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Early Childhood Co-Sleeping Predicts Behavior Problems in Preadolescence: A Prospective Cohort Study

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Abstract

Objective/Background: Co-sleeping is common practice around the globe. The relationship between early childhood co-sleeping and adolescent behavior problems remains uncertain. We aim to identify whether early childhood co-sleeping can predict behavior problems in preadolescence.

Participants: A cohort of 1,656 Chinese preschool children were followed up in adolescence.

Methods: Prospective cohort study design involving two waves of data collection from the China Jintan Cohort (1,656 children aged 3–5 years). Cosleeping history was collected at 3–5-years-old via parent-reported questionnaire at wave I data collection. Behavior problems were measured twice in childhood and preadolescence, respectively. Adolescent behavior problems were measured by integrating data from self-report, parent-report and teacher-report using the Achenbach System of Empirically Based Assessment. Predictions were assessed using the general linear model with mixed effects on the inverse probability weight propensity-matched sample.

Results: 1,656 children comprising 55.6% boys aged 4.9 ± 0.6 were initially enrolled in the first wave of data collection. In the second wave of data collection, 1,274 children were 10.99 ± 0.74 (76.9%) aged 10–13 years were retained. Early childhood co-sleeping is significantly associated with increased behavior problems in childhood (Odds Ratio [OR] 1.22–2.06, $ps < 0.03$) and preadolescence (OR 1.40–2.27, $ps < 0.02$). Moreover, cosleeping history significantly predicted multiscale increase in internal (OR 1.63–2.61, $ps < 0.02$) and external behavior problems in adolescence.

Conclusions: Early childhood co-sleeping is associated with multiple behavioral problems reported by parents, teachers, and children themselves. Early childhood co-sleeping predicts

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preadolescent internalizing and externalizing behavior after controlling for baseline behavior problems.

Introduction

Co-sleeping, including bed-sharing and room-sharing between children and caregivers, is practiced around the world (Mileva-Seitz et al., 2017). Western societies generally have lower average co-sleeping rates, ranging from 8.6% in Australia (Mindell et al., 2010) to 39% in Denmark (Nelson et al., 2001), compared to that of Asian and African societies, ranging from 68% in Thailand (Anuntaseree et al., 2008) to 100% in Mozambique (Plucinski et al., 2015). While co-sleeping is generally more prevalent in non-Western cultures, the incidence has been increasing in Western countries (Young & Shipstone, 2018). Even within the same society, rural areas have higher rates of co-sleeping arrangements (Gupta et al., 2016). Regarding children's age group, co-sleeping prevalence remains steady within the infancy and preschool period and drops as children enter school-age and preadolescence. The general co-sleeping prevalence ranged from 51.6 to 62.8% in infancy (0–12 months), 59.4% at preschool age (3–5 years), and 10–23% in preadolescence (10–12) around the globe (Mindell et al., 2017, 2013; Rath & Okum, 1995).

Childhood co-sleeping practice remains a controversial topic in pediatrics (Mileva-Seitz et al., 2017). While the American Academy of Pediatrics recommends against bed-sharing during infancy (Moon, 2016), pediatricians have differing positions on the topic (Schaeffer & Asnes, 2018). The gap between health guidelines and practice also exists in China. The latest Chinese guidelines for sleep hygiene among children aged 0–5 years recommend that preschool children should sleep in their own bed, and ideally should have solitary sleeping (National Health Commission of the People Republic of China, 2017). Yet co-sleeping in the Chinese family remains common practice, with the prevalence of co-sleeping ranging from 60% in infancy and preschool age to 37.63% in school age and 25.4% in preadolescence (Huang et al., 2016; Li et al., 2009; Z. Liu et al., 2016).

Besides socioeconomic and cultural reasons, another possible reason for the inconsistency between guidelines and practice in sleeping arrangements is that the impact of co-sleeping on children's health remains unclear. Preexisting studies examining co-sleeping have associated co-sleeping practice with both benefits and detriments. Potential benefits of co-sleeping include prolonged breastfeeding (Ball et al., 2016; Mitchell et al., 2015) and parent-child bonding (Mileva-Seitz et al., 2016), while detriments include sudden infant death syndrome (Carlin & Moon, 2017), poorer sleep quality and more night waking (Huang et al., 2016; X. Liu et al., 2003; Volkovich et al., 2015), internalizing behavior (Santos et al., 2016) and generalized anxiety (Kaymaz et al., 2015).

