Published in final edited form as:
Behav Sleep Med. 2005 ; 3(1): 44–61.

A Longitudinal Follow-Up Study of Young Children's Sleep Patterns Using a Developmental Classification System

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Abstract

Sixty-eight families participated in a longitudinal study that included video observations of sleep during the 1st year of life and annual follow-up phone interviews until the children were 4 years of age. Results revealed that approximately 19% of children have a sleep problem at 2 years of age, defined either by research criteria or parental report, and that sleep problems diminished over time. Approximately 25% of children were reported to be cosleeping at each follow-up interview, but only a third of the parents reported this behavior to be problematic. A subgroup of infants (33%), who were considered stable, non-self-soothers in the 1st year, were more likely to have a sleep onset problem and be cosleeping at the 2-year follow-up assessment.

Between 15% and 35% of children are reported to have some type of sleep disturbance in the first 5 years of life (Lozoff, Wolf, & Davis, 1985;Richman, 1981). Many pediatricians are poorly prepared to address these concerns (Owens, 2001) despite the growing number of studies that have attempted to provide norms (Archbold, Pituch, Panahi, & Chervin, 2002), define disordered sleep (Gaylor, Goodlin-Jones, & Anders, 2001;Thunstrom, 1999), and outline effective treatments (Eckerberg, 2002;Hiscock & Wake, 2002;Mindell, 1999;Ramchandani, Wiggs, Webb, & Stores, 2000). Paralleling this burgeoning literature are new questions concerning the developmental trajectories of infant sleep disorders and the potential risks versus benefits of cosleeping in a diverse, complex society such as the contemporary United States. Because sleep disorders are linked to other behavioral, emotional, and cognitive disorders (Lavigne et al., 1999;Marcotte et al., 1998;Thunstrom, 2002), it is important to systematically investigate young children's sleep patterns over time.

Longitudinal studies show that sleep disturbances tend to decline with age. Yet, a significant minority of children demonstrates persistent problems that originate in infancy (Jenkins, Bax, & Hart, 1980;Lam, Hiscock, & Wake, 2003;Zuckerman, Stevenson, & Bailey, 1987). Factors including infant temperament (Keener, Zeanah, & Anders, 1988), parental psychopathology (Seifer, Sameroff, Dickstein, Hayden, & Schiller, 1996), and environmental stressors (Van Tassel, 1985) have been implicated in the maintenance of disordered sleep, but conclusive pathways of continuity have been difficult to determine. Equally compelling as the notion that specific factors are associated with the maintenance of disordered sleep is the possibility that there is consistency in sleep behavior, influenced by both parent and infant factors, such that infant sleep behavior by 1 year of age might be predictive of a stable sleep disturbance over time. For example, some studies have shown that *signaled night awakenings* (i.e., those

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awakenings reported by parents) are indicative of fragmented sleep on the part of the young child (Anders, Halpern, & Hua, 1992). Signaled night awakening is also considered to be stable during the first 5 years of life (Jenkins, Owens, Bax, & Hart, 1984;Wolke, Meyer, Ohrt, & Riegel, 1995). In a small pilot study, signaling at 12 months observed on video recordings was predictive of night waking at 3 years, suggesting that those infants who signal and require parental intervention to return to sleep at 12 months tend to continue this pattern in the future (Gaylor et al., 2001). However, the latter study had several limitations, including a small sample size, a nonuniform follow-up assessment age, and a liberal classification system for sleep disturbance at follow-up. Furthermore, a signaled awakening is also more appropriately labeled a “non-self-soothed” awakening, as it can also be the case that a rapid parental response precludes the child’s vocalization or signaling and prevents an opportunity for the child to return to sleep on his or her own (Burnham, Goodlin-Jones, Gaylor, & Anders, 2002). Thus, non-self-soothing is considered a potential predictor of a chronic sleep disturbance.

