

Sleep and Temperament Maternal Perceptions of Temperament of Sleep-Disturbed Toddlers

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Research findings: In order to assess the relations between sleep problems and temperament in infants, temperament ratings of 63 toddlers who presented with night waking problems were compared to those of 35 non-referred toddlers. An objective method to assess sleep patterns was used to validate the distinct sleep patterns of the two groups prior to the comparison of the temperament scales. Measures included: Toddler Temperament Questionnaire (TTQ) and the child's scales of the Parental Stress Index (PSI). On the TTQ, Night wakers were rated as having lower sensory thresholds compared to the controls. Night Wakers were also rated as less adaptive than the controls. On the PSI, Night Wakers were rated as more distractible; less reinforcing; less adaptive and more demanding. **Practice or policy:** The results suggest that sleep disturbances in early childhood are closely associated with negative maternal perceptions of child temperament. It is proposed that early detection and treatment of sleep problems during early childhood may prevent some of the associated negative behavioral consequences.

Key Words: Sleep, sleep problems, temperament, night-waking, toddlers, infants.

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Introduction

Since Carey's first documentation of temperamental differences between night wakers and control infants, there has been a growing body of information suggesting that these differences are important in understanding the nature of sleep problems in early childhood (Carey, 1974). Carey reported that night wakers had lower sensory thresholds than their controls. Weissbluth and Liu (1983) found an association between sleep duration and temperament in infancy: infants with "difficult" temperaments slept less than those with "easy" ones. Van Tassel (1985) reported that sleep disturbances during the first two years of life were correlated with temperament measures of adaptability and mood. Weissbluth, Davis and Poncher (1984) concluded, from a study of night waking in 4-8-month old infants, that night wakers have higher likelihood to be rated as having "difficult" temperament. Similar findings were reported by Schaefer (1990) in children referred to Crying Baby Clinic for night waking problems. Zuckerman, Stevenson and Baily (1987) reported that persistence of sleep problems in 3-year-olds was related to other temperamental-behavioral characteristics such as temper tantrums and "being difficult to manage".

The concept of temperament has been confounded by questions related to the methodology of temperament measurement as well as by the controversy if temperament measures represent endogenous characteristics of the child, child's adaptation to a specific environment, or both. Although these issues have never been satisfactorily resolved, the perception of current measures of temperament as the result of an interplay of the child's endogenous features and the child's specific social and physical environment is a prevailing one (Bates, 1989; Thomas & Chess, 1977). This perception is central to the understanding of the possible relations between sleep disturbances and temperament in early childhood. A child may be sleep disturbed as a result of endogenous low stimulus barrier and lack of generalized adaptation skills, but on the other hand, a child may become less adaptive, with low tolerance for stress, because he or she is sleep deprived.

Overall, the literature in the field suggests that there is a relation between sleep and temperament but the nature (or specificity) of this relation seems to vary from one study to the other. The variety of findings regarding specific temperament features associated with sleep disturbances may be partially attributed to inter-study differences in the type of sleep problems investigated and in their severity. Another possible source of incongruity is the total reliance on parental reports in identifying sleep-disturbed children and documenting the child's temperament. The limitations of parents as reporters of sleep-wake patterns in young children have been addressed and demonstrated in a number of studies using objective monitoring (Anders, Keener, Bowe & Shoaff, 1983; Anders & Keener 1985; Sadeh, 1994; Sadeh, Lavie, Scher, Tirosh & Epstein, 1991; Scher, Epstein, Sadeh & Lavie, 1992). Keener, Zeanah and Anders (1988) used time-lapse video monitoring to objectively measure sleep patterns in 6-month-old normal, non-referred infants. None of the temperament measures (completed by both mothers and fathers) that were found significant in earlier studies differentiated between infants who signal their parents when they wake up (by crying) and infants who were self-soothers resuming their sleep without signaling following night-wakings. The only measure that differentiated between these two groups of infants was the rhythmicity measure rated by the fathers.

Recently, a new method, based on activity monitoring, has been introduced and validated for naturalistic studies of infant sleep-wake patterns (Sadeh, Alster, Urbach, and Lavie, 1989; Sadeh, Lavie, Scher, Tirosh & Epstein, 1991). In a recent study, Scher, Epstein, Sadeh & Lavie (1992) found, on the basis of activity-based monitoring and parental reports, only modest correlations between objective sleep measures and temperament ratings in normal toddlers. The authors raised the question if the links between sleep and temperament reported earlier by researchers are valid ones or mostly reflected reporting bias. The present study represents the first attempt to study the relations between objective sleep measures and temperament in a sample of severely sleep-disturbed toddlers.