Currently, research that explores Chinese children's co-sleeping arrangements mainly employs the cross-sectional design and focuses on its contributing factors and the relationship between co-sleeping and child sleep health, i.e., sleep quality, sleep disturbances, enuresis, etc. (Li et al., 2009; Z. Liu et al., 2016; Ma et al., 2014; Yue et al., 2018). Few studies have explored the long-term consequences of co-sleeping on childhood and adolescent behavior. To our knowledge, only four international longitudinal studies have

examined the influence of early co-sleeping on delayed manifestation of behavior problems (Barajas et al., 2011; Okami et al., 2002; Santos et al., 2016; Volkovich et al., 2015). The association between co-sleeping and children's behavior problems remains inconsistent in these studies. Given that the long-term impact of co-sleeping practice on childhood and preadolescent behavior remains unclear, and few studies have explored this topic in China, further research in the Chinese context is warranted.

Using a large community cohort involving both rural and metropolitan areas with two waves of behavior problem follow-up, this current longitudinal study aims to investigate the relationship between co-sleeping during early childhood (3–5 y) and multi-dimensional behavior problems in preadolescence (10–13 y) reported by multiple informants including children themselves, parents, and teachers via well-established instruments (Leung et al., 2006; Liu et al., 2011). Based on previous studies (Gupta et al., 2016), we expect that co-sleeping will be more prevalent in rural areas. We hypothesized co-sleeping to be inversely related to pre-adolescent behavior problems.

Methods

Participants

The current study is derived from an on-going longitudinal project, the China Jintan Child Cohort Study (Liu et al., 2015, 2010). In fall 2004, children aged 3- to 5-years-old from four preschools in Jintan City, Jiangsu Province, China were invited to participate in the study. The four preschools were chosen due to their representativeness of the demographic, geographical, social, and economic profiles of the entire city. A total of 1656 children and their parents were invited. The response rate was 97%, from which 98% agreed to participate. To ensure the quality of the study, two research assistants were employed and overseen by a psychologist to facilitate parents and preschool teachers in the questionnaire filling process.

Data collected from the study was segmented into waves according to subjects' developmental stage (Wave I: childhood, and Wave II: preadolescence) via collection year. At Wave I data collection, written informed consent for participation was obtained from the parents at initial enrollment. During Wave II data collection, written informed consent from both mothers and teachers and verbal consent from children were obtained. Institutional review board approval was obtained from the ethical committee for research at Jintan Hospital in China and the University of Pennsylvania. Detailed information for the study, including subjects, recruitment, assessments, and procedures are described elsewhere (Liu et al., 2015, 2010, 2011).

Co-sleeping history

Co-sleeping history in childhood was established for each child during Wave I data collection, when the child was 3–5 years old. Parents were asked to answer the following question “How does your child usually (i.e. more than four times per week) sleep”, with four options: alone, with parents, with grandparents, and with other people. Co-sleeping was defined as the child sleeping with parents/grandparents/others. A total of 1,274 children

with complete data on co-sleeping history and behavioral assessment were included in statistical analysis. Included children were dichotomized to cosleeping group (n = 1080) and solitary-sleeping group (n = 194).

Behavioral problem assessment

Two waves of child behavior data collection—Children's behavior problems were assessed in both childhood (at age six) and preadolescence (at age 10 to 13) with the Achenbach System of Empirically Based Assessment (ASEBA) (Achenbach, 1997; Achenbach & Rescorla, 2000; Ivanova et al., 2011). The original version of ASEBA contains three subscales including the Child Behavior Checklist (CBCL), the Teacher Report Form (TRF), and the Youth Self-Report (YSR). All the subscales were translated and validated by Liu and colleagues into Chinese with satisfactory psychometric properties (Liu et al., 2011). The internal consistencies of the CBCL, YSR, and TRF in our study were 0.966, 0.913, and 0.905, respectively, indicating good reliability of the three subscales. During Wave I data collection, childhood baseline behavior problems were assessed with the CBCL (n = 1274) and TRF (n = 1274), completed by parents and teachers, respectively (Liu et al., 2011, 2010). During Wave II data collection, behavior problems in adolescence were assessed again using the CBCL (n = 807), TRF (n = 888), and YSR (n = 924) (Liu et al., 2015, 2014).

