SLEEP, 2022, 1–11

https://doi.org/10.1093/sleep/zsac142
Advance Access Publication Date: 30 June 2022
Original Article

ORIGINAL ARTICLE

Developmental trajectories of toddler sleep problems: can a person-centered approach help identify children at risk?

Hanna C. Gustafsson[1,*] and Cathi B. Propper[2]

[1]Department of Psychiatry, Oregon Health and Science University, Portland, OR, USA [2]Frank Porter Graham Child Development Institute, University of North Carolina at Chapel Hill, Chapel Hill, NC, USA

*Corresponding author. Hanna C. Gustafsson, Oregon Health and Science University, 3181 SW Sam Jackson Park Rd., Multnomah Pavilion, Suite 1400, Mail Code: UHN-80R1, Portland, OR 97239, USA. Email: gustafha@ohsu.edu.

Abstract

Study Objectives: Previous research examining toddler sleep problems has relied almost exclusively on variable-centered statistical approaches to analyze these data, which provide helpful information about the development of the average child. The current study examined whether person-centered trajectory analysis, a statistical technique that can identify subgroups of children who differ in their initial level and/or trajectory of sleep problems, has the potential to inform our understanding of toddler sleep problems and their development.

Methods: Families (N = 185) were assessed at 12, 24, 30, and 36 months of child age. Latent class growth analysis was used to test for subgroups that differed in their 24–36 month sleep problems. Subgroups were compared on child 36-month externalizing, internalizing, and total problem behaviors, and on 12 month maternal mental health, inter-parental conflict, and maternal parenting behaviors.

Results: Results support a four-class solution, with "low, stable," "low, increasing," "high, increasing," and "high decreasing" classes. The classes whose sleep problems persisted or worsened over time had worse behavioral problems than those whose symptoms improved or remained stably low. Additionally, 12 month maternal depression and global symptom severity, intimate partner violence, and maternal harsh-intrusive parenting behaviors discriminated between the classes that had similar levels of 24 month sleep disturbance but who had diverging trajectories over time.

Conclusions: This statistical approach appears to have the potential to increase understanding of sleep problem trajectories in the early years of life. Maternal mental health, intimate partner violence, and parenting behaviors may be clinically useful markers of risk for the persistence or development of toddler sleep problems.

Key words: infant sleep; toddler sleep; developmental trajectories; maternal depression; parenting behaviors; intimate partner violence; internalizing problems; externalizing problems; latent class growth analysis; LCGA

Introduction

Parents of toddlers commonly report that their children have difficulties with sleep [1–6], such that an estimated 30% of children have sleep problems, which in this age group often manifests as frequent or prolonged night wakings or difficulties with the initiation or duration of sleep [2, 7, 8]. Though most children's sleep quality improves over the first 3 years of life [2, 9–11], there are some children for whom sleep problems persist or worsen during this timeframe [3, 12–15]. This is a process influenced by both physiological and environmental factors [16]. Children who continue to have sleep problems in the preschool years are at risk for a range of later emotional, behavioral, and cognitive difficulties [13, 17–19], making early identification of such problems important. Though previous research has identified a number of concurrent correlates of sleep problems in this age range (e.g. parenting behaviors and qualities of the home environment), little is known about factors that are related to changes in infant or toddler sleep problems over time. This is an

Submitted: 20 January, 2022; **Revised:** 15 June, 2022

Statement of Significance

Previous research examining the development of sleep problems has relied almost exclusively on variable-centered statistical techniques, which are methods that provide information about the average individual and their expected developmental course. While this information is very valuable, it does not give insight into individuals who deviate from the average trajectory (e.g. whose sleep problems persist, remit, or increase over time). As these "nonaverage" individuals are often those of most clinical concern, this is an important limitation. The current study provides evidence that person-centered statistical techniques (which are designed to identify subgroups of individuals who differ in their initial level and/or trajectories) may be a helpful method for characterizing the developmental trajectories of "nonaverage" children and for identifying children most at-risk.

important limitation of the current literature because the development of effective interventions requires not only being able to provide evidence of distinct patterns of child sleep disturbance over the toddler years (e.g. persisting, remitting, and increasing), but also on identifying factors that can discriminate between children whose sleep problems will lessen or increase over time. If such groups can be empirically identified and discriminated from one another (ideally based on information that is ascertainable before the change in sleep problems has occurred), it has the potential to facilitate earlier intervention for the most at-risk children.

Previous studies on the developmental course of toddler sleep problems

Several different study designs have been used in previous research to characterize children's sleep patterns over the first few years of life (see [11] for a relevant systematic review). Most studies in this area have utilized cross-sectional data to examine sleep patterns in this age range, including several large-scale studies that compare groups of children of different ages on various dimensions of sleep (e.g. [9, 20, 21]). Though these studies provide tremendous insight into normative sleep patterns (including reference values and percentiles that have clinical utility), the data that they yield captures between-group differences in sleep, rather than within-person change in sleep overtime (i.e. differences in sleep between a group of 2-year-olds and an independent group of 3-year-olds vs. change in sleep within the same individuals as they age from two to three). The former data type is often used to make conclusions about the latter, though this is not always appropriate, in part because studies of between- and within-person differences test different questions and because they often yield conflicting results [22, 23]. Many theoretical and clinical questions about sleep patterns in this age range are fundamentally interested in within-person change, which makes this an important distinction.

Building on this cross-sectional data, there have also been a number of longitudinal studies of infant and toddler sleep patterns. The most impressive of these have followed groups of children over many years (e.g. [3, 15, 20, 24]) and have been used to characterize the average change in children's sleep over time. These studies often report the average amount of sleep or the number or percentage of children with disturbed sleep at each time point, and compare these values over time to get a sense of developmental trajectories; few have utilized modern statistical methods for analyzing trajectories of sleep, for example, latent curve modeling (LCM; see [25] for an exception), which allow for a more nuanced understanding of change over time. More importantly, these studies have almost exclusively used variable-centered approaches for analyzing these longitudinal data; none to our knowledge have used a person-centered approach to examine trajectories of sleep problems. That is, these studies have been focused on modeling the trajectory for the average child (vs. examining whether there are subgroups of children who differ from one another in their trajectory), a fact that is reflected in their analytic approach. Though variable-centered techniques offer important information about normative sleep development, as is true for nearly every aspect of development, the average trajectory does not describe all children (and in many cases does not describe the majority of children). Rather, clinical observations and findings in the extant literature suggest that there are groups of children who differ from one another on their developmental course (e.g. who exhibit persisting, remitting, or increasing sleep problems). Such groups are not easily detectable using variable-centered approaches [23, 26]. The use of a person-centered statistical technique to examine change in toddler sleep problems, therefore, is a novel approach that may yield interesting additional information about child sleep problems, measured in the current study at 24, 30, and 36 months of age.

