Attachment & Human Development

ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/rahd20

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To cite this article: Ayten Bilgin, Isabel Morales-Muñoz, Catherine Winsper & Dieter Wolke (2024) Associations between bed-sharing in infancy and childhood internalizing and externalizing symptoms, Attachment & Human Development, 26:5, 403-422, DOI: 10.1080/14616734.2024.2380427

To link to this article: https://doi.org/10.1080/14616734.2024.2380427

ATTACHMENT & HUMAN DEVELOPMENT
2024, VOL. 26, NO. 5, 403–422
https://doi.org/10.1080/14616734.2024.2380427

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RESEARCH ARTICLE

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Associations between bed-sharing in infancy and childhood internalizing and externalizing symptoms

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ABSTRACT

Bed-sharing is a controversial but common parenting practice with claimed benefits for emotional and behavioral development. Using data from the UK Millennium Cohort Study ($N = 16,599$), this prospective study investigated whether bed-sharing at 9 months is associated with childhood internalizing and externalizing symptom trajectories. Children were grouped by their patterns of co-developing internalizing and externalizing symptoms from 3 to 11 years of age using a parallel process latent class growth analysis. There were no associations between bed-sharing at 9 months of age and internalizing and externalizing symptom trajectories across childhood. This finding suggests that bed-sharing at 9 months has no positive or negative influence on the development of internalizing and externalizing symptoms across childhood. Clinicians should inform parents that bed-sharing during the second half of the first year is unlikely to have an impact on the later emotional and behavioral development of the children.

ARTICLE HISTORY
Received 19 November 2023
Accepted 11 July 2024

KEYWORDS
Infant sleep; bed-sharing; parenting; internalizing and externalizing problems; Millennium Cohort Study

Bed-sharing, a form of co-sleeping (i.e. sleeping in close proximity to parents either in the same bed or room) in which parents and infants sleep in the same bed, is a controversial parenting practice (Bilgin & Wolke, 2022; McKenna & McDade, 2005; Mileva-Seitz et al., 2017). The American Academy of Pediatrics discourages bed-sharing before 6 months of age, due to its link with Sudden Infant Death Syndrome (Mindell et al., 2010; Moon et al., 2022). On the other hand, bed-sharing has been the norm for the majority of human history, and it is still a common parenting practice in many non-Western cultures (McKenna & McDade, 2005). Recent evidence shows that bed-sharing is also increasing in Western countries (Bilgin & Wolke, 2022; Blair & Ball, 2004; Luijk et al., 2013; Mileva-Seitz et al., 2016; Moon et al., 2022).

From an evolutionary, anthropological, and historical point of view, bed-sharing has many potential benefits for the infant providing security from predators, warmth, and temperature regulation, as well as food security due to being close to the mother (Ball,

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Supplemental data for this article can be accessed online at https://doi.org/10.1080/14616734.2024.2380427.

2006; McKenna et al., 1993). Concerns about providing security and safety to the infant still remain in many cultures that face potential threats to the infant's safety, health, and food security. However, in most high-income countries where parents and infants live in an accommodation that is safe and warm, the main evolutionary concern for survival is much diminished (Volk, 2023). The reasons for bed-sharing in high-income countries include cultural norms and family traditions (Jenni & O'Connor, 2005), convenience, facilitation of breastfeeding, and single parenthood (Blair et al., 2010; Colson et al., 2013; Luijk et al., 2013; Mileva-Seitz et al., 2016). Some other parents feel they do not have a choice but have to react to frequent infant night-waking, difficult temperament, tiredness, or limited resources (i.e. reactive bed-sharing) (Marakovitz et al., 2023). A further reason to bed-share includes the belief that it is beneficial for the infant (Barry & McKenna, 2022). In line with this argument, evidence from a night-time video observation study showed that bed-sharing infants experienced less distress at 2 weeks of age in comparison to solitary sleeping infants (St James-Roberts et al., 2016). However, empirical evidence on the long-term benefits of bed-sharing does not provide support to this claim and has revealed mixed evidence (Santos et al., 2017). This might be explained by the complexity of the reasons behind bed-sharing and their potential impact on the parents. For instance, it was shown that reactive bed-sharing mothers perceive infant night-waking as more problematic than intentional bed-sharing mothers (Ramos et al., 2007). Thus, understanding whether bed-sharing has benefits beyond infancy requires the consideration of these factors, which is the focus of the current study.

Bed-sharing in infancy and infant-parent attachment

From an attachment theory perspective, it is plausible to expect that bed-sharing will have many benefits for the development of the infant including fewer behavioral problems in childhood such as internalizing (i.e. depression and anxiety) and externalizing (i.e. aggression and hyperactivity) symptoms. Bowlby (1973) suggested that fear-inducing situations could activate the attachment system and can lead infants to display attachment behaviors such as crying to gain proximity to their caregivers. Separation at night-time could reflect a fear-inducing situation which could trigger the attachment system. Considering the importance of parental responsiveness for the development of secure infant-parent attachment (Ainsworth et al., 1978), bed-sharing could be a practice which helps to improve infant's feelings of emotional security due to its link with prompt responding to the needs of the baby during nighttime (Miller & Commons, 2010; Sears & Sears, 2001). Given the links between secure infant-parent attachment and fewer childhood internalizing and externalizing symptoms (Groh et al., 2017), we could expect a similar association between bed-sharing in infancy and decreased internalizing and externalizing symptoms in childhood. In addition, bed-sharing promotes physical proximity between parents and the infant during night-time which can help parents to regulate their infants' arousal levels (Choe et al., 2013). For example, a night-time observation study showed that infants who bed-shared at 3 months of age (i.e. some parts of the night or the whole night) showed better self-regulatory behaviors at 6 months of age (Lerner et al., 2020). The link between secure infant-parent attachment and better self-regulation capacity further suggests that bed-sharing could improve emotional and behavioral development (Bilgin & Wolke, 2020; Pallini et al., 2018; Winsper et al., 2020).