Scoring of child behavior problems—The Chinese ASEBA was scored in three ways: two broadband-of-factor structure behavior problems (i.e., internalizing and externalizing behavior) and other behavior problems; seven syndromes (i.e. anxiety/depression, withdrawn/depression, emotional reaction, sleep problems, somatic complaints, attention problems, and aggression); and five Diagnostic and Statistical Manual (Fourth Edition) (DSM-IV)-oriented scales (anxiety, affective, oppositional defiant, attention deficit/hyperactivity, and pervasive development) (Liu et al., 2011, 2014). Subscale scores and DSM-oriented scale scores were calculated from reported raw-scores. Then, t-scores (i.e., the ratio of the behavior score's deviation from the population mean to its standard deviation [SD]) for all raw subscale scores were calculated for analysis. Higher scores indicate more severe behavior problems.

Low cross-informant agreement—Due to reported low cross-informant agreement of the ASEBA subscales (Gomez et al., 2014; Grigorenko et al., 2010; Leung et al., 2006), Cronbach's alpha was used to assess the agreement of childhood and preadolescent behavior reported across informants (parents, child, and teachers). The behavior problems in our sample reported by the three informants had alpha values ranging from 0.381 (withdrawal/depressed) to 0.535 (attention problems), while the DSM subscale measurements had alpha values ranging from 0.364 (anxiety problems) to 0.509 (conduct problems). The internalizing subtotal score and externalizing subtotal score had alpha values of 0.465 and 0.547, respectively, while the alpha value for the total score was 0.550. Further, the intraclass correlation coefficient (average measure) across the CBCL, TRF, and YSR in our study was 0.409 (range: 0.314, 0.491), indicating moderate cross-informant agreement. According to the ASEBA manual (Achenbach & Rescorla, 2000, 2001), the ratings by different informants were based on different contextual child behaviors to tap different

aspects of the same phenomenon. Thus, low agreement among parents, child, and teachers is expected. The moderate level of cross-informant agreement granted the necessity of integrating information across informants using factor scores or average scores (which are described later in the statistical analysis section) to increase specificity and sensitivity in detecting behavior problems.

Statistical analysis

Sample characteristics were summarized by descriptive statistics consisted of the mean, SD, and percentages. Sex, location, and parental education differences between childhood (3–5 y) cosleeping history groups were analyzed using 2×2 and $k \times 2 \chi^2$ tests. The student t test was performed to examine the difference in age between childhood co-sleeping history groups. Following Martel et al. (2017), factor analysis were conducted to generate factor estimators for each subscale (i.e., CBCL, TRF, and YSR), integrating all available informants' ratings (Martel et al., 2017). Further, the average scores calculated as the unweighted average of all informants' ratings were also generated and used for robustness analysis (Horton & Fitzmaurice, 2004).

We first used inverse probability weighting (IPW) to balance potential confounders including age, sex, residence location, and parents' education level. Assigned stabilized weights in the main model were calculated by dividing marginal probability of co-sleeping by the propensity score for the group assigned. Re-weighting was performed for sensitivity analyses to ensure statistical robustness of results, as suggested by Nichols et al. (Nichols et al., 2007, 2008). To assess the associations between co-sleeping history and behavior problems at different development periods, weighted general linear-mixed models (GLMM) with logit linkage were performed subsequently. All baseline sample characteristics and residence locations as a mixed effect were adjusted for, and a robust variance estimator was used to increase the validity of analysis results. All questionnaire-based scores across informants as well as factor scores were explored.

To explore the marginal effect of early childhood co-sleeping history on preadolescent behavior problems, we included childhood questionnaire-based or factor scores in the corresponding weight-assigning model and GLMM model to adjust for the individual difference at the beginning of the child's developmental trajectory. All tests in the analyses exploring the association or marginal effect were two-tailed with an alpha threshold of 0.05. Participants with missing data were excluded from the analysis of corresponding categories. In our analysis (either before or after matching), less than 5% of participants had missing data in any analyzed categories. Statistical analyses were performed using STATA 15.1 (STATA Corp, College Station, TX) and SAS software, version 9.3 (SAS institute, Cary, NC).

Results

Sample characteristics

Of the 1,274 children included in the analysis, age at preadolescent behavioral assessment was 10.99 y (standard deviation [SD] = 0.74). 54.57% were male (N = 694, mean age =

11.04, $SD = 0.73$), and 45.53% were female ($N = 580$, mean age = 10.94, $SD = 0.75$). 84.77% ($N = 1,080$) of the subjects reported a history of childhood co-sleeping, while 15.23% ($N = 194$) did not. In our sample, 20.33% subjects lived in rural areas, while 38.93% and 40.74% lived in suburban and city areas, respectively. Parental education levels were distributed as follows: elementary school or less (2.05%), middle school (30.94%), high school (53.07%), college, and above (13.94%) for fathers, and elementary school or less (3.38%), middle school (40.76%), high school (46.50%), college, and above (9.36%) for mothers. A total of 84.77% (1080/1274) of preschool children in Jintan City had co-sleeping arrangements. Detailed child and family characteristics are summarized in Table 1. There were significant differences in living location between children with and without childhood co-sleeping history. Rural areas had the highest co-sleeping rate, 92.28%. After reweighting, all aforementioned potential confounders were well balanced (Table S1.)