As alluded to above, there are a few studies that have examined persisting, remitting, and increasing sleep problems in this age range (e.g. [12–14]). Most of these studies have utilized data from two-time points and have examined whether a child meets the criteria for poor sleep at one or more assessments. Based on this information, children are grouped into categories defined as having persisting (meeting criteria at both time points), remitting (meeting criteria only at time one), or increasing (meeting criteria only at time two) sleep difficulties. Though these studies represent an important first step in characterizing these patterns of children's sleep problems, we believe that using a person-centered statistical technique to analyze such data offers several advantages over this statistical approach.

For example, the previous approach typically involves categorizing children into dichotomous *problematic* vs. *nonproblematic* sleep groups at each assessment in order to evaluate whether children's problems have changed over time. Though this likely captures children whose problems have become dramatically better or worse during the prescribed timeframe, it does not capture the extent to which the child's sleep problems are increasing or decreasing over time, and likely collapses children who are showing different developmental patterns into the same group. That is, it is possible that some children who are categorized as having persistent problems (based on meeting criteria for problematic sleep at both time points) may actually be experiencing decreasing sleep problems (that may resolve over time), while others may be experiencing stable or increasing problems. Similarly, a child whose sleep was initially undisturbed but who has increasing sleep problems (that may later become clinically significant but as of yet are not) may be classified as stably nonproblematic using this approach, even though this upward trajectory likely places them at

risk for later difficulties. This level of nuance can be lost using a variable-centered analytic approaches, but can be more readily captured using a person-centered trajectory approach like latent class growth analysis (LCGA) [27].

Additionally, being able to classify children into *problematic* and *nonproblematic* groups (as the previous approach necessitates) requires an a priori operationalization of problematic sleep, and a child's classification, by definition, will depend on this operationalization. Person-centered approaches like LCGA donot require such definitions, but rather yield data-driven classes that reflect subgroups of children who differ from one another in their initial sleep difficulties and their trajectories of sleep problems over time.

There are a few previous studies that have used person-centered statistical approaches in the sleep literature, though none to our knowledge have applied person-centered techniques to model trajectories of sleep nor have they examined change in sleep across the toddler years. In a relevant example, Cook et al. [28, 29] used latent profile analysis (LPA) to examine profiles of infant sleep problems assessed at multiple timepoints between 3 and 12 months of age. This statistical approach, like LCGA, identifies subgroups (or "profiles") of individuals who differ from one another on the variables considered. However, LPA differs from LCGA in that it does not model change in sleep overtime (i.e. a slope), but rather categorizes individuals based on their score at each individual assessment without considering the underlying growth process. Using LPA, these authors found evidence of four sleep classes: one with persistently high problems, a "settled" class (with persistently low problems), a class with problems at 6 months, and a class with problems at 9 months. While this study provides important information about sleep in infancy and provides preliminary evidence of the utility of using a person-centered approach, there is additional important information to be gained by using LCGA, particularly in a different age range. That is, identifying children who differ from one another in their developmental trends (slopes) as well as their initial level of problems (intercepts) may yield additional information.

In another relevant example, Jusiené et al. (2019) [30] used mixture modeling (a person-centered approach similar to LPA) to create subgroups of children who differed from one another in preschool-aged sleep (assessed at two-time points) and in their self-regulation. Again, while informative and interesting, these classes were created without modeling change in sleep over time, and class membership in this study was contingent upon both sleep and self-regulation, in alignment with their study's research questions. A study that considers sleep (and its development) alone is likely to yield different results. Indeed, these authors found that the sleep patterns captured by their classes differed depending on the dimension of self-regulation considered (i.e. "hot" vs. "cool" task performance), suggesting that the profiles were quite dependent on the other variables considered in the particular model. In a third relevant study, Winsper et al. (2014) [31] used LCGA to look at trajectories of dysregulated behaviors between 4 and 9.5 years of age. They found evidence of four classes that differed in their overall level of dysregulation and found that these classes differed from one another in their early life sleep problems. While this study provides additional support that early sleep problems may have lasting effects on child behavior, this study did not examine trajectories of sleep or create profiles based on sleep, which provides a unique niche that the current study helps to fill.

Does a person-centered trajectory approach provide meaningful additional information?

The goal of the current study was to investigate whether person-centered trajectory analysis holds promise as an approach to studying change in children's sleep problems across the toddler years. Though the novelty of using a person-centered approach to analyze longitudinal sleep data is clear, it is our opinion that the following criteria should be met in order to demonstrate that this approach yields unique information about toddler sleep problems, above and beyond that produced by previously used approaches. (Of note, these criteria do not all need to be met in order for this approach to be statistically viable. Rather, they reflect what we believe are necessary criteria to demonstrate the incremental advantage of using this approach to help understand toddler sleep problems and their developmental course).

First, the LCGA results should suggest there are at least two subgroups, or classes, of children (if the LCGA yields a one-class solution, this would suggest that there are not distinct subgroups). Second, the classes produced should be interpretable and align broadly with previous research and/or theoretical predictions. There does not need to be perfect correspondence here, but a solution that only yields theoretically implausible subgroups would not be very useful. Third, the classes should differ on expected constructs (i.e. child correlates of sleep problems identified by previous research) in ways that show that additional information is gained by knowing about their trajectories and not just their overall level. In the current study, we examined whether the classes differed on measures of children's emotional and behavioral functioning (which have been linked with child sleep problems in previous research [13, 15, 19, 32]) when they were 3 years old, as a means of testing whether this last criteria was met.

In addition to demonstrating that this type of statistical approach has utility (using the above criteria), a study of this nature would ideally identify factors that distinguish classes with deviating developmental trajectories (e.g. to distinguish children who begin with similar levels of sleep difficulty, but who differ in their trajectories over time). If we are able to find such factors, ideally using data that was collected at or before the initial wave of sleep assessment (i.e. before the change in sleep has occurred), it could help with early identification of children who are likely to develop persisting vs. remitting problems, and could open the door to earlier intervention for at-risk children. Previous research has reported a number of correlates of concurrent child sleep problems that can be relatively easily assessed in a clinical setting, including parenting behaviors [9, 33], parental mental health (maternal depression in particular [14, 34]), and stressful environmental factors such as marital conflict [35, 36]. Though these variables are hypothesized to also be related to persisting or remitting sleep problems over time, the existing literature has not found strong support that this is the case. For example, maternal depressive symptoms have been linked with concurrent or overall level of sleep problems [14, 34, 37], but several studies have found that these symptoms were not predictive of persistent problems [13, 14]. Wake et al. [4] found that children who had repeated sleep problems (who met criteria at 3 or more times

between 2 and 24 months) had mothers with higher depressive symptoms, but they conclude that sleep problems contributed to maternal depression, not that maternal mental health was a predictor of child sleep problems. Similarly, parenting behaviors and qualities of inter-parental conflict have been associated with concurrent or overall levels of sleep problems [36, 38] but not with persistent problems in this age range [4]. Might a person-centered approach help us to clarify whether these factors can help signal risk for the persistence or development of toddler sleep problems?