Another important consideration is the practice of cosleeping. Oftentimes, a non-self-soothedor signaled awakening is quickly resolved by bringing the child to bed with the parent, referred to as “reactive cosleeping” (Lozoff, Wolf, & Davis, 1984). Of interest, reported cosleeping rates during the first 6 months of life have doubled in the last decade (Willinger, Ko, Hoffman, Kessler, & Corwin, 2003) despite mixed findings regarding the safety and developmentally appropriate nature of cosleeping. For example, recently, a longitudinal investigation found no relationship between early cosleeping (i.e., during the first 4 years of life) and later adverse outcomes (Okami, Weisner, & Olmstead, 2002). Similarly, a recent study suggests that signaled night awakenings and the practice of cosleeping occur more frequently within the context of a healthy mother–infant relationship (Scher & Dror, 2003). McKenna and colleagues also have suggested that early parent–infant cosleeping is protective against the sudden infant death syndrome (SIDS) by preventing the infant from having lengthy sleep bouts (McKenna, 1990;Mosko, Richard, & McKenna, 1997;Mosko, Richard, McKenna, & Drummond, 1996). Hunsley and Thoman (2002) found that infants who habitually slept with their mothers had longer uninterrupted sleep bouts when monitored in a solitary sleeping condition, a finding not in-consistent with the results of McKenna and colleagues; however, Hunsley and Thoman interpreted their finding to suggest that early parent–infant cosleeping is a stressful condition for the infant that may lead to a disturbance in the infant’s neurobehavioral development, thus causing the infant to enter longer uninterrupted sleep bouts when sleeping alone. In clinical settings, cosleeping often presents as a concern for parents who worry about creating long-term behavioral patterns that become increasingly difficult to change (Mindell, 1997). Many factors determine how parents respond to their child’s nighttime needs, not the least of which are cultural tradition and caregiving practices (Ball, Hooker, & Kelly, 1999;Latz, Wolf, & Lozoff, 1999;Lozoff, Askew, & Wolf, 1996;Morelli, Rogoff, Oppenheim, & Goldsmith, 1992). This is why some researchers advocate distinguishing between reactive cosleeping and cosleeping as a cultural tradition or caregiving practice. The longitudinal trajectories of reactive cosleeping versus nonreactive cosleeping may be different and deserve further study.

Finally, the absence of a clear diagnostic tool and reliable and valid nosology to assess and define disordered sleep in this population makes comparisons across studies nearly impossible. A classification scheme is needed that accounts for both normative sleep patterns and the caregiving diversity of contemporary society. A developmental sleep disorders classification scheme for toddlers and young children has been proposed (Anders, Goodlin-Jones, & Sadeh, 2000;Gaylor et al., 2001) and is revised further in this article. Briefly, the syndrome of difficulty in initiating sleep is labeled *sleep onset protodysomnia*, and the syndrome of difficulty in maintaining sleep is termed *night waking protodysomnia*. The term *protodysomnia* was chosen because the classification criteria are derived from the adult criteria for sleep disorders in the *Diagnostic and Statistical Manual of Mental Disorders*, Fourth Edition (*DSM–IV*;American Psychiatric Association, 1994). However, the frequency and duration criteria in *DSM–IV* do

not adequately define the sleep disturbances observed in infants and young children. The proposed developmental scheme quantifies frequency and severity of symptoms by age, resulting in three categories of sleep behavior: perturbation, disturbance, and disorder (Anders, 1989). The criteria for classifying night waking and sleep onset protodysomnia are presented in Table 1. The major revisions to the previously published classification scheme are in the severity criteria. A child is considered to have a sleep onset protodysomnia if he or she meets two of the three sleep onset criteria instead of just one. Similarly, a night waking protodysomnia involves both regular night waking (one or more awakenings) and a total time awake following sleep onset that equals or is greater than 20 min.

The present study tracked, in a prospective longitudinal design, the natural progression of young children's sleep behaviors from infancy to age 4. We examined the rates and stability of protodysomnias; specific sleep behaviors related to falling asleep and sleep maintenance (e.g., parental presence at sleep onset); parental report of a sleep problem; and cosleeping at 2, 3, and 4 years of age. Second, we were interested in identifying early predictors of a later protodysomnia or parental report of a sleep problem obtained at follow-up assessments (e.g., non-self-soothing, room sharing, and requiring parental presence to fall asleep at 6, 9, and 12 months of age). We chose to use the video observations at 6, 9, and 12 months of age and not the data from earlier infancy because we have reported that sleep patterns stabilize around 6 months (Burnham et al., 2002). Room sharing was considered a potential predictor of a protodysomnia because we also previously reported that infants who sleep in their parents' rooms have more contact with their mother and are less likely to engage inself-soothing (Burnham et al., 2002). Specific research questions included the following: (a) Do the rates of specific sleep behaviors change substantially during the transition from toddler age to preschool age? (b) What is the degree of concordance between the research criteria and parental report of a sleep problem during this transition? (c) Does the inability or lack of opportunity to self-soothe to sleep at the beginning of the night or following middle-of-the-night awakenings during the 1st year of life predict a later protodysomnia, parent report of a sleep problem, or cosleeping? (d) Does room sharing in the 1st year of life predict a later protodysomnia, parent report of a sleep problem, or cosleeping?