Associations between early childhood co-sleeping and childhood behavior problems

As shown in Table 2, early childhood co-sleeping behavior was associated with multiple concomitant behavior problems, especially as reported by parents. From parents' reports (CBCL), early childhood co-sleeping is associated with more severe internalizing (anxious/depressed, $p = .021$; withdrawal/depressed, $p = .006$) problems, externalizing (aggressive behavior, $p < .001$) problems, as well as all four DSM-oriented subscale problems (affective problems, $p = .048$; anxiety problems, $p < .001$; attention deficit hyperactivity (ADH) problems, $p < .001$; oppositional defiant problems, $p = .002$). Teachers' reports (TRF) revealed more affective problems ($p = .007$) in co-sleeping children.

After information from teacher and parent reports using factor score analysis was aggregated, multiple behavior problems were still associated with co-sleeping behavior. The affected behavior expanded from internalizing (anxious/depressed, $p = .021$; somatic problems, $p = .028$), externalizing (aggressive behavior, $p = .005$), other (attention problems, $p = .018$) and three DSM-oriented behavior problems (anxiety problems, $p < .001$; ADH problems, $p < .001$; oppositional defiant problems, $p < .001$). After varying the weighing model and/or changing to the average score method, the results (shown in Table S2.1, Table S3.1, Table S4.1S4.1, and Table S5.1) were similar, confirming the robustness of the analysis.

Associations between early childhood co-sleeping and preadolescent behavior problems

As shown in Table 3, early childhood co-sleeping continued to associate with multiple preadolescent behavior problems. Among children with co-sleeping history in early childhood, the children themselves reported higher internalizing (anxious/depressed, $p < .001$; subscale total, $p < .001$) problems and scored higher in two DSM-oriented subscales (anxiety problems, $p = .003$; ADH problems, $p = .003$); parents reported higher prevalence of internalizing (anxious/depressed, $p = .036$; withdrawal/depressed, $p = .002$; subscale total, $p = .046$), externalizing (aggressive behavior, $p = .027$), overall (total score, $p = .049$) and two DSM-oriented behavior problems (anxiety problems, $p < .001$; conduct problems, $p = .011$); teachers reported more internalizing (subscale total, $p = .047$) and other behavior problems (social problems, $p = .002$; thought problems, $p = .039$).

After information from all three informants via factor score was aggregated, early childhood co-sleeping history was associated with all three internalizing subscale problems (anxious/depressed, $p < .001$; withdrawal/depressed, $p < .001$; somatic problems, $p = .001$; subscale total, $p < .001$), external problem (aggressive behavior, $p = .023$; subscale total, $p < .001$), other (social problems, $p < .001$; attention problems, $p < .001$), overall (total score, $p = .014$), and DSM-oriented behavioral problems (affective problems, $p < .001$; anxiety problems, $p = .014$; ADHD problems, $p = .008$). After varying the weighing model and/or changing to the average score method, the results (shown in Table S2.2, Table S3.2 TableS4.2, and Table S5.2) were similar, confirming the robustness of the analysis.

Prediction of preadolescent behavior problems among children with early childhood co-sleeping

As shown in Table 4, after childhood baseline behavior problems were controlled for, parental reports indicate that early childhood co-sleeping predicts more severe withdrawal/depressed problems in preadolescence ($p < .001$). After information from all available informants with the differential weighting approach was aggregated, early childhood co-sleeping history predicts increased severity in internalizing (anxious/depressed, $p < .001$; withdrawal/depressed, $p = .008$; somatic problems, $p = .012$), externalizing (aggressive behavior, $p = .001$), other (attention problem, $p < .001$), and two DSM-oriented behavior problems (affective problems, $p = .001$; anxiety problems, $p = .002$). After varying the weighing model and/or changing to the average score method, the results (shown in Table S2.3 Table S3.3, Table S4.3, and Table S5.3) were similar, confirming the robustness of the analysis.