Only two studies have investigated the association between bed-sharing and infant-parent attachment and revealed mixed findings. In a Dutch sample, Mileva-Seitz et al. (2016) found that bed-sharing at 2 months of age was associated with a higher likelihood of secure infant-mother attachment at 14 months of age. However, there was no dose–response association with the frequency of bed-sharing, and the role of infant sleeping difficulties (e.g. frequent night waking, long sleep onset duration) was not included as a potential confounder. In contrast, another study which used a UK sample and considered the role of infant sleeping difficulties reported that bed-sharing during the first 6 months was not associated with secure infant-mother attachment at 18 months of age, as well as observed behavioral outcomes such as poor attention/hyperactivity and task persistence (Bilgin & Wolke, 2022). Thus, no consistent evidence so far suggests that bed-sharing helps build secure infant-mother attachment.

Bed-sharing in infancy and childhood internalizing and externalizing symptoms

The few existing studies on the associations between bed-sharing and later internalizing and externalizing symptoms in childhood revealed mixed findings. A cross-sectional study of children aged 2–3 years of age revealed no associations between bed-sharing and behavioral problems (Madansky & Edelbrock, 1990). Similar findings were found in a longitudinal study of low-income families in US, which showed that bed-sharers at one time point only (i.e. either at 1, 2, or 3 years) and persistent bed-sharers across 2 or 3 time points were not statistically different than those who did not bed-share in terms of their social skills and hyperactivity levels at 5 years of age (Barajas et al., 2011). Moreover, no associations were found between reactive bed-sharing at 4 years and psychiatric diagnoses at 6 years in a study focusing on a clinical sample of children with high anxiety symptoms in the US (Marakovitz et al., 2023). On the other hand, another longitudinal study, using a sample from Brazil, showed that both bed-sharing during early years only (until 24 months of age) and persistent bed-sharing from 3 months to 6 years were associated with increased odds of internalizing symptoms, but not externalizing symptoms, at 6 years of age (Santos et al., 2017). This study revealed no associations between late-onset bed-sharing (i.e. starting at 4 years) and internalizing and externalizing symptoms. Thus, the existing limited empirical evidence suggests either no influence of bed-sharing or influence on internalizing symptoms only for early onset and persistent bed-sharing. However, the existing evidence includes many limitations such as lack of consideration of the impact of parenting beliefs, factors that might be related to reactive bed-sharing and cross-cultural variations. A further limitation includes the assessment of internalizing and externalizing symptoms at 1 time point only.

Identifying the trajectories of internalizing and externalizing symptoms across childhood

The majority of the previous studies have examined internalizing and externalizing symptoms separately and at 1 time point, which provides little insight into the development of internalizing and externalizing symptoms across childhood given that they are highly comorbid (Achenbach et al., 2016; Angold et al., 1999), and not all children may have the same pattern of internalizing and externalizing symptoms

over time (Winsper et al., 2020). Children may vary in scores of internalizing and externalizing symptoms both cross-sectionally and longitudinally, which was shown to predict adverse outcomes such as adolescence and adulthood psychiatric disorders, drug abuse, criminal behaviors, and suicide (Althoff et al., 2010; Holtmann et al., 2011). Thus, it is informative to identify developmental subgroups of internalizing and externalizing symptom trajectories while considering that these symptoms can co-occur (Goulter et al., 2021; Patalay et al., 2017; Speyer et al., 2022; Wiggins et al., 2015; Winsper et al., 2020). This approach would increase our understanding of the etiology, course, and treatment of psychiatric disorders (Wiggins et al., 2015). Thus, in the current study, we applied parallel process latent class growth analysis (PP-LCGA) modelling using a population-based UK cohort (i.e. Millennium Cohort Study), to categorize children into subgroups of co-occurring internalizing and externalizing symptom trajectories. This approach provides nuanced information regarding high-risk developmental trajectories for psychopathology (Cosgrove et al., 2011; Winsper et al., 2020).

To the best of our knowledge, only a few studies have applied parallel process latent class growth analysis to identify the co-occurring internalizing and externalizing symptom trajectories (Goulter et al., 2021; Patalay et al., 2017; Speyer et al., 2022; Wiggins et al., 2015; Winsper et al., 2020). One previous study, using the same cohort (i.e. Millennium Cohort Study), identified five distinct sub-groups of children in terms of emotional and behavioral problems (Patalay et al., 2017). However, their calculation of emotional and behavioral problems only focused on emotional symptoms and conduct problem subscales of the Strengths and Difficulties Questionnaire (SDQ). This approach is different than the recommended calculation of externalizing symptoms which include both conduct problems and hyperactivity symptoms (Goodman et al., 2010). Further, they did not consider the role of gender in the identification of the co-developing internalizing and externalizing symptom trajectories. It is important to incorporate gender as a covariate during the PP-LCGA process given the previous evidence on the significant effects of gender on the development of internalizing and externalizing symptoms (Wiggins et al., 2015) and to avoid misspecification of internalizing/externalizing classes (Jung & Wickrama, 2008).

Current study

The aim of the current study was to investigate whether there are distinct co-developing internalizing and externalizing symptom trajectories across childhood and whether bed-sharing in infancy is related to these distinct trajectories across childhood. It was hypothesized that bed-sharing at 9 months of age will be associated with high-risk trajectories of co-developing internalizing and externalizing symptoms across childhood. The current study considers the influence of several variables which might be associated with bed-sharing and internalizing and externalizing symptoms such as parenting beliefs and variables that might be associated with reactive bed-sharing such as frequent night-wakings, and difficult infant temperament. Further, the current study focuses on an ethnically and socio-economically diverse population-based sample in the UK which enables to account for the role of

variations in bed-sharing practice due to different cultural and socio-economic backgrounds.