METHOD

Participants

The Institutional Review Board at the University of California, Davis approved the study, and all participating parents gave their informed consent. The children ($N = 83$) and their families participated in a longitudinal study that involved periodic video observations of nighttime sleep during the 1st year of life associated with the introduction of a special sleep aid intervention (Burnham et al., 2002). The participants were recruited from a university community through local childbirth classes during pregnancy. At the conclusion of this study, families were invited to participate in a follow-up study that involved structured telephone assessments at 2, 3, and 4 years of age. All but one family agreed to be contacted following the video observation study. Fourteen participants were lost to follow-up because of relocation or difficulty in contacting the parent for one or more follow-up interviews. The present analysis only includes those children whose parents completed all three follow-up interviews ($n = 68$). There were no differences between those who continued in the follow-up study and those who did not participate with respect to original sleep aid intervention condition, gender, ethnicity, socioeconomic status (SES), health of newborn and mother at delivery, maternal–paternal age, or sleep video variables (self-soothing category and awake–asleep at sleep onset). Of interest, those families whom we could not reach for the follow-up phone interview were more likely to have had a child who was sleeping in the parents' room at 12 months (36% vs. 24%), $\chi^2(1,$

$N = 80) = 6.12$, $p = .05$, and were more likely to have only one child (93% vs. 82%), $\chi^2(1, N = 83) = 7.36$, $p = .03$.

The majority of the follow-up sample was Caucasian (79%) and first born (82%). Approximately half of the children were female (53%). All infant participants had been healthy at the time of delivery and through the follow-up period. The families were representative of a university community with high SES as indicated by their Hollingshead (1975) scores (82% in Categories 1 and 2) and educational status (68% of primary caregivers had a college degree). The mothers were, on average, 29.8 years old ($SD = 5.3$) at the time of delivery. The average age of infant weaning was 13 months ($SD = 9.4$), also representative of the larger university community (Dewey, Heinig, Nommsen, Peerson, & Lonnerdal, 1992).

Telephone interviews were conducted near the child's 2nd, 3rd, and 4th birthdays ($M = 24.8 \pm 1.5$ months, $M = 37 \pm 1.5$ months, and $M = 49.2 \pm 1.2$ months, respectively). Interviews occurred within 6 months of the child's actual birth date. The majority of interview respondents were mothers (98%).

Procedure

Video observations during the 1st year.—Briefly, all infants were videotaped during the 1st year of life for 2 nights at 1, 3, 6, 9, and 12 months of age. Each nighttime awakening (after at least 30 min of initial sleep) was coded into one of five categories: Category 1, vocalization, no parental intervention; Category 2, no vocalization, no parental intervention; Category 3, vocalization, parental intervention; Category 4, no vocalization, parental intervention; and Category 5, no awakenings (i.e., infant slept through the night). The night awakenings over the course of both nights were examined to determine the modal pattern for each infant. Thus, we determined for each infant which of the five categories predominated over the course of 2 nights. The categories were collapsed into two based on whether or not the child received a parental intervention, regardless of vocalization. Each infant was thus classified as either a self-soother (SS) or a non-self-soother (NSS) from a review of the videotapes at 6, 9, and 12 months of age (Burnham et al., 2002). Infants with no awakenings on either night were coded as such initially and eventually collapsed with the SSs, as their night was undisturbed. If the infant did not remain in the crib for at least 4 hr or if the infant spent the whole night cosleeping in the parental bed, the infant could not be coded and was excluded from the SS–NSS analyses (see Table 2 for missing data by age of recording).

To determine self-soothing at sleep onset, the beginning of each video night was coded on the basis of whether the infant was put into the crib awake or asleep. Infants were considered NSSs at sleep onset if they were placed into the crib already asleep. If the 2 nights were not concordant, the infant's self-soothing at sleep onset status was coded as "mixed." Participants who were cosleeping full-time could not be coded and thus were considered missing for the sleep onset analyses. (It should be noted here that parents who planned to cosleep with their infants from the beginning of life were specifically excluded from the study; nonetheless, a number of families began to cosleep at some point during the child's 1st year of life and were allowed to continue with the study if they were willing.) Crib location was also recorded at 6, 9, and 12 months of age according to parental report (own room vs. parent's room) and confirmed by researchers' observations during study visits.