Research questions

Using data from a sample of ethnically and economically diverse children living in and around a medium-sized southeastern city, we examined the following research questions: (1) Using LCGA, a person-centered analytic approach, can we identify subgroups of children who differ meaningfully from one another in their trajectories of sleep problems over the toddler years?; and (2) Can we identify factors that distinguish the groups of children who begin with similar levels of sleep problems but who subsequently have deviating developmental trajectories (persisting vs. remitting sleep problems)?

Based on the data described above, we hypothesized that there would be subgroups of children who differed in their sleep problems. We hypothesized that these subgroups would include classes that exhibit persisting, remitting, or increasing sleep problems. We hypothesized that at least some of the factors identified using previous research (as being related to sleep problems using other research designs and other analytic strategies) would help us to discriminate between classes. As outlined above, if these hypotheses are supported, this would provide compelling evidence that person-centered analytic techniques may be useful for understanding toddler sleep problem trajectories.

Methods

Participants

Data came from 185 participants enrolled in the Durham Child Health and Development Study, a longitudinal study of socioeconomically and racially diverse families living in and around a mid-sized southeastern city. Families with healthy, full-term infants were recruited via fliers and postings at birth and parenting classes and through phone contact via birth records during the first 3 months of the child's life. Participants were selected in accordance with a stratified sampling plan designed to reflect the demographic diversity of Durham, North Carolina. Recruitment procedures were designed to yield approximately equal numbers of White and Black families sampled from low- and middle-income groups.

Procedure

Data used in these analyses came from a series of assessments completed when children were 12, 24, 30, and 36 months old. At each assessment time point, mothers completed questionnaires, and the mother and child came to our laboratory to complete a number of age-appropriate tasks, including a parent–child free-play interaction task.

Measures

Demographic variables. When children were 12 months old, mothers reported information on a variety of household demographics, including the sex (0 = female, 1 = male) and race of the child (0 = Black, 1 = White), and parental age (in years), parental education completed. The mother's and father's highest level of completed education was assessed via parental report using a 23-point scale where values 0–11 indicate the highest grade level that they had completed, and values 12–22 include milestones including obtaining a Graduate Equivalency Diploma (12), graduating from high school (14), completing a 4 year college degree (18), and obtaining a PhD (22). When children were 36 months old, parents reported on the total family income from all sources and the total number of people residing in the home. Income-to-needs ratios were calculated by dividing the total household income from all possible sources by the federally determined poverty threshold for the number of people living in the household for that year.

Child sleep problems. Child sleep problems were assessed via maternal ratings on the 100-item Child Behavior Checklist (CBCL) [39] when children were 24, 30, and 36 months old. The 7-item sleep problem scale asks respondents to rate on a 3-point scale (where 0 = not true, 1 = somewhat or sometimes true, and 2 = very true or often true) how true each statement is of their child now or within the past 6 months. The items assess a variety of sleep problems, and query about how often the child "has trouble getting to sleep," "resists going to bed at night," "talks or cries out in sleep," "doesn't want to sleep alone," is "overtired," has "nightmares," and "sleep less than most kids during the day and/or night." Scores on these 7-items were summed to create the sleep problem score (α = 0.701–0.703 at the various child ages). The CBCL sleep problems score has been validated against objective measures of sleep [40, 41], has been shown to exhibit convergent validity [41, 42], and has successfully been used in previous studies of young children [19, 25, 30, 37]. Following conventions of trajectory analysis, raw scores were used in analyses.

Child behavioral problems. Child behavior problems were also assessed using the CBCL at 36 months. The internalizing, externalizing, and global symptom severity scores (αs = 0.86–0.95) were summed using standard scoring methods, and *t*-scores were calculated. Example items include "nervous, high strung, or tense" (internalizing) and "temper tantrums or hot temper" (externalizing).

Maternal parenting behaviors. At the 12 month visit, mothers and children participated in a 10-minute free-play interaction. Dyads were asked to sit on a blanket on the floor and were presented with a standard set of developmentally appropriate toys. Mothers were instructed to play with their children as they normally would if they had a few free minutes during the day. Interactions were videotaped and were later coded using seven global rating scales adapted from those used in the NICHD Study of Early Childcare [43, 44], Sensitivity/Supportive Presence, Detachment/Disengagement, Intrusiveness, Stimulation of Cognitive Development, Positive Regard, Negative Regard, and Animation. Coders rated parenting behaviors on a 5-point scale (1 = *not at all characteristic* and 5 = *very characteristic*). Informed by an exploratory factor analysis with an oblique rotation (i.e. promax), the seven individual scales were combined to obtain

overall measures of sensitive parenting (the mean of Sensitivity, Stimulation, Positive Regard, Animation, and reverse-scored Detachment) and harsh-intrusive parenting (the mean of Intrusiveness and Negative Regard). All interactions were coded by two coders, and inter-rater reliability was excellent (ICC sensitive parenting = 0.88; ICC harsh-intrusive parenting = 0.80).

Maternal mental health. Maternal mental health was assessed at 12 months of child age, using the sex-adjusted *t*-scores for the depression, anxiety, and global severity subscales of the Brief Symptom Inventory [45] (α = 0.77–0.96).

Inter-parental conflict. Inter-parental verbal and physical aggression were assessed using the Conflict Tactics Scale–Couple Form R (CTS-R) [46] a 19-item self-report measure completed by the mother when the child was 30 months old (this measure was not administered in this study prior to this time point). Respondents were asked to rate on a 7-point Likert-type scale (0 = *never*, 1 = *once*, 2 = *twice*, 3 = *3–5 times*, 4 = *6–10 times*, 5 = *11–20 times*, and 6 = *<20 times*) how often in the past 12 months they engaged in specific behaviors in response to an argument. They were also asked to rate how often in the past 12 months their partner engaged in each behavior. This reference window indexes behaviors that occurred when the child was 18–30 months old.

The 12-item verbal aggression and 9-item physical violence subscales were used in this study. An example item reads "insulted or swore at him/her/you" (verbal aggression) "kicked, bit, or hit him/her/you with a fist" (physical violence). Following previous reports [47, 48], maternal reports of her and her partner's behavior on each subscale were averaged to capture the total verbal aggression (α = 0.77) and total physical aggression (α = 0.83) occurring in the relationship.

Analytic strategy. First, LCM was used to characterize the average trajectory of child sleep problems. Model fit was evaluated using the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), and the Root Mean Square Error of Approximation (RMSEA). CFI and TLI values above 0.90 and RMSEA values below 0.05 indicate adequate model fit [49, 50]. Next, LCGA was used to identify subgroups of children who differed from one another in the initial level or slope of sleep problems. One- through nine-class unconditional LCGA models were fit to the data. All analyses were conducted using M*plus* 7.4 [51] using the robust maximum likelihood estimator. Full information maximum likelihood [52] was used to handle missing data.