Methods

Participants

The current study used data from the Millennium Cohort Study (MCS), which is a nationally representative longitudinal study of 18,522 infants born in the United Kingdom (Connelly & Platt, 2014). A random two-stage sample of all infants born in England and Wales between September 2000 and August 2001 and in Scotland and Northern Ireland between November 2000 and January 2022, who were alive and living in the UK at age 9 months, was drawn from Child Benefit registers that cover virtually all children in the UK. The sample is geographically clustered by over-sampling of ethnic minority and disadvantaged areas. The first sweep of interviews with cohort members' mothers took place when the infants were 9 months old and follow-up interviews were conducted when the children were 3, 5, 7, 11, 14, 17, and 22 years of age. In the current study, we focus on the assessments made at 9 months, 3, 5, 7, and 11 years of age. Of the initial participating families, 81% were assessed at 3 years ($N = 15,590$), 79% participated at 5 years ($N = 15,246$), 72% participated at 7 years ($N = 13,857$), and 69% participated at 11 years of age ($N = 13,287$). The interviews included questions on a wide variety of topics, including health, education, social, family, and economic status of the cohort members' households. Detailed information on the sampling and scope of MCS is available at: http://www.cls.ioe.ac.uk/. Ethical approval and written informed consent for all participants were obtained (London – Hampstead Research Ethics Committee, REC reference 14/LO/0868).

The final sample for this study included 16,599 participants who had at least one internalizing and externalizing symptom measure in childhood (sweeps 2–5; assessments from 3 to 11 years) (88.5% of the original sample at 9 months). In order to assess whether loss to follow-up had been random or selective, those who dropped out were compared to those who were retained in the study. Those lost to follow up had lower birth weight ($M = 3.23$ kg, SE = 0.02 vs $M = 3.35$ kg, SE = 0.006, $p < 0.001$) were more often male ($N = 524$, 55.5% vs $N = 5832$, 51%, $p < 0.001$) and from a minority background ($N = 446$, 37.9% vs $N = 1608$, 12.9%, $p < 0.001$) than those retained in the study.

Measures

Bed-sharing

At 9 months, parents reported the usual sleep location of their baby with the following question: "Does your child sleep in her/his/their own bed or cot most nights or does she/he/they share a bed or cot?" The answer options included in own bed or cot, in bed/cot with other children, or in parents' bed. Using this question, a dichotomous variable was created to measure parental bed-sharing: 0 = solitary sleeping (in own bed or cot); 1 = bed-sharing (in parents' bed).

Internalizing and externalizing symptoms across childhood

Internalizing and externalizing symptoms were measured using the Strengths and Difficulties Questionnaire (SDQ), which parents completed at four assessment points when children were 3, 5, 7 and 11 years. SDQ is a widely used and psychometrically valid behavioral screening tool suitable for community samples (Flouri et al., 2019). In line with recommendations (Goodman et al., 2010), internalizing symptoms were measured with the negative emotionality sub-scale including 5 items (e.g. "child has many worries") with a total score ranging from 0 to 10. Externalizing symptoms were measured with conduct problems (e.g. "child often cheats or lies") and hyperactivity (e.g. "child is easily distracted") sub-scales including 10 items, with a total score ranging from 0 to 20. This was divided into two to create a common scale of scores ranging from 0 to 10.

Covariates

The following demographic variables were used as covariates: infant gender (0 = male, 1 = female), self-reported lowest level of education of either parent at participants' birth as a proxy for socioeconomic status (0 = A level or vocational equivalent or higher education or university degree: 1 = Obligatory education or lower), minority ethnicity: parent-reported ethnic minority status (0 = White: Majority; 1 = Indian, Pakistani, Bangladeshi, Black, Mixed and Other: Minority), and single parenting at 9 months (not cohabiting, not married) entered as categorical variables, and birth weight (kg) and maternal age at birth as continuous variables.

The role of several further covariates was also considered in the analyses given the previous evidence on factors associated with parental bed-sharing (Ball, 2002). *Night waking frequency*: Mothers reported on the frequency of the child's night waking at 9 months of age with the following question: "*At the moment how often child normally wakes at night?*" and the response scale: 1 = never, 2 = occasionally, 3 = most nights, 4 = once every night, 5 = more often than once a night, which was included as a continuous variable in the analysis with higher scores indicating higher night waking frequency.

Breastfeeding

Mothers reported on whether they ever breastfed (0 = no; 1 = yes).

Maternal psychological distress

Maternal psychological distress was assessed at 9 months using the Kessler Psychological Distress Scale (Kessler et al., 2003), which is a widely used brief screening tool for mental health problems in the general population. It includes six items (e.g. "*How often did you feel hopeless?*") rated on a 5-point scale ranging from "none" to "all of the time" that assess psychological distress in the past 30 days. Mean value was computed with higher scores reflecting higher symptoms of mental health problems.

Infant temperament

Temperament was assessed at 9 months by 14 items from the Carey Infant Temperament Scale (Carey & McDevitt, 1978), a widely used measure of children's temperament that has

demonstrated good validity and reliability (Rothbart & Bates, 2006). The scale captures infant temperament across four dimensions: positive mood (five items), withdrawal (three items), low adaptability (two items), and regularity (four items). Responses were made on a 5-point scale (1 = almost never, 2 = rarely, 3 = usually does not, 4 = often, 5 = almost always) and summed so that higher scores indicate higher scores in each dimension.

Parenting beliefs

At 9 months of age, parental attitudes towards child rearing were assessed with five questions originally derived from the European Longitudinal Study of Pregnancy and Childhood (ELSPAC, 1989). We used one item from these questions which reflects structured parenting beliefs (i.e. *"It is important to develop a regular pattern of feeding and sleeping with the baby")*. Answers were rated on a 5-point scale (1 = very much disagree; 5 = very much agree).