The aims of the present study were: (a) to reevaluate the relationships between temperament and sleep disturbances by comparing a clinical group of sleep-disturbed toddlers who presented with a specific sleep problem of severe night waking with a group of normal controls presented with no sleep problems (confirmed by an objective method in both groups); and (b) to examine the relation between objective and subjective sleep measures and temperament ratings in this clinical group of sleep-disturbed toddlers and their controls.

Method

Subjects

Two groups of children were studied. The sleep-disturbed children included 63 infants and toddlers (37 boys and 26 girls), ranging in age between 9 and 24 months (mean age = 14.3 months; SD = 4.2), who were consecutively referred to the Technion Sleep Disorders Center because of their parents' complaints of multiple and/or prolonged night wakings. The children were all screened and found to be otherwise healthy, with no physiological, neurological or developmental problems. Inclusion criteria were: (1) age between 9 and 24 months; (2) severe sleep problems as reported by the parents and validated by home-monitoring. The control group consisted of 35 children (19 boys and 16 girls), ranging in age between 11 and 27 months (mean age = 17.7 months; SD = 5.5). These were normal, non-referred children recruited from a survey of normative sleep patterns in early childhood. These children were healthy with no identified medical or developmental problems. Both samples consisted of mostly middle-class intact families.

The sleep patterns of both the clinical and control groups were monitored using an objective method that is based on activity monitoring in the natural environment of the child (Sadeh, Lavie, Scher, Tirosh & Epstein, 1991). This method has been validated against laboratory polysomnographic studies with agreement rates of 85.3% for sleep-wake measures (Sadeh et al., 1991). Significant night-to-night reliability has also been demonstrated.

Sleep of the referred infants was more fragmented as manifested by a significantly higher number of night-wakings per night and a longer time spent in wakefulness during night-wakings (as measured objectively). No differences were found with respect to sleep schedule or sleep duration. The sleep-disturbed children in this sample presented severe night-waking problems relative to other groups of sleep-disturbed children described in the literature. For instance, on average, these children woke-up more than 3 times per night as documented by parental reports and objective actigraphic recordings (Sadeh et al., 1991). To be included in the clinical group a child had to present an average of at least 3 night wakings (5 minutes or longer) or at least one prolonged night waking (30 minutes

or longer) per night during the baseline monitoring period. Reportedly, the control toddlers did not present sleep problems. Their actigraphic recordings showed that on average these infants did wake up twice per night on average. However, besides waking up less often, their night-wakings were significantly shorter, and usually they resumed their sleep without signaling to their parents (Sadeh et al., 1991). Informed consent was obtained from the parents of each child. It was indicated to the parents in the clinical sample that their treatment is non-contingent upon their participation in the study.

Procedure: Actigraphy - a new method in pediatric sleep research based on a small activity monitor - was used to assess sleep patterns of all participating subjects. The method, procedures and results have been described elsewhere (Sadeh et al., 1991). In short, the actigraph was attached to each infant's ankle for a baseline evaluation week. The motility data was then transformed to sleep measures using an algorithm and a software program that had been validated against polysomnographic measures (Sadeh, Alster, Urbach & Lavie, 1989; Sadeh et al., 1991). In summary, sleep-disturbed children slept significantly worse than the control subjects as assessed by actigraphic measures. The formers' sleep was characterized by increased number of night wakings, by lower percentages of sleep and quiet sleep, by multiple sleep-wake transitions, and by a shorter period of continuous, consolidated sleep.

In the present study, the activity raw data was automatically scored for sleep-wake measures according to the algorithm developed by Sadeh et al (1989). Actigraphic sleep measures included: sleep onset time; sleep duration; number of awakenings longer than 5 minutes; percent of quiet motionless minutes; sleep efficiency (the percent of minutes scored as sleep from sleep duration); and mean activity level. Parallel sleep measures (the first 4) were obtained from sleep logs completed by the parents.

The initial intake interview with a clinical psychologist was followed by a week of baseline assessment of the child's sleep patterns. In addition, the mothers were asked to complete questionnaires focused on the child's temperament and related characteristics. Two questionnaires were used: (1) the Toddler Temperament Questionnaire (Carey & McDevitt, 1978; Fulard, McDevitt & Carey, 1984) and (2) the Parental Stress Index (Abidin, 1983). The Toddler Temperament Questionnaire (TTQ) is a 97-item rating scale of specific observed behaviors providing scores on the following dimensions: (a) Activity-child's activity level and inability to remain still; (b) Rhythmicity-child's tendency to have time regulated activities and constant schedules; (c) Approach-child's approach to new and unfamiliar people; (d) Adaptability-child's adaptability to new situations and maternal treatment; (e) Intensity-child's intensity of response in different situations; (f) Mood-child's mood in daily situations; (g) Persistence-child's ability to persist and focus on specific game or task for prolonged periods; (h) Distractibility-child's tendency to be distracted from his or her activity by external, environmental stimuli; and (i) Sensory Threshold-child's response to various sensory stimuli like noise, touch, smell, taste and temperature; (Fulard, McDevitt & Carey, 1984).