Follow-up phone interview.—At 2, 3, and 4 years of age, a 30-min follow-up phone interview was conducted with the parent by an interviewer who was blind to the SS–NSS status of the child. The interview was an adapted version of the Sleep Habits Questionnaire (SHQ), a measure of sleep behavior in preschool children with established reliability and validity (Seifer, Dickstein, Spirito, & Owens-Stively, 1996). The SHQ contains 44 items and asks a variety of specific questions about sleep and waking behaviors that have occurred over the past

week. The items are scored on a 3-point scale, based on frequency of occurrence: *rarely* (0–1 time per week), *sometimes* (2–4 times), or *regularly* (5–7 times). To classify protodysomnias, scoring focused on bedtime and middle-of-the-night items on the SHQ. If a particular behavior was present, the interviewer probed to determine the infant's state of health, how often the behavior occurred in a typical week, and the duration over the past month. If the child's sleep behavior was atypical or related to a period of illness, parents were asked to report on a more typical week. These responses were then used to determine if a child met criteria for a sleep onset protodysomnia, night waking protodysomnia, both, or none (cf. Table 1 for criteria). Only the disorder category, not the perturbation or disturbance categories, was used in the current sample because of the limited sample size.

To assess parents' subjective concern about their child's sleep, in contrast to obtaining the more quantitative responses on the SHQ, we asked parents at the beginning of each interview whether they felt their child had a sleep problem at present (current sleep problem) or at any time since the last contact (past sleep problem). The interviewer probed for the parent to describe in more detail these global impressions to classify the problem as a night waking, sleep onset, combined, or other type of disorder (e.g., insufficient sleep or sleep apnea). If parents indicated that they regularly coslept, they were also asked to elaborate on the cosleeping pattern. Those children who were cosleeping regularly (5–7 nights per week) from the beginning of the night were considered nonreactive cosleepers, whereas those children who were cosleeping regularly but only following a night awakening were considered reactive cosleepers.

Data reduction.—There were 2 infants who had no observed awakening on the 6-and 12-month recording nights, where as 5 infants were observed to sleep through the night without awakening at 9 months. Excluding them did not change the results of the analyses. They were thus collapsed with the SSs, as their night was undisturbed. In addition, there was a subgroup of infants who were considered mixed in their sleep onset pattern—21%, 6 months; 29%, 9 months; and 18%, 12 months; these infants were collapsed together with the asleep group for the chi-square analyses. We chose to be more stringent and only include those infants who were able to consistently put themselves to sleep from awake in the awake onset group.

Statistical analysis.—All statistics were computed using the Statistical Package for the Social Sciences (SPSS), Version 11.5. To test for significant differences across the three follow-up assessments in prevalence of the dichotomous variables (sleep onset and non-self-soothing variables, protodysomnias, cosleeping), we used the Cochran Q test. To examine the relationship between 12-month video and behavioral observations (crib location, sleep onset status, and self-soothing status) and follow-up protodysomnias, we used the chi-square test for significance.

Sleep disturbances and perturbations were not analyzed because of their low incidence. The only perturbation or disturbance that occurred in more than 1 to 2 children at any age were sleep onset perturbations, which ranged from occurring in 5 children at 4 years to 11 children at 3 years.

RESULTS

Descriptive Data From 6 to 12 Months

Table 2 shows the percentage of infants who were considered NSSs, put down asleep–mixed, and sleeping in the parent's room at each of the video observation recording points. It is interesting to note that the average percentages do not change substantially during this time. However, there was considerable instability in that individual children moved in and out of the NSS and asleep–mixed sleep onset groups during the 6-month period of observation. We then examined the percentage of children who remained stable as NSSs across the 6-, 9-, and 12-

month observations and found 33% (n = 18) were consistently coded as NSSs across this time period.

Child's Sleep at Follow Up

Table 3 portrays the number and percentages of children with a sleep problem as defined by parents, and the number and percentage of sleep protodysomnias as described by the research classification system defined in Table 1 at each of the follow-up assessments. Parental generic report of a sleep problem declined over time but not significantly (Q = 4.63, p = .10), whereas the research classification identified significantly fewer night waking protodysomnias over time (Q = 10.1, p = .004). Specifically, the percentage of night waking protodysomnias declined from 9% at 2 years of age to none by 4 years of age. The sleep onset protodysomnia rate was similar across the 2- and 3-year assessments and did not visibly decline until 4 years, although this decline was not significant. Parental presence at sleep onset (Sleep Onset Criterion 2) declined significantly from 47% at 2 years of age to 24% at 4 years of age (Q = 17.5, p = .0001); however, time to fall asleep (Sleep Onset Criterioni 1) and requiring multiple reunions (Sleep Onset Criterion 3) did not decline. Similarly, the number of children who awoke during the night on a regular basis (5–7 nights per week but not meeting the duration criteria of ≥ 20 min) declined over time from 35% of participants at 2 years of age to 13% at 4 years of age (Q = 13.8, p = .001; data are not displayed in the table).