As with any data-driven approach, the process of selecting the optimal number of classes depends on a number of factors, including indices of model fit, theoretical justification, and interpretability of the resultant classes [27]. To this end, we examined Bayseian Information Criteria (BIC) values and the results of Vuong-Lo-Mendell-Rubin likelihood ratio tests (VLMR LRT) for the k-class vs. k-1 class model. Lower BIC and a significant VLMR LRT generally support the preferred model [27, 53]. Entropy, an index of precision of class assignment, was also examined (higher values suggest greater precision of class assignment [27]). In terms of theory and interpretability, it is recommended that each class should include at least 5% of the complete sample and that the classes produced should capture theoretically plausible patterns of change. The above described statistical indices do not always converge on a single solution; class selection, therefore, relies on a global impression of the statistical indices (rather than a value on any single criteria) in consultation with theory [27].

After a class solution was selected, the resulting classes were compared to one another using analysis of variance (ANOVA) or using analysis of covariance (ANCOVA) for models that included covariates. A Bonferroni correction for multiple comparisons was applied in each of these models. Groups were compared to one another on (1) child internalizing, externalizing, and total problem behaviors at 36 months (used to examine whether the groups differed from one another on expected constructs; Research Question One). In each of these models, we controlled for the 24 month assessment of the same construct (i.e. 24 month internalizing problems were controlled for in the model that considered 36 month internalizing problem differences across classes); and (2) contextual factors that may help discriminate which children will go on to have difficulties measured at 12–18 months of age (Research Question Two). As articulated above, we focused on 12–18 months of age because we reasoned that measures that could be obtained before the change in sleep problems has occurred (i.e. those that would have the greatest possibility of signaling early risk for persisting problems) would have the greatest clinical utility.

Results

Descriptive statistics

Descriptive Statistics appear in Table 1. Approximately half (49%) of the children in this sample were female, and 59% were Black (41% were White). On average, mothers were 28.71 years old (*SD* = 5.60), and fathers were 30.43 years old (*SD* = 6.16) at study entry. The median household income when the child was 36 months old was $78 482 (*SD* = $60 096, range: $1100–$410 400).

Latent curve model: describing the average trajectory of toddler sleep problems

Prior to testing for subgroups, we estimated an LCM in order to describe the average trajectory of sleep problems from 24 to 36 months. On average, children started with a 24 month sleep problem score of 2.11 and increased, on average, 0.25 every 6 months (p = .003). This model fit the data well, χ^2 = 4.28 (df = 3), p = .23, CFI = 0.99, TLI = 0.99, RMSEA = 0.048. This average trajectory is visually depicted in Figure 1.

Latent class analysis: selection of the optimal class solution

See Table 2 for the BIC and VLMR LRT p values associated with the two- through nine-class solutions. As can be seen in this table, the four-class solution had the lowest BIC value (2265.68 vs. 2273.67 for the three-class and 2268.04 for the five-class solution). The VLMR LRT p value for the four- vs. three-class solution was not quite significant p = .14; however, the entropy was higher for the four- vs. the three-class solution (0.86 vs. 0.80), suggesting greater precision of class assignment for the four-class solution. When examining the classes produced by the four-class solution, we saw that each class included at least 5% of the sample (this was not true of the five- through nine-class solutions) and that each class was theoretically sound. As such, the four-class solution was selected.

The four classes are visually depicted in Figure 1. Class one, which we named "high, increasing" (n = 12; 6.5% of the sample) began with an average sleep problem score of 5.5 at 24 months.

Table 1. Descriptive statistics

	Mean (SD) or %	Range
Demographics		
Child sex (% female)	49%	—
Child race (% Black)	59%	—
Family income	$78 482 ($60 095)	$1100–$410 400
Income-to-needs ratio	4.19 (3.48)	0.08–26.99
Maternal age	28.71 (5.60)	18–40
Paternal age	30.43 (6.16)	18–48
Child CBCL sleep problems (raw)		
24 months	2.07 (2.16)	0–9
30 months	2.43 (2.24)	0–12
36 months	2.60 (2.33)	0–11
36 month child symptoms (*t*-scores)		
CBCL internalizing	43.78 (9.66)	29–81
CBCL externalizing	46.66 (10.45)	28–76
CBCL total problems	45.42 (10.30)	28–85
12 month maternal symptoms (adjusted *t*-scores)		
Maternal BSI depression	49.39 (8.49)	42–71
Maternal BSI anxiety	45.18 (8.91)	38–70
Maternal BSI global severity	48.38 (10.62)	33–74
30 month inter-parental conflict		
Intimate partner violence	0.05 (0.22)	0–2.22
Verbal aggression	1.14 (1.02)	0–5.83
12 month maternal parenting behavior		
Maternal sensitivity	3.11 (0.76)	1–4.80
Maternal harsh-intrusiveness	2.56 (0.85)	1–5

CBCL, Child Behavior Checklist; BSI, Brief Symptom Inventory; m, month.

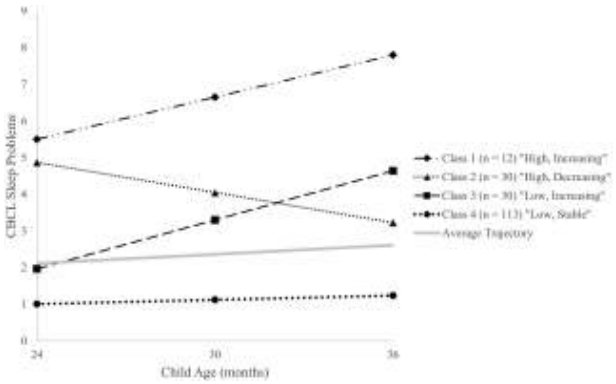

Figure 1. Depiction of the four classes identified using latent class growth analysis.

They increased on average 1.15 every 6 months (p = .02). Class two, which we named "high, decreasing" (n = 30; 16.2%), started with an average sleep problem score of 4.89 and decreased, on average, 0.82 every 6 months (p = .04). These two classes began with a similar degree of sleep difficulty at 24 months, but deviated in their developmental trajectory over time (i.e. one class increased while the other decreased).

Class three, "low, increasing" (n = 30; 16.2%), started with a 24 month sleep problems score of 1.97. On average, they decreased 1.34 every 6 months (p = .001). Class four, "low, stable" (n = 113; 61.1%) started with few sleep problems, 1.01, and their sleep problem score did not change significantly over time (p = .12). These two groups started with few sleep problems at 24 months, but deviated in their developmental trajectory (increasing vs. stable problems).

The four classes did not differ significantly from one another on any of the demographic variables reported herein (ps > .09).

LCGA class differences in child behavioral problems

As can be seen in Table 3, the four classes differed significantly from one another in their symptoms of behavior problems, even after controlling for 24 month measures of the same measure. The classes differed on internalizing problems, F = 17.49 (4, 171), p < .001, such that the "high, decreasing class" (Class 2; mean = 46.66, SD = 10.51) and the "low, stable" class (Class 4; mean = 40.74, SD = 7.49) exhibited fewer internalizing symptoms than the "high, increasing" class (Class 1; mean = 54.42, SD = 11.61). The "low, stable" class (Class 4) also had fewer internalizing problems than the "low, increasing" class (Class 3; mean = 47.57, SD = 10.12).