Discussion

Main findings

To the best of our knowledge, this is the first longitudinal study to explore the association between early childhood co-sleeping and preadolescent behavior problems after adjusting for childhood baseline behavior. The major findings of this research include: 1) Chinese preschool children (aged 3 to 5 years) have a high prevalence (84.77%) of co-sleeping arrangements with their parents; 2) early childhood co-sleeping is significantly associated with increased behavior problems in childhood (Odds Ratio [OR] 1.22–2.06, $ps < 0.03$) and preadolescence (OR 1.40–2.27, $ps < 0.02$); 3) early childhood cosleeping history significantly predicts an increase in internalizing (OR 1.63–2.61, $ps < 0.02$) and externalizing behavior problems in preadolescence.

High prevalence of co-sleeping arrangements in Chinese preschool children

In this study, we found that 84.77% (1080/1274) of preschool children in the Jintan area have co-sleeping arrangements, which is similar to the prevalence of co-sleeping among preschool children in other cities in China, including Shanghai, Guangzhou, and Nanjing (Liu, 2005; Wang, 2015; Yue et al., 2018). This suggests that co-sleeping arrangements for preschool children remain a common practice in Chinese families. Regarding residency location, we find that children living in rural areas have the highest prevalence of co-sleeping arrangements, which is in line with several studies that report children in rural

areas and/or areas of lower socioeconomic status (SES) tend to have higher cosleeping rates (Gupta et al., 2016; Li et al., 2007; Norton et al., 2011; Salm Ward et al., 2016). Indeed, lower SES might indicate crowded housing space and parents' lower awareness of children's sleep hygiene; both can contribute to lower adherence to the recommendation for solitary-sleeping for preschool children as suggested by the latest Chinese children's sleep hygiene guidelines (National Health Commission of the People Republic of China, 2017). Beyond these factors, however, cultural reasons may be another factor contributing to Chinese children's sleeping arrangements, in that Chinese traditional collectivist culture and the high value placed on family unity may result in the normalization of co-sleeping by Chinese parents (Li et al., 2007; X. Liu et al., 2003; Owens, 2004).

Associations between co-sleeping and childhood and preadolescent behavior problems

Using multiple methods to balance potential variances in parent-child dyads' baseline characteristics, we found that early childhood (3–5 y) co-sleeping is associated with internalizing (anxious/depressed, somatic complaints), externalizing (aggressive behavior), attention problems, and oppositional defiant behavior in childhood. These behaviors still exist when children reach their preadolescence (10–13 y). Furthermore, we found that positive associations between early childhood co-sleeping and preadolescent behavior problems expanded to withdrawal/depressed, social problems, and affective problems.

Existing studies exploring the relationship between co-sleeping and children's behavior have inconsistent conclusions. While some cross-sectional studies found no associations between co-sleeping arrangements and childhood internalizing or externalizing behavior (Cortesi et al., 2004; Kim et al., 2017; Sourander, 2001), a cross-sectional study conducted in Russia found that bed-sharing infants are more likely to have negative moods and less persistence in maintaining an activity for a certain period of time (Kelmanson, 1999). Another study conducted in the US found that bed-sharing in preschool children is associated with intense temperament, less adaptability and rhythmicity (Hayes et al., 2001).

Furthermore, the impact of co-sleeping on children's behavior remains inconclusive in existing cohort studies. A cohort study found that bed-sharing at age 1–3 years has no negative associations with children's behavior and cognition at the age of five (Barajas et al., 2011). Yet a more recent longitudinal study conducted in Brazil with a larger sample size ($n = 3583$) found that bed-sharing is associated with increased odds of presenting internalizing behavior and DSM-IV diagnosed mental health issues at the age of six (Santos et al., 2016). The inconsistencies between different cohort studies may be due to potentially insufficient statistical power from small sample sizes or different assessment instruments (Barajas et al., 2011; Okami et al., 2002; Volkovich et al., 2015). However, with a much larger sample, we found that early childhood co-sleeping is associated with multiple pre-adolescent behavior problems across internalizing and externalizing behavior, and DSM-oriented mental health problems.

Prediction of preadolescent behavior problems among children with early childhood co-sleeping

After the individual differences in childhood are accounted for, early co-sleeping history remains a statistically significant predicting risk factor for aforementioned behavior problems. The predicted risk for having certain behavior problems (e.g., withdrawal/depressed) is more than doubled. Thus, our findings highlight co-sleeping in early childhood as an important predicting risk factor for persistent behavior problems. Multiple studies have identified that childhood co-sleeping is associated with children's sleep disturbances and poorer sleep quality but not behavior problems (Kim et al., 2017; Lo, 2016). A recent longitudinal study identified a bidirectional association between childhood sleep problems and both internalizing and externalizing difficulties (Quach et al., 2018). This might suggest a potential pathway to explain the strong prediction effect identified in our study.