Statistical analysis

To examine the differences between infants who were bed-sharing and solitary sleeping, we performed independent samples t-tests for continuous variables and chi-square test for categorical variables using SPSS 27 (IBM Corp., Armonk, NY, USA). The significance level was set at $p < .05$.

Our main analysis was conducted using a two-stage process as described in Jung and Wickrama (2008). In stage one, we conducted a parallel process latent class growth analysis (PP-LCGA) (Speyer et al., 2022) to identify distinct groups of children showing similar longitudinal patterns of co-developing internalizing and externalizing symptoms using MPlus (version 8, Muthen & Muthen, Los Angeles, CA, USA). The PP-LCGA approach is a special case of growth mixture modeling that assumes homogeneity of growth parameters within each latent subgroup. It discerns homogenous classes defined by different developmental trajectories of co-developing symptoms, which is useful for identifying how different groups of children who share common characteristic develop over time. The full information maximum likelihood approach was used to handle missing data.

Gender was incorporated as a covariate in the PP-LCGA. However, we did not include other confounding variables at this stage due to the considerable computational intensity required to estimate PP-LCGA models and to avoid controlling for confounders twice. We used automatic R3STEP approach to model the auxiliary variable (gender), which adjusts for the impact of covariates while estimating the number of latent classes and shown to produce less-biased estimates than traditional methods (Vermunt, 2017).

In order to determine the optimal number of latent classes, we examined several model fit indices: Bayesian information criterion (BIC) and Akaike information criterion (AIC), Lo – Mendell – Rubin (LMR), Vuong – Lo – Mendell – Rubin (VLMR), and the entropy value (Jung & Wickrama, 2008). Briefly, we estimated one to six classes and selected the best fitting model based on fit indicators. In addition to statistical model fit indices, several other criteria were considered to determine the optimal number of latent classes, that is, the probability of belonging to a latent class should be 0.80 or higher; the smallest class should include at least 5% of the sample; parsimony of models, their interpretability and theoretical justification (Bilgin et al., 2020; Wiggins et al., 2015).

Children were grouped into their most likely latent class, and the groupings were saved and imported into SPSS, version 17 (IBM, Armonk, NY). During stage two, we used the imported internalizing/externalizing classes to conduct multinominal logistic regression analysis which tested the associations between bed-sharing and classes of co-developing internalizing and externalizing symptoms controlling for all covariates. We added the variables to the regression using the following steps: (1) bed-sharing; (2) structured parenting beliefs, maternal psychological distress, night waking frequency; and (3) other covariates (female sex, minority ethnicity, low parental education at participants' birth, single parenting, maternal age at birth, birth weight, ever breastfed, and infant temperament). Sampling weights were applied in line with guidance for conducting analyses using the MCS – sweep 5 (assessment at 11 years of age). The sampling weights account for the stratified clustered design of the data and the oversampling of subgroups, and adjust for non-response, attrition, and representation of the population in the UK (Mostafa, 2014).

Further, to investigate whether attrition resulted in biased findings, we conducted a sensitivity analysis and repeated the main multinominal logistic regression analysis with data using multiple imputations with chained equations ($n = 20$).

Table 1. Participant characteristics according to bed-sharing and solitary sleeping at 9 months.

	Bed-sharing ($N = 1376$, 8.8%)	Solitary sleeping ($N = 14175$, 91.2%)	p
Infant Gender: N (%)			
Female	454 (44.9%)	5382 (49.0%)	0.002
Male	539 (55.1%)	5366 (51.0%)	
Ethnicity: N (%)			
Majority (White)	547 (58.8%)	9420 (88.5%)	<0.001
Minority (non-White)*	446 (41.2%)	1328 (11.5%)	
Birth weight (gr): M (SE)	3.31 (0.02)	3.35 (0.007)	0.094
Parental Education: N (%)			
Below Tertiary Education	243 (28.8%)	2422 (25.8%)	0.181
At least A level/vocational equivalent or tertiary education	750 (71.2%)	8326 (74.2%)	
Maternal age at 9 months: M (SE)	26.95 (0.31)	28.21 (0.13)	<0.001
Single parenting: N (%)	278 (34.2%)	1635 (17.4%)	<0.001
Ever breastfed at 9 months: N (%)			<0.001
No	241 (31.4%)	3277 (34.3%)	
Yes	752 (68.6%)	7471 (65.7%)	
Night waking frequency at 9 months: M (SE)	3.45 (0.06)	2.59 (0.02)	<0.001
Infant temperament at 9 months			
Positive mood: M (SE)	19.08 (0.04)	19.22 (0.04)	0.364
Withdrawal: M (SE)	6.16 (0.16)	5.32 (0.03)	<0.001
Low adaptability: M (SE)	6.07 (0.15)	5.61 (0.04)	0.004
Regularity: M (SE)	11.73 (0.15)	13.07 (0.03)	<0.001
Maternal psychological stress at 9 months: M (SE)	1.88 (0.08)	1.67 (0.02)	0.014
Structured parenting beliefs at 9 months: M (SE)	4.21 (0.83)	4.41 (0.74)	0.001
Internalizing problems at 3 years: M (SE)	1.60 (0.08)	1.36 (0.02)	0.009
Internalizing problems at 5 years: M (SE)	1.70 (0.12)	1.37 (0.02)	0.009
Internalizing problems at 7 years: M (SE)	2.00 (0.12)	1.52 (0.02)	<0.001
Internalizing problems at 11 years: M (SE)	2.35 (0.12)	1.93 (0.02)	0.001
Externalizing problems at 3 years: M (SE)	3.53 (0.09)	3.41 (0.03)	0.216
Externalizing problems at 5 years: M (SE)	2.70 (0.11)	2.43 (0.02)	0.018
Externalizing problems at 7 years: M (SE)	2.68 (0.12)	2.38 (0.02)	0.022
Externalizing problems at 11 years: M (SE)	2.58 (0.12)	2.27 (0.02)	0.016

M=Mean; SE=Standard error.
*Indian, Pakistani, Bangladeshi, Black, Mixed and Other.