The classes also differed on externalizing symptoms, F = 24.59 (4, 171), p < .001. The "low, stable" class (Class 4; mean = 43.56, SD = 9.71) and the "high, decreasing" class (Class 2; mean = 48.72, SD = 9.04) exhibited fewer symptoms than the "high, increasing" class (Class 1; mean = 58.75, SD = 8.83) and the "low, increasing" class (Class 3; mean = 43.65, SD = 9.71).

The four classes also differed from one another in their Total Problems scores (F = 36.16 [4, 171], p < .001), such that the "low, stable" class (Class 4; mean = 41.33, SD = 7.98) and the "high, decreasing" class (Class 2; mean = 48.69, SD = 9.51) had fewer total problems than the "low, increasing" class (Class 3; mean = 50.70, SD = 9.47), and the "high, increasing" class (Class 1; mean = 41.33, SD = 7.98).

Interestingly, these results suggest that the two classes that began with high levels of sleep problems (Classes 1 and 2) but who showed diverging trajectories (i.e. increasing vs. decreasing) and those with low levels of sleep problems (Classes 3 and 4) but who had diverging trajectories (i.e. stable vs. increasing) differed from one another on all three dimensions of behavioral problems at 36 months, even after controlling for 24 month

behavioral functioning. This is consistent with the proposition that additional information may be gained by using this statistical approach than would be gleaned by examining the overall level or initial level of sleep problems.

Supplemental analyses: additional behavioral differences across classes

As described above, we a priori decided to examine child behavioral outcomes at 36 months to test whether the differences in developmental trajectories of sleep that were captured using this approach had meaningful longer-term consequences for children. However, a natural question is whether the classes also differed from one another in their behavioral problems at 24 and 30 months. At 24 months, results from ANOVAs suggest that Class 1 ("high, increasing") and Class 2 ("high, decreasing") both had greater scores than Class 4 ("low, stable") on both internalizing problems (Class 1 mean = 50.25, *SD* = 14.53; Class 2 mean = 48.76, *SD* = 9.99; Class 4 mean = 41.51, *SD* = 7.33; $F = 7.94$ [3, 177], $p < .001$) and externalizing problems (Class 1 mean = 53.42, *SD* = 9.22; Class 2 mean = 51.03, *SD* = 7.42; Class 4 mean = 43.24, *SD* = 8.77; $F = 10.11$ [3, 177], $p < .001$). For 24 month total problems, Class 1 ("high, increasing"; mean = 56.33, *SD* = 13.34) and Class 2 ("high, decreasing"; mean = 52.28, *SD* = 7.90) both had greater total problems than Class 3 ("low, increasing"; mean = 45.32, *SD* = 8.01) and Class 4 ("low, stable"; mean = 41.66, *SD* = 7.56). Class 1 did not differ significantly from Class 2, nor did Class 3 differ significantly from Class 4, $F = 21.45$ (3, 177), $p < .001$.

At 30 months, Class 1 ("high, increasing") had greater internalizing problems than Class 4 ("low, stable"), $F = 5.07$ (3, 177), $p = .002$ (Class 1 mean = 50.58, *SD* = 10.38; Class 4 mean = 42.45, *SD* = 7.87). For 30 month externalizing problems. Class 1 ("high, increasing"; mean = 57.00, *SD* = 7.39) and Class 2 ("high, decreasing"; mean = 49.21, *SD* = 7.39) both had greater total problems than Class 3 ("low, increasing"; mean = 48.00, *SD* = 9.15) and Class 4 ("low, stable"; mean = 44.06, *SD* = 8.84), who did not differ from one another, $F = 10.10$ (3, 177), $p < .001$). For total problem behaviors, Class 1 ("high, increasing"; mean = 57.42, *SD* = 8.13) had more total behaviors than Class 2 ("high, decreasing"; mean = 48.61, *SD* = 6.75) and Class 3 ("low, increasing; mean = 47.90, *SD* = 8.85), who were all greater than Class 4 ("low, stable"; mean = 42.53, *SD* = 7.91). $F = 16.45$ (3, 177), $p < .001$.

Table 2. Bayesian information criteria and likelihood ratio test results for the one- through nine-class solutions

	BIC	VLMR LRT *p* value
Two-class	2290.39	<.001
Three-class	2273.67	.04
Four-class	**2265.68**	.14
Five-class	2268.04	.24
Six-class	2270.53	.25
Seven-class	2271.12	.57
Eight-class	2278.05	.11
Nine-class	2281.60	.35

BIC, Bayesian Information Criteria; VLMR LRT, Vuong-Lo-Mendell-Rubin likelihood ratio tests. The bolded values indicate the class solution that was selected.

Predictors of persisting or remitting course

Our secondary research question surrounded whether we could identify early life factors that differentiated between children who began with similar levels of sleep problems but who differed in their developmental course (i.e. differences between Classes 1 and 2, and between Classes 3 and 4). Results indicate that dimensions of maternal mental health, inter-parental conflict, and maternal parenting behaviors helped to identify children whose sleep problems increased over time.

The mothers of children in the "low, stable" class (Class 4) endorsed fewer depressive symptoms at 12 months (mean = 47.39, *SD* = 7.51) than both the "high, decreasing" (Class 2; mean = 53.19, *SD* = 9.37) and "low, increasing" classes (mean = 52.36, *SD* = 8.87), who did not differ significantly from one another on maternal depressive symptoms, $F = 4.95$ (3, 153), $p = .003$. Mothers in the "low, stable" class (Class 4; mean = 44.72,

Table 3. Differences across latent class growth analyses classes

	"High, increasing"	"High, decreasing"	"Low, increasing"	"Low, stable"		
	N = 12	*N* = 30	*N* = 30	*N* = 113		
	Class 1	Class 2	Class 3	Class 4		
36 month child symptoms (*t*-scores)						
CBCL internalizing	54.42 (11.61)	46.66 (10.51)	47.57 (10.12)	40.74 (7.49)	C2=C4<C1; C3<C1	$F = 17.49$ (4, 171), $p < .001$
CBCL externalizing	58.75 (8.83)	48.72 (9.04)	50.57 (10.01)	43.65 (9.71)	C2=C4<C1=C3	$F = 24.59$ (4, 171), $p < .001$
CBCL total problems	60.83 (10.02)	48.69 (9.51)	50.70 (9.47)	41.33 (7.98)	C2=C4<C1=C3	$F = 36.16$ (4, 171), $p < .001$
12 month maternal symptoms (adjusted *t*-scores)						
Maternal BSI depression	50.45 (9.22)	53.19 (9.37)	52.36 (8.87)	47.39 (7.51)	C4<C2=C3	$F = 4.95$ (3, 153), $p = .003$
Maternal BSI anxiety	48.27 (9.95)	47.11 (10.85)	46.96 (1.77)	43.80 (8.03)	—	$F = 1.99$ (3, 153), $p = .118$
Maternal BSI global severity	55.09 (10.53)	53.93 (9.36)	53.16 (9.04)	44.72 (9.90)	C4<C1=C2=C3	$F = 11.13$ (3, 153), $p < .001$
30 month inter-parental conflict						
Intimate partner violence	0.45 (1.27)	0.05 (0.13)	0.09 (0.28)	0.06 (0.23)	C2=C4<C1	$F = 3.21$ (3, 134), $p = .025$
Verbal aggression	3.44 (3.03)	2.36 (1.83)	2.14 (2.12)	2.13 (1.87)	—	$F = 1.53$ (3, 134), $p = .210$
12 month maternal parenting behavior						
Maternal sensitivity	2.67 (0.71)	2.99 (0.75)	3.04 (0.63)	3.21 (0.78)	—	$F = 1.19$ (3, 148), $p = .103$
Maternal harsh-intrusiveness	2.72 (0.82)	2.75 (0.87)	2.95 (0.97)	2.40 (0.79)	C4<C3	$F = 2.37$ (3, 148), $p = .019$