Strengths and limitations

The strengths of this study lie in its robust longitudinal cohort study design, which allowed for the assessment of baseline behavior problems during childhood and preadolescence using parent report and teacher reports. However, since the included children were in their early developmental stages during the first wave of data collection, their baseline behavior problems could not be collected via self-report. Another limitation is that we could not distinguish between bed-sharing and room-sharing based on one single question. Propensity score-based analysis design partially compensated for the non-randomized control study design and allowed for examination of the causal relationship between early childhood co-sleeping and preadolescent behavioral problems. However, uncontrolled confounders may have caused biased associations and predictions, as this was an epidemiological study. For example, puberty onset age and pubertal stage can potentially impact adolescent aggression/delinquent behavior (Najman et al., 2009). Since the pubertal onset and stage indicators were not collected and thus adjusted for in our analysis, our conclusions are subject to bias. Another limitation is that the co-sleeping arrangements were not collected in children's preadolescent period. Since co-sleeping in preadolescence is associated with the increase of certain children's behavior problems (i.e., DSM-derived anxiety problems (Palmer et al., 2018), not adjusting for this variable in our analysis may have mixed the effect of early co-sleeping with preadolescent co-sleeping on children's preadolescent behavior. The findings should be replicated in other ethnic groups as childhood co-sleeping behavior varies vastly between different cultures with regards to prevalence and interpretation. As a result of these limitations, we acknowledge the need to interpret our conclusions with caution.

Conclusions

Overall, we found that early childhood co-sleeping is associated with multiple behavior problems reported by parents, teachers, and children themselves. We also found that childhood co-sleeping history predicts both internal and external behavior problems after controlling for baseline behavior problems. Thus, early childhood co-sleeping arrangements should be practiced with caution. Future studies are encouraged to verify our findings in other cultures as well as investigate the effect of early co-sleeping behavior in later developmental stages. Future studies can also investigate children's sleep problems as a

potential mediating factor between co-sleeping arrangements and children's short-term and long-term behavior.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Data availability statement

Data are available from the corresponding author upon reasonable request.

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Table 1.

Sample characteristics at the time of collecting sleeping arrangements history.

	Childhood Sleeping Arrangements History		Statistical Test	
	Solitary-sleeping (N = 194)	Co-sleeping (N = 1,080)	χ^2/t	p
Sex – no. (%)			0.46	0.499
Male	110 (15.85)	584 (84.15)		
Female	82 (14.48)	496 (85.52)		
Age (Wave 1), Mean (SD)	4.95 (0.63)	5.00 (0.76)	0.94	0.347
Location – no. (%)			14.47	0.001
Rural	20 (7.72)	239 (92.28)		
Suburban	82 (16.53)	414 (83.47)		
City	92 (17.73)	427 (82.27)		
Father's education – no. (%)			1.29	0.277
Primary school	2 (7.69)	24 (92.31)		
Middle school	52 (13.23)	341 (86.77)		
High school	114 (16.91)	560 (83.09)		
College or above	26 (14.69)	151 (85.31)		
Mother's education – no. (%)			0.82	0.484
Primary school	3 (6.98)	40 (93.02)		
Middle school	82 (15.83)	436 (84.17)		
High school	90 (15.23)	501 (84.77)		
College or above	19 (15.97)	100 (84.03)		

Note: SD, Standard deviation

Table 2.

Association between early childhood co-sleeping and concomitant behavior problems.