The Parental Stress Index (PSI) is a questionnaire developed to assess 3 potential stress sources for the mother: (1) child's characteristics; (2) mother's characteristics; and (3) situational demographic characteristics. For this project we focused only on the child scales which include the following scales: (a) Adaptability-child's ability to adapt to new situations, stimuli, places and people; (b) Acceptability-child's acceptance by the parents;

situations, stimuli, places and people; (b) Acceptability-child's acceptance by the parents; (c) Demandingness-the extent to which the child is perceived as demanding and controlling; (d) Mood-child's negative mood, sad, depressed and unhappy; (e) Distractibility-child's level of activity, inattentiveness and distractibility; and (f) Reinforcing-the extent that the child's behavior reinforces the parent; (Abidin, 1983).

Higher scores on all TTQ and PSI scales correspond to more "problematic" or "stressful" characteristics.

Results

Multivariate Analysis of Covariance was used (MANCOVA) for comparison of the groups with Sex and Group as independent variables and Age as a covariate (to control for age differences between the two groups). Since no main Sex or Sex by Group interaction effects was found, the results are reported for the combined boys and girls groups. MANCOVA revealed significant group differences on the TTQ and PSI measures ($F = 2.20$; $p < .05$).

Sleep-Disturbed vs. Control Children

Comparison of the Sleep-Disturbed and Control group on the Toddler Temperament Questionnaire revealed two significant scale differences (see Table 1). The Sleep-Disturbed children had significantly higher scores than the Control children on the Adaptability scale [group means corrected for age: 3.56 vs. 3.08, respectively; $p < .01$].

Table 1.

TTQ and PSI scales scores of Night Wakers and Control Toddlers:
Means Corrected for Age Covariance (Std. Deviation) and F Statistics

MEASURE	GROUP		F (1,92)
	Night Wakers	Controls	
<i>TTQ Scales</i>			
Activity	3.91 (.72)	3.70 (.62)	1.77
Rhythmicity	2.61 (.83)	2.47 (.62)	.65
Approach	3.08 (.94)	2.95 (.92)	.38
Adaptability	3.56 (.74)	3.08 (.75)	7.70 **
Intensity	3.65 (.69)	3.61 (.59)	.06
Mood	3.19 (.71)	2.94 (.63)	2.60
Persistence	3.71 (.65)	3.50 (.73)	1.81
Distractibility	4.43 (.84)	4.11 (.85)	2.94
Sensory Threshold	4.04 (.74)	3.59 (.95)	6.82 *
<i>PSI Child's Scales</i>			
Adaptability	25.38 (5.9)	21.51 (6.7)	8.15 **
Acceptability	11.57 (4.1)	9.99 (3.5)	3.28
Demandingness	21.02 (6.6)	15.99 (5.1)	8.40 ***
Mood	10.77 (3.7)	9.33 (3.1)	2.81
Distractibility	27.22 (4.2)	24.11 (5.1)	9.16 ***
Reinforcing	12.61 (1.9)	11.12 (3.2)	7.33 **

* $p < .05$; ** $p < .01$; *** $p < .005$

Thus, Sleep-Disturbed children were described by their mothers as more difficult to care for and less adaptable. In addition, the Sleep-Disturbed children had significantly higher scores on the Sensory Threshold scale (4.04 vs. 3.59, respectively; $p < .05$). Sleep-Disturbed children were described as more sensitive and responsive to sensory stimuli of various types.

No other significant differences were found between the groups on any of the other TTQ scales.

On the PSI questionnaire, significant group differences were found for most of the child-related scales. Sleep-Disturbed children were rated as more distractible than the Controls (27.2 vs. 24.1, respectively; $p < .005$). They were also rated as less reinforcing (12.6 vs 11.1; $p < .01$), less adaptive (25.4 vs. 21.5; $F = 8.15$, $p < .01$) and more demanding (21.0 vs. 16.0; $F = 14.13$, $p < .0005$). No group differences were found in respect to the Mood and the Acceptability scales.

Age-Related Trends

In order to better understand the nature of the group differences, correlation of each of the TTQ and PSI scales with Age were computed separately for each group (see table 2).

Table 2.