CBCL, Child Behavior Checklist; BSI, Brief Symptom Inventory; m, month; C, class.

SD = 9.90) also differed from all of the other classes on their global symptom severity scores (F = 11.13 [3, 153], $p < .001$); Class 1 ("high, increasing"; mean = 55.09, *SD* = 10.53), Class 2 ("high, decreasing"; mean = 53.93, *SD* = 9.36), and Class 3 ("low, increasing"; mean = 53.16, *SD* = 9.04) did not differ significantly from one another. The "low, increasing" class (Class 3) exhibited more harsh-intrusive parenting behaviors at 12 months of age than the "low, stable" class (Class 4), F = 2.37 (3, 148), p = .019. The classes did not differ on maternal anxiety, inter-parental verbal aggression, or on observed maternal sensitivity, *p*s > .10.

Discussion

Utilizing longitudinal data from a racially and economically diverse sample of children, the goal of the current study was to explore whether person-centered analysis holds promise as a helpful approach to studying change in children's sleep problems. As described in more detail below, results suggest that there were four subgroups of children that differed from one another in their initial level and/or trajectory of toddler sleep problems. These groups differed from one another on expected constructs (i.e. child behavioral problems), and, intriguingly, we were able to identify several early life factors that distinguished children who would go on to develop worsening sleep problems from those whose sleep problems improved or remained consistently low. This is the first study to our knowledge to apply a person-centered approach to the study of sleep trajectories; the results suggest that this may be a helpful approach to understanding change in sleep problems over time and may represent a unique way of identifying children at risk for persistent sleep problems.

In designing this study, we a priori proposed three criteria that should be met in order to support the utility of using a person-centered approach to analyzing toddler sleep problem data. We proposed that the utility of this approach would be confirmed if we found evidence of at least two classes (Criteria 1), that yielded classes that aligned broadly with theoretical expectation (Criteria 2), and that differed from one another in ways that suggested that additional information was gained by considering these data in this way (Criteria 3). Each of these criteria was met. Results from our LCGAs pointed to a four-class solution (Criteria 1), with "low, stable," "low, increasing," "high, increasing," and high, decreasing" classes. These classes are consistent with our hypothesis that there would be subgroups that exhibit persisting, remitting, and increasing sleep problems (Criteria 2). Consistent with clinical observations, for most toddlers, sleep problems improved over time or remained stably low (as evidenced by Classes 2 and 4 making up 77% of the sample). However, for approximately one in five children, sleep problems increased between 2 and 3 years of age (Classes 1 and 3 made up 23% of the sample).

These classes differed from one another in their behavioral problems, in ways that suggest that this approach provides additional information than simply examining the overall level of sleep problems or examining the average trajectory of child sleep problems (Criteria 3). Across all three domains (internalizing, externalizing, and total problem behaviors), we found that the two classes that began with high levels of sleep problems but who showed diverging trajectories (increasing vs. decreasing; Classes 1 and 2) differed on their behavioral problems, as did the two classes who began with low levels of sleep problems but that had diverging trajectories (increasing vs. stable; Classes 3 and 4), even after controlling for behavioral problems at 24 months. In each case, the increasing class exhibited more problems than the stable/decreasing class. Together, these results suggest that additional information about child behavioral functioning is gained by considering trajectories of toddler sleep problems in this way.

As a secondary goal, this study examined whether we could identify factors that discriminated between children who started with similar levels of sleep problems but who would go on to have increasing or decreasing problems. In this study, we focused on constructs that can be fairly easily measured in a clinical setting and intentionally focused on measures obtained at 12 months of age because we reasoned that the most useful clinical tool would be one that would signal risk before the change in sleep has occurred. Results suggest that greater maternal depressive symptoms, global symptom severity, and harsh-intrusive parenting behaviors at 12 months may signal risk for the onset of new sleep problems. Specifically, we found that these factors differed between children who had few sleep problems at 24 months but whose sleep problems increased over time (Class 3) and children who consistently had few sleep problems (Class 4). Intimate partner violence may help to identify children with persistent sleep problems; intimate partner violence distinguished children who had higher 24 month sleep problems that increased over time (Class 1) from those whose sleep problems decreased over time (Class 2). These findings add to a limited body of literature examining correlates of persistent sleep problems, and uniquely identify factors that may help to identify the onset of new sleep problems.

The results of this study, while preliminary until replicated in other samples, may have implications for the earlier identification of children with increasing or persistent sleep problems. For example, it suggests that screening for and offering support related to maternal mental health and domestic violence in a pediatric care setting may have benefits not just for physical or emotional health (as is often the focus), but also for their sleep. Intervention aimed at supporting harmonious parent–child interaction may also help support healthy sleep development as well as its associated behavioral problems. Our results also suggest that assessing sleep problems repeatedly over this developmental time frame (and considering any individual sleep assessment within the context of its developmental trend) may be helpful for the early detection of sleep problems. Finally, this study provides reassuring information that clinicians can provide to parents of toddlers—for the majority of children, sleep problems remain low and stable, and even among those who had challenges early on, almost all have resolved by 3 years of age.

This study had a number of strengths, in addition to the novel statistical approach used to analyze these data. We utilized prospective, longitudinal data collected from a racially and economically diverse sample of children. We utilized multi-method assessments to characterize both child- and family-level variables, and we were able to identify multiple factors that were related to the onset or persistence of sleep problems. The specific variables that we examined can be easily assessed in a clinical setting and represent potentially modifiable environmental factors, which makes them amenable to intervention and may therefore increase the clinical significance of these findings.