Results

Table 1 compares characteristics of bed-sharers ($N = 1376$, 8.8%) and solitary sleepers ($N = 14175$, 91.2%). A higher percentage of mothers who bed-share were from minority ethnic backgrounds, younger, single mothers, more likely to ever breastfeed, and had higher levels of psychological distress and lower levels of structured parenting beliefs. Bed-sharing infants were more often male and had higher frequency of night-waking, withdrawal, and lower regularity and adaptability in comparison to solitary sleepers. Table 2 shows the bivariate correlations between the study variables.

Parallel process latent class growth analysis (PP-LCGA): Co-developing internalizing and externalizing symptom classes

Table 3 shows the fit indices for the one to six class models. Likelihood ratio tests (Lo-Mendell-Rubin and Vuong-Lo-Mendell-Ratio) suggested that a three-class model was a significantly better fit than the two-class alternative. The fit of the four-class model did not significantly differ from the three-class model according to likelihood ratio tests. (LMR $p = 0.101$; VLMR $p = 0.098$). However, The Bayesian Information Criteria (BIC = 396127.531) and Akaike Information Criteria (AIC = 395919.169) values were lower for the four-class model compared to the three (BIC = 399705.912; AIC = 399536.136) class model. Further, classification precision (entropy) results suggested that the four-class model (0.794) was better able to represent internalizing/externalizing symptom trajectories rather than the three-class alternative (0.764). Therefore, we chose the four-class model which included the following classes (Figure 1): Low stable internalizing and externalizing symptoms (class 1; 56.5%), low increasing internalizing, and moderate decreasing externalizing symptoms (class 2; 27.2%); moderate decreasing internalizing and externalizing symptoms (class 3; 7.5%); and low increasing internalizing and high stable externalizing symptoms (class 4; 8.9%).

Associations between bed-sharing at 9 months and trajectories of co-developing internalizing and externalizing symptoms across childhood

Figure 2 shows that children who had bed-shared were more likely to be in one of the three elevated internalizing/externalizing symptom trajectory groups (in comparison to the low stable group) than those who were solitary sleeping.

Multinominal regression findings revealed a significant association between bed-sharing at 9 months of age and moderate decreasing internalizing and externalizing trajectory (class 3) (OR = 1.55; 95% CI = 1.16–2.06), and low increasing internalizing and high stable externalizing trajectory (class 4) (OR = 1.68; 95% CI = 1.19–2.38) when the low stable internalizing/externalizing trajectory group (class 1) was used as the reference in the analysis. When the influences of structured parenting beliefs, maternal psychological distress, and infant night-waking frequency were considered, there was only an association between bed-sharing and low increasing internalizing and high stable externalizing trajectory class (OR = 1.66; 95% CI = 1.16–2.38), which became non-significant after adjusting for covariates (Table 4).

Table 2. Bivariate correlations among study variables.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1.Female	1																					
2.Minority	.004	1																				
3.Low parental education	−.002	−.02**	1																			
4.Maternal age	.005	−.04**	−.23**	1																		
5. Single parenting	−.001	.06**	.19**	−.29**	1																	
6.Birth weight	−.10**	−.13**	−.03**	.06**	−.06**	1																
7.Ever breastfed	−.01	.15**	−.17**	.19**	−.17**	.03**	1															
8.Bed-sharing	−.02**	.24**	.01	−.04**	.09**	−.01	.04**	1														
9.Structured parenting beliefs	−.01	−.002	−.08**	.14**	−.05**	.02*	.10**	.03**	1													
10.Maternal psychological distress at 9 m	−.01	.05**	.05**	−.07**	.09**	−.06**	−.04**	.02**	−.02**	1												
11.Night waking frequency	−.06**	.09**	−.03**	.07**	−.02**	.01*	.07**	.14**	−.07**	.10**	1											
12. Withdrawal	.07**	.17**	.04**	−.05**	.08**	−.03**	−.05**	.08**	−.06**	.12**	.05**	1										
13. Positive mood	−.003	−.08**	.02**	−.02**	−.002	−.007	−.03**	−.02**	.03**	−.11**	−.07**	−.11**	1									
14. Low adaptability	.05**	.13**	.01	−.05**	.04**	−.02**	−.01*	.04**	−.04**	.08**	.04**	.50**	−.15**	1								
15. Regularity	.009	−.18**	−.02**	.05**	−.09**	.04**	.007	−.14**	.27**	−.13**	−.12**	−.05**	.13**	−.02*	1							
16.Internalizing problems at 3 years	.006	.11**	.06**	−.12**	.09**	−.07**	−.10**	.05**	−.04**	.20**	.03**	.18**	−.09**	.13**	−.13**	1						
17. Internalizing problems at 5 years	.02**	.08**	.05**	−.09**	.07**	−.06**	−.04**	.05**	−.05**	.21**	.04**	.14**	−.07**	.11**	−.10**	.42**	1					
18. Internalizing problems at 7 years	.01	.05**	.06**	−.10**	.08**	−.05**	−.05**	.04**	−.03**	.20**	.04**	.10**	−.06**	.09**	−.09**	.35**	.51**	1				
19. Internalizing problems at 11 years	−.004	.04**	.09**	−.09**	.11**	−.06**	−.09**	.04**	−.03**	.22**	.02**	.10**	−.05**	.06**	−.10**	.29**	.38**	.48**	1			
	−.11**	.04**	.13**	−.22**	.15**	−.06**	−.14**	.03**	−.05**	.24**	.03*	.09**	−.09**	.05**	−.15**	.31**	.24**	.24**	.34**	1		

(*Continued*)

Table 2. (Continued).