	CBCL, Wave 1			TRF, Wave 1			FACTOR SCORE, Wave 1			AVERAGE SCORE, Wave 1						
	OR	P	Confidence Interval	OR	P	Confidence Interval	OR	P	Confidence Interval	OR	P	Confidence Interval				
Internalizing Problems																
Anxious/depressed	1.58	0.021*	1.07	2.33	1.03	0.934	0.56	1.87	1.48	<0.001***	1.24	1.77	1.42	0.071	0.97	2.09
Withdrawal/depressed	1.56	0.006**	1.14	2.14	1.07	0.629	0.81	1.42	1.08	0.791	0.61	1.92	1.01	0.959	0.63	1.63
Somatic Problems	1.31	0.225	0.85	2.02	0.83	0.146	0.65	1.07	1.26	0.028*	1.02	1.56	1.34	0.053	1.00	1.80
Externalizing Problems																
Aggressive Behavior	2.20	<0.001***	1.39	3.49	1.03	0.936	0.53	1.98	1.52	0.005**	1.13	2.05	1.49	<0.001***	1.22	1.83
Other Behavior problems																
Attention Problems	1.51	0.078	0.96	2.37	1.21	0.283	0.86	1.71	1.22	0.018*	1.03	1.45	1.22	<0.001***	1.15	1.28
DSM-oriented Scales																
Affective Problems	1.57	0.048*	1.00	2.45	0.81	0.007**	0.70	0.94	1.09	0.601	0.79	1.52	1.21	0.055	1.00	1.47
Anxiety Problems	3.11	<0.001***	2.04	4.74	1.11	0.733	0.62	1.99	2.06	<0.001***	1.47	2.88	2.31	<0.001***	1.81	2.94
ADH Problems	1.75	<0.001***	1.32	2.34	1.08	0.647	0.79	1.47	1.60	<0.001***	1.23	2.09	1.36	0.013*	1.07	1.72
Oppositional Defiant Problems	2.04	0.002**	1.30	3.19	1.05	0.721	0.81	1.36	1.59	<0.001***	1.54	1.64	1.95	<0.001***	1.81	2.11

Adjusted for age, sex, parents' education and mixed effect of location, heteroscedasticity assumed for robustness of analysis result.

CBCL, Child Behavior Checklist; TRF, Teacher's Report Form; DSM, diagnostic and statistical manual of mental disorders; ADH problems, attention deficit hyperactivity problems; OR, odds ratio.

* $p < .10$;

** $p < .05$;

*** $p < .01$.

Table 3. Association between early childhood co-sleeping and preadolescent behavior problems.

	YSR Wave 2			CBCL Wave 2			TRF Wave 2			FACTOR SCORE Wave 2			AVERAGE SCORE Wave 2		
	OR	p	Confidence Interval	OR	p	Confidence Interval	OR	p	Confidence Interval	OR	p	Confidence Interval	OR	p	Confidence Interval
Internalizing Problems															
Anxious/depressed	1.69	<0.001***	1.43 2.00	1.37	0.036*	1.02 1.84	1.50	0.139	0.88 2.58	2.08	<0.001***	1.66 2.61	1.79	<0.001***	1.52 2.11
Withdrawal/depressed	1.94	0.116	0.85 4.44	1.73	0.002**	1.22 2.47	1.32	0.174	0.89 1.96	2.27	<0.001***	1.42 3.65	2.71	<0.001***	2.12 3.45
Somatic Problems	0.94	0.519	0.78 1.13	0.86	0.684	0.42 1.77	2.31	0.143	0.75 7.11	1.38	0.001**	1.14 1.68	1.29	0.228	0.85 1.96
Subtotal: Internalizing Problems	1.46	<0.001***	1.23 1.73	1.20	0.046*	1.00 1.44	1.69	0.047*	1.01 2.83	2.00	<0.001***	1.45 2.76	2.03	<0.001***	1.48 2.78
Externalizing Problems															
Rule-breaking Behavior	1.48	0.071	0.97 2.26	1.16	0.448	0.79 1.72	1.19	0.505	0.71 2.01	1.56	0.129	0.88 2.79	1.56	0.129	0.88 2.79
Aggressive Behavior	1.05	0.791	0.74 1.48	1.31	0.027*	1.03 1.65	1.00	0.999	0.72 1.39	1.59	0.023*	1.06 2.37	1.73	0.009**	1.15 2.62
Subtotal: Externalizing Problems	1.19	0.478	0.73 1.94	1.29	0.067	0.98 1.70	1.20	0.511	0.69 2.09	2.00	<0.001***	1.42 2.82	1.93	<0.001***	1.31 2.86
Other Behavior Problems															
Social Problems	1.16	0.506	0.75 1.77	1.46	0.072	0.97 2.22	1.90	0.002**	1.26 2.85	1.58	<0.001***	1.21 2.07	1.51	0.010*	1.10 2.08
Thought Problems	1.27	0.247	0.85 1.91	1.15	0.673	0.61 2.16	1.29	0.039*	1.01 1.64	1.34	0.057	0.99 1.81	1.68	<0.001***	1.30 2.18
Attention Problems	1.40	0.103	0.93 2.11	1.14	0.538	0.75 1.74	1.44	0.151	0.88 2.36	1.88	<0.001***	1.55 2.29	1.63	0.029*	1.05 2.54
Total Score	1.30	0.375	0.73 2.34	1.47	0.049*	1.00 2.15	1.36	0.287	0.77 2.39	1.71	0.014*	1.11 2.61	1.80	0.009**	1.16 2.80
DSM-oriented Scales															