This study also had limitations. Many of our measures relied on the maternal report, including our measure of child sleep problems. Though this measure has been validated and shows correspondence with some objective measures of sleep [41, 42], responses could be biased by maternal perception or conceptualizations of normative child sleep behavior. While we believe that utilizing parental reports in this context is helpful because parental report is how most children in this age range will be assessed clinically, future research should examine whether similar findings hold when examining more objective measures of child sleep quality. This study utilized a measure of sleep that captures overall sleep problems (vs. more specific dimensions of sleep disturbance), which conflates multiple types of sleep problems that likely have different causes, consequences, and possibly developmental course (e.g. problems with sleep initiation, efficiency, duration, and fragmentation). Though this focus and sampling strategy increases the population to which our findings extend, these data may not represent all children or clinical populations. Future studies that examine specific dimensions of sleep disturbance may yield different results, as might studies that use more objective measures of sleep efficacy and quality. Our measure of inter-parental conflict was assessed at 30 months (indexing behaviors occurring between 18 and 30 months of child age). This was the first assessment of marital conflict available in this longitudinal study, but indexes behaviors occurring later in development than our measures of maternal mental health or parenting behaviors. In referring to these variables as potential "risk factors" for sleep problems, we may be implying a directionality of effect. While the temporal ordering of the measurement of the current study is consistent with the idea that these "risk factors" predate the change in sleep problems, there likely are bidirectional associations between these variables and sleep (e.g. [54, 55]) that should be explored in future studies. Of note, in the current study, we examined measures of these "risk factors" early in the child's life (prior to the assessment of sleep), with the goal of identifying factors that could signal risk for developing sleep problems later in development. However, factors like maternal depressive symptoms, parenting behaviors, and intimate partner violence tend to show some stability over time [56–58], which the current study did not capture or examine. Thus, we want to be clear that these results do not necessarily suggest that maternal or family functioning at 12–18 months is uniquely related to the development of child sleep problems (over and beyond the effects of maternal or family functioning at 18–36 months), simply that an assessment of these factors early in life may be helpful for signaling later risk.

Summary and conclusions

The current study examined whether utilizing person-centered trajectory analysis had the potential to inform our understanding of toddler sleep problems and their development. We found evidence of four distinct classes of children that differed from one another in their initial level and/or developmental course of sleep problems from 24 to 36 months of age. These classes align with theoretical expectations and captured persisting, remitting, and increasing sleep problems. These groups differed from one another on internalizing, externalizing, and total problem behaviors at 3 years of age, in ways that demonstrate that additional information is gained by using this statistical approach, as compared to variable-centered approaches. Additionally, we found evidence that greater maternal depression, global symptom severity, and harsh-intrusive parenting behaviors may signal risk for the onset of new sleep problems, while intimate partner violence may help to identify the most at-risk children.

Funding

Financial Disclosure: this study was supported by the National Science Foundation through a Children's Research Initiative grant (BCS-0126475) and an Integrative Research Activities for Developmental Science grant (BCS-0720660) as well as by the National Institute of Mental Health (K01-MH120507).

Disclosure Statement

None declared.

References

1. Sadeh A, *et al*. Infant sleep problems: origins, assessment, interventions. *Infant Ment Health J*. 1993;**14**(1):17–34. doi:10.1002/1097-0355(199321)14:1<17::aid-imhj2280140103>3.0.co;2-q.
2. Armstrong KL, *et al*. The sleep patterns of normal children. *Med J Aust*. 1994;**161**(3):202–206. doi:10.5694/j.1326-5377.1994.tb127383.x.
3. Byars KC, *et al*. Prevalence, patterns, and persistence of sleep problems in the first 3 years of life. *Pediatrics*. 2012;**129**(2):e276–e284.
4. Wake M, *et al*. Prevalence, stability, and outcomes of cry-fuss and sleep problems in the first 2 years of life: prospective community-based study. *Pediatrics*. 2006;**117**(3):836–842. doi:10.1542/peds.2005-0775.
5. Davis KF, *et al*. Sleep in infants and young children: part two: common sleep problems. *J Pediatr Health Care*. 2004;**18**(3):65130–65171. doi:10.1016/s0891-5245(03)00149-4.
6. Crowell J, *et al*. Sleep habits in toddlers 18 to 36 months old. *J Am Acad Child Adolesc Psychiatry*. 1987;**26**(4):510–515.
7. Petit D, *et al*. Dyssomnias and parasomnias in early childhood. *Pediatrics*. 2007;**119**(5):e1016–e1025.
8. Sadeh A. A brief screening questionnaire for infant sleep problems: validation and findings for an Internet sample. *Pediatrics*. 2004;**113**(6):e570–e577. doi:10.1542/peds.113.6.e570.
9. Sadeh A, *et al*. Sleep and sleep ecology in the first 3 years: a web-based study. *J Sleep Res*. 2009;**18**(1):60–73. doi:10.1111/j.1365-2869.2008.00699.x.
10. Acebo C, *et al*. Sleep/wake patterns derived from activity monitoring and maternal report for healthy 1- to 5-year-old children. *Sleep*. 2005;**28**(12):1568–1577. doi:10.1093/sleep/28.12.1568.
11. Galland BC, *et al*. Normal sleep patterns in infants and children: a systematic review of observational studies. *Sleep Med Rev*. 2012;**16**(3):213–222. doi:10.1016/j.smrv.2011.06.001.
12. Kataria S, *et al*. Persistence of sleep disturbances in preschool children. *J Pediatr*. 1987;**110**(4):642–646. doi:10.1016/s0022-3476(87)80571-1.
13. Lam P, *et al*. Outcomes of infant sleep problems: a longitudinal study of sleep, behavior, and maternal

