yes=1; No=0)			Did caregiver (or any other family member) use toys to play with the child yesterday? (Yes=1; No=0)		
	Mean	CI (95%)	P-value	Mean	CI (95%)	P-value	Mean	CI (95%)	P-value
Gender									
Male	0.12	(0.10; 0.14)	0.41	0.36	(0.32; 0.39)	0.13	0.41	(0.37; 0.44)	0.17
Female	0.13	(0.11; 0.16)		0.40	(0.36; 0.43)		0.37	(0.34; 0.41)	
Only child?									
Yes	0.14	(0.08; 0.14)	0.13	0.40	(0.37; 0.43)	0.02	0.41	(0.38; 0.44)	0.13
No	0.11	(0.11; 0.16)		0.34	(0.30; 0.39)		0.37	(0.33; 0.41)	
Mother is primary caregiver									
No	0.11	(0.08; 0.14)	0.17	0.32	(0.27; 0.36)	0.00	0.34	(0.30; 0.38)	0.00
Yes	0.14	(0.11; 0.16)		0.41	(0.38; 0.44)		0.42	(0.39; 0.45)	

Maternal educational level									
≤ 9 years	0.11	(0.09; 0.13)	0.00	0.34	(0.32; 0.37)	0.00	0.37	(0.35; 0.40)	0.00
> 9 years	0.19	(0.15; 0.23)		0.53	(0.47; 0.59)		0.48	(0.42; 0.54)	
Maternal age									
≤ 25 years	0.13	(0.27; 0.34)	0.92	0.38	(0.35; 0.42)	0.56	0.39	(0.35; 0.42)	0.46
>25 years	0.13	(0.32; 0.39)		0.37	(0.33; 0.40)		0.40	(0.36; 0.43)	

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Note: Regression estimates are from a logistic bivariate regression model. Data are presented as mean ± SD or % (n) for categorical variables. CI represents confidence interval.

Table 6 Mental and psychomotor development of sample infants in rural Shaanxi

(n =1,442)

	Mean/Percent	CI (95%)
MDI score	83.7±21.2	[82.6; 84.8]
Moderate or severe (MDI<70)	27.4% (395)	[0.25; 0.30]
Mild (70 ≤ MDI<80)	14.6% (211)	[0.13; 0.16]
Any (MDI<80)	42.0% (606)	[0.39; 0.45]
PDI score	105.2± 20.4	[104.2; 106.3]
Moderate or severe (PDI<70)	4.2%(60)	[0.03; 0.05]
Mild (70 ≤ PDI<80)	6.0%(87)	[0.05; 0.07]
Any (PDI<80)	10.2%(147)	[0.09; 0.12]

Note:Data are presented as mean±SD or % (n) for categorical variables. CI, confidence interval.

Table 7 Mental and psychomotor development of sample children in rural Shaanxi Province with different parenting behavior (n=1,442)

	N	MDI	P value	PDI
		Mean± SD		Mean± SD
Does caregiver (or any other family member) read books to the child <b>yesterday</b> ?				
Yes	182	91.4±21.4	<0.01	108.6±19.5
No	120	82.6 ±20.9		104.7 ±20.8
Does caregiver (or any other family member) sing songs to the child <b>yesterday</b> ?				
Yes	541	89.4±21.5	<0.01	108.1±19.4
No	901	80.4 ±20.2		103.5±21.7
Did caregiver (or any other family member) use toys to play with the child <b>yesterday</b> ?				
Yes	565	87.4±21.5	<0.01	107.4±20.4
No	877	81.4 ±20.6		103.8 ±20.4

Note: Data are presented as mean ± SD or % (n) for categorical variables.

Table 8: Association between parenting behavior and child development (N=1,442)

	MDI score			PDI score		
	Coefficient	95% CI	p-value	Coefficient	95% CI	p-value
Reads to child yesterday	7.04	(4.05; 10.03)	0.00	3.03	(-0.15; 6.20)	0.06
Sings to child yesterday	7.57	(-0.68; 3.49)	0.00	4.21	(1.99; 6.43)	0.00
Used toys to play with child yesterday	4.87	(2.65; 7.10)	0.00	2.74	(0.72; 4.77)	0.01
Showed affection in past 2 days	0.08	(-0.05; 0.22)	0.23	-0.07	(-0.20; 0.07)	0.32
Minutes of screen time per day	0.35	(-0.10; 0.80)	0.13	0.54	(-0.05; 1.13)	0.08
Minutes per day that child plays alone per day	-0.55	(-0.96; -0.15)	0.01	0.02	(-0.35; 0.40)	0.90

Note: Regression estimates from multiple linear models adjusted for gender, age, whether the child was born prematurely, whether the

the family received Minimum Living Standard Guarantee Payments, and Bayley score in baseline survey. Clustering is at the village level. The results (which are not shown for brevity) were substantially the same.