The average percentage of children who were cosleeping (reactive and nonreactive) with their parents did not change across the three time periods; however, some children were removed from the parental bed and other children began cosleeping on a more regular basis over time. In fact, only 9% of the total sample was cosleeping full-time (5–7 nights/week) at all three follow-up ages. Of interest, of the cosleeping families, either reactive or nonreactive, at each follow-up assessment, approximately a third (31% to 41%) of the parents felt it was a problem for the family or child. Of the 9% who were consistently cosleeping (reactive or nonreactive) from 2 to 4 years, the majority of parents did not report cosleeping to be problematic until their children were 4 years of age. At 4 years, 4 of the 6 parents who had been consistently cosleeping since the 1st year considered cosleeping a problem for themselves and/or for the family. Of the 4 who considered the cosleeping pattern to be a problem, 3 were consistently nonreactive cosleeping at 2, 3, and 4 years of age.

When examining the agreement between parental report and the research criteria for a sleep problem, we found low sensitivity and high specificity (Halkin, Reichman, Schwaber, Paltiel, & Brezis, 1998). *Sensitivity* is the probability that a symptom is present (in this case, parental report of a sleep problem) given that the person has the disorder (e.g., a sleep protodysomnia is present as measured by research criteria). Sensitivities at the three follow-up ages ranged from 0% (4 years) to 25% (3 years) to 62% (2 years). This is also known as the *true positive rate*. Thus, parents, especially when their infants were older, tended to describe a sleep–wake behavior as a sleep problem when the research criteria suggested that the observed behavior was within the proposed normal range of sleep–wake behaviors. Sensitivity was greatest when the toddler was 2 years of age and least at 4 years of age. *Specificity*, on the other hand, is the probability that a symptom is not present (in this case, parental report is negative for a sleep problem) given that the person does not have the disorder (a sleep protodysomnia as measured by the research criteria). This is also known as the *true negative rate*. Specificity rates were high, ranging from 90% (3 years) to 92% (4 years) to 93% (2 years). That is, there was a high rate of agreement between parental observations and the research criteria in the absence of a sleep protodysomnia.

Relation Between Self-Soothing During the 1st Year and Follow-Up Assessments of Sleep Protodysomnias

Infants' classification as non-self-soothing at 12 months of age from the videotape was not significantly associated with a later protodysomnia at follow-up. However, there were significant relationships between infants' self-soothing status at 6 and 9 months and the later assessment of protodysomnias. For example, non-self-soothing behavior at both 6 and 9 months was related to the presence of a sleep onset protodysomnia at 2 years, $\chi^2(1, N = 62) = 3.92$, $p = .05$, and $\chi^2(1, N = 58) = 3.86$, $p = .05$, respectively. None of these associations were observed at 3 or 4 years.

Infants who were considered NSSs at 12 months of age were not more likely to be reported by parents to have a sleep problem at follow-up assessment, nor were they more likely to be cosleeping at the follow-up ages. However, non-self-soothing status at 6 months was significantly associated with cosleeping at 2 years of age, $\chi^2(1,N = 62) = 11.67$, $p = .001$, and 4 years of age, $\chi^2(1, N = 62) = 6.95$, $p = .008$. This association was significant at 9 months as well, with 9-month-olds classified as non-self-soothing more likely to be cosleeping at 2 years of age, $\chi^2(1, N =58) = 7.84$, $p = .005$, and 4 years of age, $\chi^2(1, N = 58) = 5.59$, $p = .02$. Infants who were considered NSSs at 9 months were also more likely to have regular night waking at 2 years of age, $\chi^2(1, N = 58) = 5.75$, $p = .02$, but not the prolonged awakening required by the protodysomnia classification scheme to be classified as a disorder.

When we collapsed those infants who were stable NSSs across the 6- to 12-month period of observation (among those participants who had data on self-soothing from each video observation), "chronic" NSSs ($n = 18$) met the criteria for a sleep onset protodysomnia at 2 years, $\chi^2(1, N = 55) = 5.58$, $p = .02$, and were cosleeping at 2 years, $\chi^2(1, N = 55) = 8.03$, $p = .005$. At 4 years, chronic NSSs in the latter half of the 1st year of life were more likely to be waking at least once a night, $\chi^2(1, N = 55) = 5.46$, $p = .02$, and to be cosleeping at least part of the night every night, $\chi^2(1, N = 55) = 8.03$, $p = .005$.