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
20.Externalizing problems at 3 years																						
21. Externalizing problems at 5 years	−.14**	.03**	.12**	−.18**	.16**	−.07**	−.12**	.03**	−.05**	.22**	.008	.06**	−.07**	.02**	−.12**	.20**	.32**	.29**	.39**	.60**	1	
22.Externalizing problems at 7 years	−.17**	.02**	.10**	−.18**	.15**	−.07**	−.11**	.02**	−.04**	.21**	.01*	.05**	−.05**	.02**	−.11**	.18**	.24**	.37**	.44**	.54**	.70**	1
23. Externalizing problems at 11 years	−.16**	−.004	.12**	−.17**	.15**	−.05**	−.11**	.02**	−.03**	.18**	−.004	.04**	−.04**	.01	−.11**	.16**	.21**	.27**	.61**	.48**	.60**	.69**

***$p<.001$; **$p<.01$; *$p<.05$.

Table 3. Model fit indices of parallel process latent class growth analysis (PP-LCGA) estimated within internalizing and externalizing symptoms from 3 to 11 years of age.

Number of Classes	Bayesian Information Criteria (BIC)	Akaike Information Criteria (AIC)	Lo-Mendell-Rubin (LMR) p value	Vuong-Lo-Mendell-Rubin (VLMR) p value	Parametric Bootstrapped Likelihood Ratio Test	Entropy	Number of subjects per class
1	430020.075	429927.469					
2	405697.806	405566.615	<.001	<.001	<.001	.831	12391/4208
3	399705.912	399536.136	<.001	<.001	<.001	.762	5572/9158/1869
4	**396127.531**	**395919.169**	**.101**	**.098**	**<.001**	**.794**	**9376/4510/1241/1472**
5	393765.434	393618.486	.005	.005	<.001	.766	1491/1698/4632/8035/743
6	392291.488	392005.955	.015	.013	<.001	.771	7553/444/4791/1228/905/1678

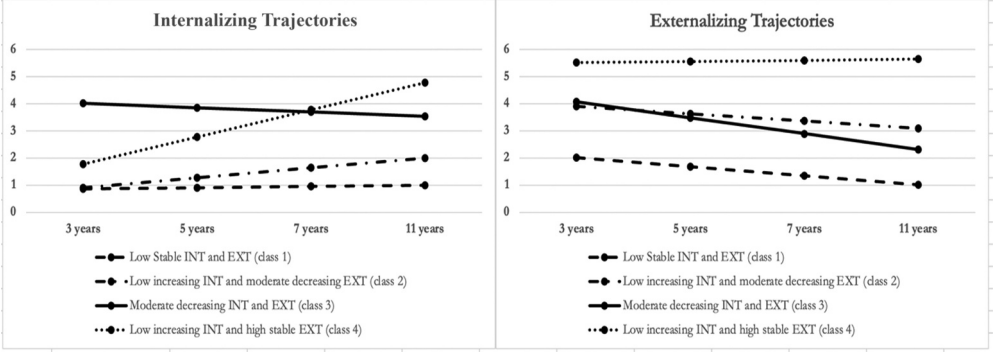

Figure 1. Parallel process latent class growth analysis (PP-LCGA) co-developing internalizing (INT) and externalizing (EXT) trajectories.

The main findings remained the same when the analyses were repeated using multiple imputed data (Suplementary Table S1).

Discussion

A large community sample was used to examine whether bed-sharing at 9 months of age is associated with internalizing and externalizing symptoms across childhood. Using PP-LCGA, we identified four distinct groups of children who differed in their longitudinal patterns of co-developing internalizing and externalizing symptoms. Our findings showed no associations between parental bed-sharing at 9 months of age and co-developing internalizing/externalizing symptom trajectories across childhood.

We identified four distinct groups of children who differed regarding their longitudinal patterns of co-developing internalizing/externalizing symptoms. The majority of the children showed a normative pattern of low stable internalizing and externalizing symptoms (class 1; 56.5%). A substantial proportion of children showed initially low

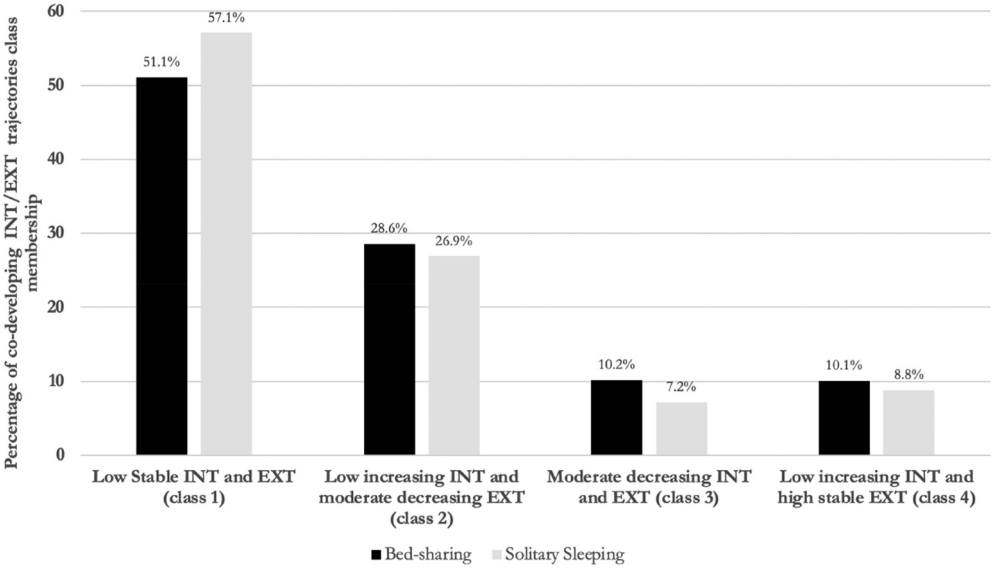

Figure 2. Percentage of co-developing internalizing (INT) and externalizing (EXT) symptom trajectories class membership based on bed-sharing and solitary sleeping infants.