well-being. *Pediatrics*. 2003;**111**(3):e203–e207. doi:10.1542/peds.111.3.e203.
14. Morrell J, *et al*. The role of attachment security, temperament, maternal perception, and care-giving behavior in persistent infant sleeping problems. *Infant Ment Health J*. 2003;**24**(5):447–468.
15. Schmid G, *et al*. A prospective study on the persistence of infant crying, sleeping and feeding problems and preschool behaviour. *Acta Paediatr*. 2010;**99**(2):286–290.
16. Bathory E, *et al*. Sleep regulation, physiology and development, sleep duration and patterns, and sleep hygiene in infants, toddlers, and preschool-age children. *Curr Probl Pediatr Adolesc Health Care*. 2017;**47**(2):29–42. doi:10.1016/j.cppeds.2016.12.001.
17. Nelson TD, *et al*. Preschool sleep problems and differential associations with specific aspects of executive control in early elementary school. *Dev Neuropsychol*. 2015;**40**(3):167–180. doi:10.1080/87565641.2015.1020946.
18. Whalen DJ, *et al*. Variation in common preschool sleep problems as an early predictor for depression and anxiety symptom severity across time. *J Child Psychol Psychiatry*. 2017;**58**(2):151–159.
19. Gregory AM, *et al*. Sleep problems in childhood: a longitudinal study of developmental change and association with behavioral problems. *J Am Acad Child Adolesc Psychiatry*. 2002;**41**(8):964–971.
20. Williams JA, *et al*. Norms and trends of sleep time among US children and adolescents. *JAMA pediatrics*. 2013;**167**(1):55–60. doi:10.1001/jamapediatrics.2013.423.
21. Xiao-na H, *et al*. The epidemiology of sleep and its disorder in Chinese children aged 0–5 years. *Biol Rhythm Res*. 2009;**40**(5):399–411. doi:10.1080/09291010902863578.
22. Lorente-Cebrián S, *et al*. Role of omega-3 fatty acids in obesity, metabolic syndrome, and cardiovascular diseases: a review of the evidence. *J Physiol Biochem*. 2013;**69**(3):633–651. doi:10.1007/s13105-013-0265-4.
23. Magnusson D. The person approach: concepts, measurement models, and research strategy. *New Dir Child Adolesc Dev*. 2003;**2003**(101):3–23. doi:10.1002/cd.79.
24. Iglowstein I, *et al*. Sleep duration from infancy to adolescence: reference values and generational trends. *Pediatrics*. 2003;**111**(2):302–307. doi:10.1542/peds.111.2.302.
25. Propper CB, *et al*. Parenting and maternal reported child sleep problems in infancy predict school-age aggression and inattention. *Sleep Health*. 2022;**8**(1):62–68. doi:10.1016/j.sleh.2021.11.010.
26. Laursen B, *et al*. Person-centered and variable-centered approaches to longitudinal data. *Merrill-Palmer Q*. 2006;**52**(3):377–389.
27. Jung T, *et al*. An introduction to latent class growth analysis and growth mixture modeling. *Soc Personal Psychol Compass*. 2008;**2**(1):302–317.
28. Cook F, *et al*. Infant sleep and child mental health: a longitudinal investigation. *Arch Dis Child*. 2020;**105**(7):655–660. doi:10.1136/archdischild-2019-318014.
29. Cook F, *et al*. Profiles and predictors of infant sleep problems across the first year. *J Dev Behav Pediatr*. 2020;**41**(2):104–116.
30. Jusienė R, *et al*. Preschoolers' self-regulation and developmental trajectories of sleep problems in early childhood. *Infant Child Dev*. 2019;**28**(6):e2158.
31. Winsper C, *et al*. Infant and toddler crying, sleeping and feeding problems and trajectories of dysregulated behavior across childhood. *J Abnorm Child Psychol*. 2014;**42**(5):831–843.
32. Lavigne JV, *et al*. Sleep and behavior problems among preschoolers. *J Dev Behav Pediatr*. 1999;**20**(3):164–169.
33. Philbrook LE, *et al*. Bidirectional associations between bedtime parenting and infant sleep: parenting quality, parenting practices, and their interaction. *J Fam Psychol*. 2016;**30**(4):431.
34. Martin J, *et al*. Adverse associations of infant and child sleep problems and parent health: an Australian population study. *Pediatrics*. 2007;**119**(5):947–955.
35. El-Sheikh M, *et al*. Marital conflict and disruption of children's sleep. *Child Dev*. 2006;**77**(1):31–43.
36. Rhoades KA, *et al*. Marital hostility and child sleep problems: direct and indirect associations via hostile parenting. *J Fam Psychol*. 2012;**26**(4):488.
37. Gueron-Sela N, *et al*. Infant respiratory sinus arrhythmia and maternal depressive symptoms predict toddler sleep problems. *Dev Psychobiol*. 2017;**59**(2):261–267.
38. Bordeleau S, *et al*. Maternal sensitivity and children's behavior problems: examining the moderating role of infant sleep duration. *J Clin Child Adolesc Psychol*. 2012;**41**(4):471–481.
39. Achenbach TM, *et al*. The Child Behavior Checklist and related forms for assessing behavioral/emotional problems and competencies. *Pediatr Rev*. 2000;**21**(8):265–271.
40. Gregory AM, *et al*. Sleep items in the child behavior checklist: a comparison with sleep diaries, actigraphy, and polysomnography. *J Am Acad Child Adolesc Psychiatry*. 2011;**50**(5):499–507.
41. Becker SP, *et al*. Convergent validity of the Child Behavior Checklist sleep items with validated sleep measures and sleep disorder diagnoses in children and adolescents referred to a sleep disorders center. *Sleep Med*. 2015;**16**(1):79–86.
42. Luginbuehl M, *et al*. Pediatric sleep disorders: validation of the sleep disorders inventory for students. *School Psychol Rev*. 2008;**37**(3):409–431.
43. Cox M, *et al*. *Qualitative Ratings for Parent–Child Interaction at 3-12 Months of Age*. Unpublished manuscript Department of Psychology. Chapel Hill: University of North Carolina; 2002.
44. Network NECCR. Child care and mother–child interaction in the first 3 years of life. *Dev Psychol*. 1999;**35**(6):1399–1413.
45. Derogatis L. *Brief Symptom Inventory 18*. Minneapolis, MN: NCS Pearson Inc; 2000.
46. Straus MA, *et al*. How violent are American families? Estimates from the National Family Violence Resurvey and other studies. In: Straus MA, Gelles RJ, eds. *Physical Violence in American Families: Risk Factors and Adaptations to Violence in 8,145 Families*. 1990; **8** (145): 95–112.
47. Gustafsson HC, *et al*. Investigators tFLPK. Maternal parenting as a mediator of the relationship between intimate partner violence and effortful control. *J Fam Psychol*. 2012;**26**(1):115–123.
48. Gustafsson HC, *et al*. Intimate partner violence and children's memory. *J Fam Psychol*. 2013;**27**(6):937–944.
49. Browne MW, *et al*. Alternative ways of assessing model fit. In: Bollen KA, Long JS, eds. *Testing Structural Equation Models*. Newbury Park, CA: Sage Focus Editions; 1993: 136–162.
50. Hu L, *et al*. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Struct Equ Model*. 1999;**6**(1):1–55.
51. Muthén LK, *et al*. *Mplus User's Guide*. 8th ed. Los Angeles, CA: Muthén & Muthén; 1998–2017.
52. Allison PD. Missing data techniques for structural equation modeling. *J Abnorm Psychol*. 2003;**112**(4):545–557.
53. Asparouhov T, *et al*. Using Mplus TECH11 and TECH14 to test the number of latent classes. *Mplus Web Notes*. 2012;**14**:22.
54. Warren SL, *et al*. Maternal depressive symptoms and child sleep: models of mutual influence over time. *Dev Psychopathol*. 2006;**18**(1):1–16.

55. Sadeh A, *et al*. Parenting and infant sleep. *Sleep Med Rev*. 2010;**14**(2):89–96.
56. Gustafsson HC, *et al*. Investigators FLPK. Intimate partner violence in rural low-income families: correlates and change in prevalence over the first 5 years of a child's life. *J Fam Violence*. 2016;**31**(1):49–60.
57. Turney K. Prevalence and correlates of stability and change in maternal depression: evidence from the fragile families and child wellbeing study. 2012.
58. Mills-Koonce WR, *et al*. Mothers' and fathers' sensitivity and children's cognitive development in low-income, rural families. *J Appl Dev Psychol*. 2015;**38**:1–10.