Sleep onset status (awake vs. asleep–mixed) at 6, 9, and 12 months of age was unrelated to the presence of a protodysomnia at follow-up assessment. Infants who were put to bed asleep–mixed at 12 months of age were more likely to be cosleeping at 4 years of age, $\chi^2(1, N = 66) = 3.49$, $p = .06$, although this association was not statistically significant.

Relation Between Crib Location During the 1st Year and Follow-Up Assessments of Sleep Disorders

Crib location at 12 months of age was unrelated to a sleep onset protodysomnia or night waking protodysomnia at 2, 3, or 4 years of age. Crib location at 12 months of age also was not related to parental report of a sleep problem at follow-up. If an infant was sleeping in the parent's room at 12 months of age, he or she was more likely to have regular night awakenings at 2 years of age, $\chi^2(1, N = 68) = 4.02$, $p = .05$—although they were of short duration (3 min vs. 14 min for infants sleeping in their own rooms) and, thus, did not meet the more stringent criteria for a night waking protodysomnia. This finding was a trend at 4 years of age, such that infants who were sleeping in the parent's room at 12 months of age were more likely to have regular night waking at 4 years of age, $\chi^2(1, N = 68) = 3.53$, $p = .06$. In the subgroup of children who were chronic cosleepers, crib location in the parent's room at 12 months of age was significantly related to cosleeping at 2 years, $\chi^2(1, N = 68) = 12.41$, $p = .0001$; 3 years, $\chi^2(1, N = 68) = 10.90$, $p = .001$; and 4 years, $\chi^2(1, N = 68) = 10.90$, $p = .001$.

DISCUSSION

This study is noteworthy for several reasons. Using a prospective, longitudinal design, we tracked 68 children's sleep patterns over the course of 4 years. We collected objective data on the children's sleep during the 1st year of life using videosomnography and coded for specific sleep behaviors that are potentially predictive of problem sleep in toddlers and preschool children (e.g., non-self-soothed night awakenings, sleeping in close proximity to parents, requiring parental presence to fall asleep). Continuing to follow these families at 2, 3, and 4 years of age, we investigated the presence of sleep problems as reported by the parents and by a research classification scheme developed specifically for this age group.

Children's Sleep in the Toddler-to-Preschool Transition

The rate of a sleep protodysomnia (either sleep onset, night waking, or both) at the 2-year follow-up assessment (19%) is consistent with the rates described in the literature on young children's sleep (Lozoff et al., 1985;Richman, 1981). Over time, night waking problems decrease and sleep onset problems (bedtime resistance and struggles) remain constant or increase (Crowell, Keener, Ginsburg, & Anders, 1987;Jenkins et al., 1984;Salzarulo & Chevalier, 1983). The present data replicate previous studies and show a decline of night waking protodysomnias and a constant rate of sleep onset protodysomnias from 2 to 3 years of age.

We found high rates of cosleeping over time. The fact that approximately 25% of the sample reported cosleeping at each of the follow-up interviews in a predominately Caucasian, higher SES sample is most likely reflective of the overall increase in the acceptance of cosleeping and willingness to report such behaviors, as evidenced by a recent epidemiological study of young infants (Willinger et al., 2003). Our study documents this pattern in an older sample of children in a university community.

The implications are two-fold. First, cosleeping, at least in this sample, was considered acceptable as suggested by the fact that 25% of the families practiced cosleeping and the majority of the parents who were cosleeping did not view it as a problem. This contrasts sharply with earlier studies that reported that Caucasian families coslept as a response to a sleep disturbance compared to parents of other ethnic groups (i.e., Black, Latino) who actively chose to cosleep, not viewing it as a symptom of a sleep problem (Lozoff et al., 1996;Schachter, Fuchs, Bijur, & Stone, 1989). Second, children who were cosleeping from time to time were no more likely to develop a sleep problem at follow-up assessments than noncosleeping children, although a subgroup of families (9%) consistently coslept, which may suggest difficulty in removing a child from the parental bed once the pattern has become routine.

It is interesting to note that there was little agreement between what the research criteria identified as a protodysomnia and what the parents identified as a sleep problem (i.e., low sensitivity), suggesting that parents may become less tolerant of night waking of any duration over time but may become more accepting of lengthy bedtime routines and staying in the room until the child falls asleep with age. Because the research criteria were set using the authors' clinical judgment plus experience of typical sleep–wake pattern development from previous studies, it is possible that these criteria may need further refinement in larger prospective studies to more firmly establish their reliability, validity, and developmental progression.