internalizing symptoms which increased over time and initially moderate externalizing symptoms which decreased over time (class 2; 27.2%). For a smaller group of children, both internalizing and externalizing symptoms were initially moderate but decreased over time (class 3; 7.5%). Further, we identified a group of children with more severe and chronic symptoms who showed initially low symptoms of internalizing problems which increased over time and high levels of externalizing symptoms which remained stable (class 4; 8.9%). This analytical approach allowed for categorization of joint trajectories which would have been unnoticed by examining symptom domain trajectories in isolation. To illustrate, investigating externalizing symptom trajectories alone would give the impression that externalizing symptoms are decreasing over time for children in class 2, but by including internalizing symptoms in this co-development model, we identified a subgroup of individuals whose internalizing symptoms increase over time as their externalizing symptoms decreased. Similarly, for children who showed the most severe and chronic symptoms (class 4), investigating externalizing symptom trajectories alone would give the impression that they have high externalizing symptoms which are stable over time, but our approach revealed that their initial low internalizing symptoms showed a large increase over time reaching nearly the same level as externalizing symptoms by the age of 11. Therefore, the research implications of the current findings highlight the importance of examining parallel processes which provide a more precise classification of individuals in terms of their patterns of internalizing and externalizing symptom trajectories in comparison to studies examining the trajectories of a single domain. Although our four distinct groups are congruent with a previous UK study using a different sample (Winsper et al., 2020), they diverge from the five classes previously identified in the same sample (Patalay et al., 2017). Differences might be attributable to our inclusion of additional subscale of SDQ for externalizing symptoms (hyperactivity sub-scale) and

Table 4. Multinominal logistic regression associations between bed-sharing at 9 months and childhood internalizing (INT) and externalizing (EXT) symptom classes from 3 to 11 years of age.

Steps	Variables	Low stable INT and EXT (Class 1) Odds Ratio (95% CI)	Low increasing INT and moderate decreasing EXT (Class 2) Odds Ratio (95% CI)	Moderate decreasing INT and EXT (Class 3) Odds Ratio (95% CI)	Low increasing INT and high stable EXT (Class 4) Odds Ratio (95% CI)
1	Bed-sharing at 9 months	[reference]	1.154 (0.942–1.413)	**1.552 (1.168–2.063)**	**1.688 (1.196–2.383)**
2	Bed-sharing at 9 months	[reference]	1.108 (0.892–1. 376)	1.256 (0.898–1.757)	**1.669 (1.166–2.388)**
	Structured parenting beliefs at 9 months	[reference]	0.917 (0.851–0.988)	0.878 (0.784–0.982)	0.938 (0.835–1.054)
	Maternal psychological distress at 9 months	[reference]	1.211 (1.177–1.245)	1.439 (1.381–1.499)	1.465 (1.410–1.522)
	Night waking frequency at 9 months	[reference]	0.952 (0.916–0.988)	0.993 (0.937–1.052)	0.963 (0.907–1.022)
3	Bedsharing at 9 months	[reference]	0.936 (0.705–1.244)	0.748 (0.471–1.188)	1.387 (0.904–2.129)
	Structured parenting beliefs at 9 months	[reference]	0.889 (0.809–0.977)	0.917 (0.793–1.061)	0.941 (0.815–1.087)
	Female	[reference]	0.551 (0.487–0.622)	0.847 (0.674–1.065)	0.368 (0.297–0.456)
	Minority	[reference]	1.052 (0.841–1.315)	1.426 (0.995–2.045)	0.678 (0.463–0.992)
	Low parental education	[reference]	1.327(1.105–1.595)	1.439 (1.122–1.845)	1.396 (1.081–1.803)
	Maternal age at birth	[reference]	0.960 (0.948–0.972)	0.952 (0.931–0.973)	0.933 (0.915–0.952)
	Single parenting	[reference]	1.483 (1.225–1.796)	1.294 (0.967–1.732)	1.874 (1.468–2.394)
	Birth weight	[reference]	0.935 (0.837–1.045)	0.813 (0.661–0.999)	0.796 (0.666–0.951)
	Ever breastfed	[reference]	0.760 (0.660–0.874)	0.669 (0.523–0.857)	0.661 (0.530–0.825)
	Maternal psychological distress at 9 months	[reference]	1.158 (1.113–1.204)	1.363 (1.288–1.442)	1.398 (1.333–1.467)
	Night waking frequency at 9 months	[reference]	0.958 (0.914–1.004)	1.007 (0.933–1.088)	0.935 (0.862–1.015)
	Infant temperament at 9 months				
	Positive mood	[reference]	0.964 (0.945–0.982)	0.979 (0.945–1.014)	0.962 (0.934–0.992)
	Withdrawal	[reference]	0.988 (0.956–1.021)	1.106 (1.046–1.168)	1.057 (1.006–1.111)
	Low Adaptability	[reference]	0.994 (0.970–1.019)	1.016 (0.973–1.061)	0.977 (0.944–1.012)
	Regularity	[reference]	0.944 (0.917–0.972)	0.910 (0.871–0.951)	0.909 (0.866–0.954)

consideration of the role of gender in the identification of internalizing/externalizing symptom trajectories.