	YSR Wave 2			CBCL Wave 2			TRF Wave 2			FACTOR SCORE Wave 2			AVERAGE SCORE Wave 2		
	OR	p	Confidence Interval	OR	p	Confidence Interval	OR	p	Confidence Interval	OR	p	Confidence Interval	OR	p	Confidence Interval
Affective Problems	1.35	0.313	0.75 2.41	1.15	0.368	0.85 1.56	1.03	0.917	0.62 1.71	1.67	<0.001***	1.34 2.07	1.77	<0.001***	1.30 2.42
Anxiety Problems	1.77	0.003**	1.22 2.57	1.32	<0.001***	1.16 1.50	1.62	0.105	0.90 2.92	1.68	0.014*	1.11 2.55	1.68	0.014*	1.11 2.55
Somatic Problems	0.90	0.539	0.63 1.27	0.80	0.363	0.49 1.29	2.25	0.181	0.69 7.39	0.81	0.352	0.52 1.26	0.84	0.415	0.55 1.28
ADH Problems	1.52	0.003**	1.15 2.00	1.33	0.087	0.96 1.86	1.39	0.162	0.88 2.22	1.40	0.008**	1.09 1.79	1.82	<0.001***	1.41 2.34
Oppositional Defiant Problems	1.34	0.231	0.83 2.18	1.29	0.101	0.95 1.74	1.55	0.197	0.80 3.03	1.50	0.129	0.89 2.52	1.90	<0.001***	1.41 2.55
Conduct Problems	1.30	0.361	0.74 2.30	1.43	0.011*	1.09 1.89	0.91	0.741	0.54 1.56	1.27	0.415	0.72 2.23	1.47	0.153	0.87 2.49

Adjusted for age, sex, parents' education and mixed effect of location, heteroscedasticity assumed for robustness of analysis result.

YSR, Youth Self Report; **CBCL**, Child Behavior Checklist; **TRF**, Teacher's Report Form; **DSM**, diagnostic and statistical manual of mental disorders; **ADH problems**, attention deficit hyperactivity problems; **OR**, odds ratio.

* *p* .10;

** *p* .05;

*** *p* .01.

Table 4.

Prediction of early childhood co-sleeping on preadolescent behavior problems.

	CBCL, Wave 2			TRF, Wave 2			FACTOR SCORE, Wave 2			AVERAGE SCORE, Wave 2		
	OR	p	Confidence Interval	OR	p	Confidence Interval	OR	p	Confidence Interval	OR	p	Confidence Interval
Internalizing Problems												
Anxious/depressed	1.08	0.641	0.78	1.50	0.125	0.89	2.59	<0.001***	1.80	2.28	1.82	<0.001***
Withdrawal/depressed	1.73	<0.001***	1.28	2.33	0.210	0.87	1.93	0.008**	1.23	3.92	2.61	<0.001***
Somatic Problems	0.74	0.367	0.39	1.42	0.157	0.74	6.26	0.012*	1.07	1.70	1.28	0.260
Externalizing Problems												
Aggressive Behavior	1.11	0.458	0.84	1.48	0.841	0.75	1.42	0.001**	1.21	2.17	1.66	0.018*
Other Behavior problems												
Attention Problems	0.94	0.840	0.54	1.66	0.085	0.95	2.29	<0.001***	1.43	1.69	1.63	0.009**
DSM-oriented Scales												
Affective Problems	0.86	0.354	0.63	1.18	0.857	0.61	1.83	0.001**	1.16	1.86	1.65	0.002**
Anxiety Problems	1.11	0.502	0.82	1.49	0.107	0.90	2.95	0.002**	1.22	2.48	1.72	<0.001***
ADH Problems	1.02	0.929	0.61	1.73	0.062	0.98	2.19	0.057	1.00	1.36	1.71	<0.001***
Oppositional Defiant Problems	1.13	0.440	0.82	1.56	0.088	0.92	3.09	0.223	0.80	2.59	1.67	<0.001***

Adjusted for age, sex, parents' education, corresponding childhood behavior problems scores and mixed effect of location, heteroscedasticity assumed for robustness of analysis result.

CBCL, Child Behavior Checklist; TRF, Teacher's Report Form; DSM, diagnostic and statistical manual of mental disorders; ADH problems, attention deficit hyperactivity problems; OR, odds ratio.

* $p < .10$;

** $p < .05$;

*** $p < .01$.