Individual factors may also influence parental tolerance regarding certain sleep behaviors. For example, parenting characteristics, including attitudes and behaviors in relation to limit setting, may be related to their threshold in reporting a sleep problem (Morrell, 1999).

Trends in Predicting a Later Sleep Problem

Although previous studies suggest there is a certain amount of continuity in sleep problems, we did not find a relationship between self-soothing status during the 1st year of life and later sleep problems as defined by the research criteria or parental report. We did find that chronic non-self-soothing at 6 and 9 months was related to cosleeping at follow-up, suggesting consistency in parental caregiving and intervention style, and perhaps child temperament. It is interesting to speculate that one reason why this chronic pattern did not remain continuous at 12 months of age may be related to the disruption, or biobehavioral shift, that occurs from 9 to 12 months of age when self-generated locomotion and other developmental milestones begin to appear.

Scher and Dror (2003) found that mothers who scored more highly on an attachment-related construct, “pleasure-in-interaction,” reported more awakenings in their infants and were more likely to practice cosleeping. In contrast, Thunstrom (1999) found that parents of infants with severe sleep problems were more likely to feel insecure in their role as parent. Perhaps, self-soothing is best viewed as a dyadic variable, within the parent–infant context, and profiles of relationships should be studied. It is also likely that because our original sample was specifically selected as a nonreferred population, we did not observe true, clinically significant sleep problems either in the 1st year of life nor in the subsequent follow-up years. The continuity of sleep problems described in other studies may pertain more to clinic-referred samples of children.

Revision of Classification Scheme

A large percentage of children (approximately half at 2 years of age) required parental presence to fall asleep at the beginning of the night. This characteristic alone, although diagnostic in the original pilot study (Gaylor et al., 2001), was not considered diagnostic in the revised classification scheme. However, when this criterion was combined with either a lengthy time to fall asleep or multiple reunions, children met criteria for a sleep onset protodysomnia, which characterized significantly fewer children (9% at 2 years) and, theoretically, a more severe sleep onset disturbance. Similarly, using more stringent criteria to classify a night waking protodysomnia compared to our previous study (Gaylor et al., 2001), we were better able to identify children who had prolonged night awakenings.

Our criteria differ from the most widely used classification system (Richman, 1981) in two important ways. First, we have not included cosleeping by itself as a criterion of problem sleep. This decision reflects the state of our knowledge regarding the effects of cosleeping, the cross-cultural differences associated with cosleeping, and an acknowledgement that cosleeping is best viewed within a caregiving context. Second, our scheme distinguishes between sleep onset and night waking criteria, as the developmental trajectories and presentations of these two “types” of problems seem to be distinct. Richman’s criteria only include one sleep onset symptom (taking longer than 30 min to fall asleep) and do not address the common parental complaints of bedtime resistance and struggles. Because treatment strategies may differ for sleep problems that occur at sleep onset and those that occur during the middle of the night, it is useful to continue to keep these two common types of infant–toddler sleep disorders distinct. It is also still not clear how often these two types of problems coexist in the same child. Nevertheless, the proposed research criteria require further revision and testing before they can be adopted for clinical use.

LIMITATIONS

The families that did not participate in the follow-up study were more likely to have their child sleep in the parent’s room at 12 months and were more likely to have only one child during

the study period. These differences are notable. Because the sample was derived primarily from a university community, we speculate that most of the parents we could not locate were students at the time of the original study and had moved away before the follow-up study began. These "student" parents may have also been more likely to cosleep, and to be beginning their families, and, thus, have only one child. Second, although there was great variability in the age of weaning in our sample, 32 infants(47%) were still breastfeeding at 12 months of age. In contrast, in the most recent nationwide survey of breastfeeding rates in the U.S., only 17.6% of mothers were breastfeeding when their children were 12 months of age (Ross Products Division of Abbott Laboratories, 2000). This factor also may make this sample somewhat unique. There is a need for future studies that include a more representative sample of families. However, this study documents the sleep trends of children exposed to extended breastfeeding and an accepting approach to cosleeping, both of which may reflect more and more communities in contemporary society.

An additional limitation is that multiple statistical tests were performed on these data, raising the possibility that some of the findings might have been chance occurrences. Caution should be exercised in generalizing these results.

FUTURE DIRECTIONS

Future research on the clinical utility of our protodysomnia classification scheme is warranted. It is important to investigate different ways of classifying night waking and sleep onset problems. We have very little information on how night waking frequency and/or duration affects daytime behavior. For example, severe sleep problems in infancy, defined as three night awakenings at least 5 nights a week, were related to a later diagnosis of attention deficit disorder with hyperactivity (Thunstrom, 2002). Perhaps, one approach might be to examine sleep efficiency using a cutoff of the percentage of wake after sleep onset to define sleep debt in this population. We need more information on the effects of night waking on daytime behavior.