In all three high-risk internalizing/externalizing symptom trajectories across childhood, there was a higher percentage of children who bed-shared at 9 months of age in comparison to solitary sleepers. Further, there was a prospective association between bed-sharing at 9 months of age and the likelihood of belonging in the two severe internalizing/externalizing symptom trajectories with 1.55 increased likelihood for "moderate decreasing internalizing and externalizing" trajectory and 1.68 for "low-increasing internalizing and high stable externalizing" trajectory. However, the strength of this prospective association decreased when the roles of structured parenting beliefs, maternal psychological distress, and infant night waking frequency were considered and diminished when other covariates, such as single parenting and breastfeeding, were included in the analysis. Thus, the likelihood of belonging in internalizing and externalizing symptom trajectories is explained by other factors related to bed-sharing rather than bed-sharing itself. Our findings provide no evidence for a positive or negative influence of bed-sharing at 9 months of age on internalizing and externalizing symptom risk trajectories across childhood. This is in line with the results of a previous longitudinal study, which found no associations between bed-sharing either at one time point only or persistently across years 1, 2, and 3 and behavioural problems at 5 years (Barajas et al., 2011).

It is important to note that, although disappeared after considering the role of covariates, the direction of the association between bed-sharing and childhood internalizing and externalizing symptoms appears more likely to be positive in contrast to theoretical postulations (e.g. attachment theory). This suggests that bed-sharing at 9 months of age is more likely to increase childhood internalizing and externalizing symptoms than decrease them. However, the impact of bed-sharing on child outcomes could depend on its impact on the family and the co-parenting relationship. It was shown that bed-sharing was associated with higher marital and coparenting distress (Teti et al., 2016) and lower co-parenting quality in comparison to solitary sleeping (Teti et al., 2015). Furthermore, it was shown that marital and coparenting distress is more severe when bed-sharing persists beyond the first few months (Cortesi et al., 2008). Thus, it is possible that bed-sharing would be associated with negative outcomes only if it is a source of stress to both parents which could negatively impact the quality of their co-parenting relationship and in turn could predict childhood emotional and behavioral problems (Frosch & Mangelsdorf, 2001). Future studies could examine whether the quality of the co-parenting relationship influences the association between bed-sharing and internalizing and externalizing symptoms.

The findings of the current study have important implications for clinicians and parents. It is important that clinicians acknowledge bed-sharing as a parenting decision which might depend on parenting and cultural values as well as many other factors such as breastfeeding. Thus, clinicians should discuss bed-sharing with parents, providing information about how to avoid potential risks and guide them to arrive at their own informed decision. Parents should be informed that no negative impacts of bed-sharing during the second half of the first year are expected as long as it is practiced safely.

There are several strengths of the current longitudinal study including the large sample size representative of the population in the UK, which allows generalizability of

the findings to the population, high power to detect statistically significant differences, and repeated assessment of internalizing and externalizing problems across childhood. There are also limitations. First, the assessment of bed-sharing was completed once at 9 months of age. Thus, there was no information on the age when infants started bed-sharing and the duration of bed-sharing. However, if parents are bed-sharing with their infants at 9 months, there is strong likelihood that the practice was used fairly consistently from early infancy (Teti et al., 2016). Second, all assessments were mother reports which could induce reporter bias. However, objective measurements of infant sleep such as utilizing actigraphy and more detailed assessment of internalizing/externalizing symptoms such as clinical interviews were not possible in a large, general population study. Third, it was not possible to consider the influence of reactive and intentional bed-sharing. It was shown that reactive bed-sharing mothers reported increased marital conflict and fatigue than intentional bed-sharing mothers (Messmer et al., 2012; Mileva-Seitz et al., 2017), which may have influenced our findings. However, we considered the role of night-waking frequency in our analyses, which is higher in reactive bed-sharing mothers than intentional bed-sharers (Mileva-Seitz et al., 2017). Further, the impact of bed-sharing in infancy on children's emotional and behavioral development may only be apparent based on the extent to which this creates stress in the family. Therefore, future studies should assess parents' perception about bed-sharing and incorporate this as a factor into the analyses. Fourth, our measurement of breastfeeding only assessed ever breastfeeding, rather than whether parents are breastfeeding currently.

To conclude, the current findings suggest that parental bed-sharing at 9 months of age does not differentiate children belonging in the different internalizing and externalizing symptom trajectories across childhood. Thus, parent's decision to bed-share at 1 time point in infancy may have no positive or negative consequences on children's emotional and behavioral development. This finding reassures parents who choose to bed-share that it is not associated with negative emotional and behavioral outcomes in childhood.

Acknowledgments

The authors are extremely grateful to all families who took part in the Millennium Cohort Study, and the whole Millennium Cohort Study teams, which includes interviewers, computer and laboratory technicians, clerical workers, research scientists, volunteers, managers, receptionists, and nurses. They are also grateful to the Centre for Longitudinal Studies, UCL (London, UK) for the use of the data from the Millennium Cohort Study, and to the UK Data Archive and UK Data Service for making them available; however, these bear no responsibility for the analysis or interpretation of these data.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

The author(s) reported that there is no funding associated with the work featured in this article.

Data availability statement

The data necessary to reproduce the analyses presented here are publicly accessible at the following URL: https://beta.ukdataservice.ac.uk/datacatalogue/series/series?id=2000031

Abbreviations

INT/EXT (Internalizing/Externalizing), PP-LCGA (Parallel Process Latent Class Growth Analysis), OR (Odds Ratio), LMR (Lo-Mendell-Rubin), VLMR (Vuong-Lo-Mendell-Rubin), BLRT (Parametric Bootstrapped Likelihood Ratio Test), BIC (Bayesian Information Criterion), AIC (Akaike Information Criterion), Strengths and Difficulties Questionnaire (SDQ)

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