We have not used the number of awakenings during the night per se, but rather the prolonged nature of night waking, as a criterion for a night waking protodysomnia. However, any amount of night waking may be disruptive to the parents if they are required to awaken and tend to the child. This pattern, occurring consistently over the first 4 years of a child's life, may significantly disrupt the parents' sleep in a way that compromises their daytime functioning. No evidence supporting or refuting this speculation has been put forth. Research into the effect of a child's sleep pattern on the family's functioning is warranted.

Finally, we have documented a high rate of cosleeping in a sample of families living in a university community. Hunsley and Thoman (2002) have suggested that young infants who cosleep on a regular basis are at risk for neurobehavioral and developmental problems based on evidence that cosleeping infants had more "deep" sleep and higher thresholds for arousal and awakening when they slept alone. Their conclusion should lead researchers to examine more closely the effect of cosleeping over time, not just in very young infants. Future research will need to tease apart the effects of the various concomitants of chronic cosleeping (e.g., multiple night awakenings over time, extended breastfeeding, fewer opportunities to self-soothe, differences in sleep architecture–arousals) on sleep, daytime behavior, and family functioning.

Acknowledgements

This work was supported, in part, by National Institute of Mental Health Grant R01–MH50741 (to Thomas F. Anders).

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TABLE 1

Classification Scheme for Sleep Protodysomnias in Infants, Toddlers, and Preschoolers

Age	*Perturbation (1 episode per week for at least 1 month)*	*Disturbance (2–4 episodes per week for at least 1 month)*	*Disorder (5–7 episodes per week for at least 1 month)*
Sleep onset protodysomina (meets 2 of 3 criteria)			
12–23 months of age	> 30 min to fall asleep; parent remains in room for sleep onset;more than two reunions.[a]		
≥ 24 months of age	> 20 min to fall asleep; parent remains in room for sleep onset; more than one reunion.[a]		
Night waking protodysomnia			
12–23 months of age	≥ 2 awakenings[b] per night, totaling ≥ 20 min[c]		
≥ 24 months of age	≥ 1 awakening[b] per night, totaling ≥ 20 min[c]		

Note. A protodysomnia is not diagnosed before 1 year of age. The criteria pertain to solitary sleeping infants. Episode criteria are subdivided. Perturbations are considered variations within normal development; disturbances are considered as possible risk conditions that may be self-limiting; disorders most likely are continuous and require intervention.

[a] Reunions reflect resistances in going to bed (e.g., repeated bids, protests, struggles).

[b] Awakenings require parental intervention and occur after the child has been asleep for more than 10 min.

[c] ≥20 min criterion is applied to the whole night regardless of the number of awakenings.

TABLE 2

Video Observation Data During the First 12 Months of Life

Observation	*% NSS*	*% Asleep—Mixed at Sleep Onset*	*% Share Parent's Room*	*Missing Participants for NSS/SS (n)*[a]	*Missing Participants for Awake/Asleep Onsets (n)*[a]
6 month	63	67	31	6	2
9 month	59	67	25	9	3
12 month	69	67	25	4	2

Note. $n = 68$. NSS = non-self-soother; SS = self-soother.

[a]Missing data due to cosleeping or shortened observation period.

TABLE 3

Description of Sleep Variables at Follow Up

Variables	*2 Year*		*3 Year*		*4 Year*		*Significance*[a]
	n	*%*	*n*	*%*	*n*	*%*	
Current sleep problem (parent)	12	18	8	12	5	7	.10
Past sleep problem (parent; in last year)	16	24	12	18	16	24	*ns*
SO criterion 1 (> 20 min to fall asleep)	6	9	7	10	5	7	*ns*
SO criterion 2 (parental presence at sleep onset)	32	47	27	40	16	24	.0001
SO criterion 3 (> 1 reunion)	5	7	7	10	6	9	*ns*
SO protodysomnia only	6	9	6	9	2	3	*ns*
Night waking protodysomnia only	6	9	2	3	0	0	.004
Both	1	2	0	0	0	0	*ns*
Cosleeping reactive	11	16	7	10	7	10	*ns*
Cosleeping nonreactive	8	12	10	15	10	15	*ns*

Note. SO = Sleep Onset.

[a] Cochran *Q* test was used to determine differences in the rate of problem sleep variables across the three follow-up assessments.