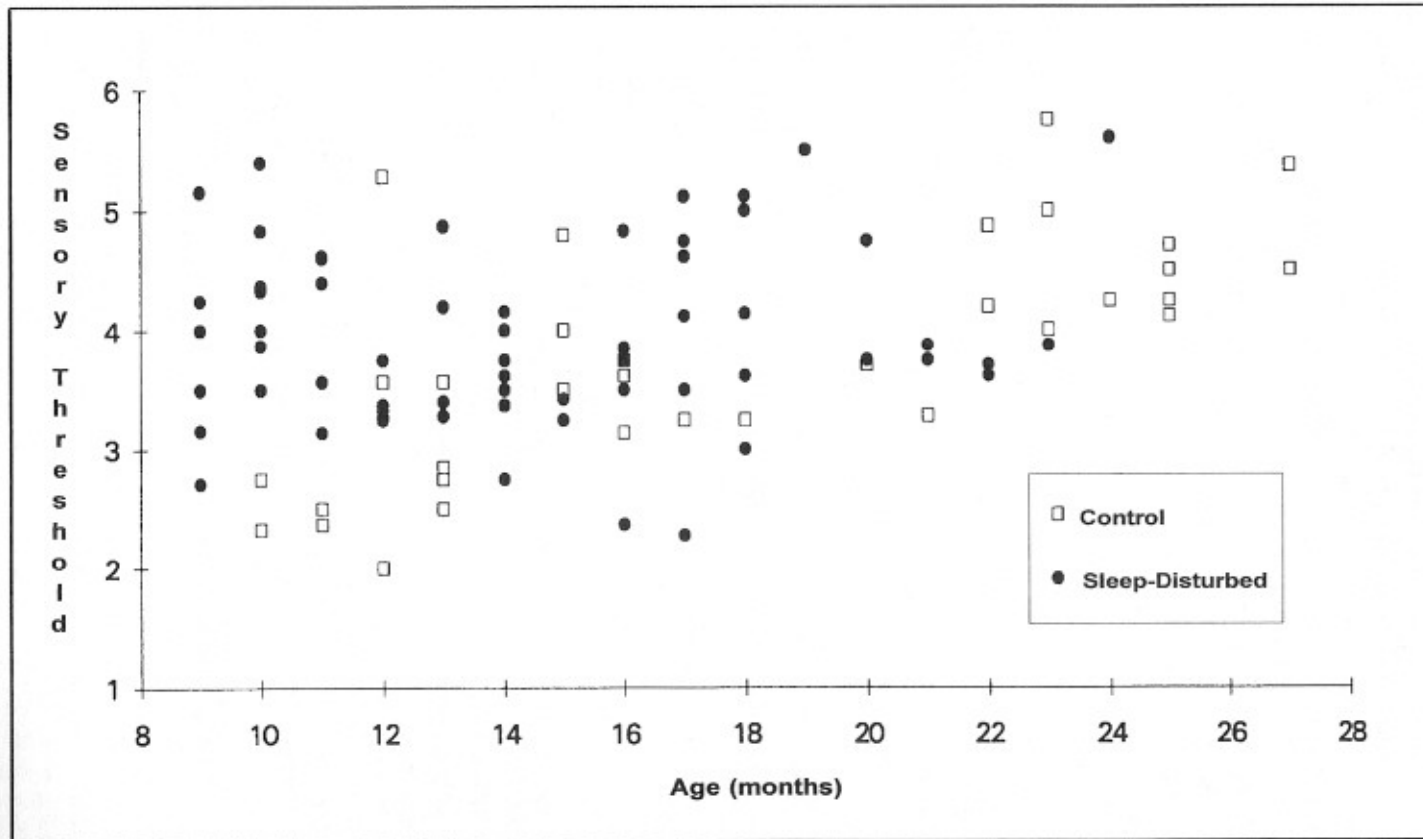
Pearson Correlations of TTQ and PSI Scale Scores with Age in Night Wakers and Control Toddlers

MEASURE	GROUP	
	Night Wakers	Controls
<i>TTQ Scales</i>		
Activity	.008	-.015
Rhythmicity	-.046	.013
Approach	.013	-.050
Adaptability	.074	-.117
Intensity	.037	.010
Mood	.077	-.104
Persistence	.051	-.453**
Distractibility	-.111	.168
Sensory Threshold	.112	.702***
<i>PSI Child's Scales</i>		
Adaptability	.153	.306
Acceptability	.250*	.134
Demandingness	.212	.374*
Mood	.150	-.077
Distractibility	.276*	-.078
Reinforcing	.177	.057

* $p < .05$; ** $p < .01$; *** $p < .0001$

Figure 1.

Scatter Plots of Sensory Threshold Scores and Age in Night Wakers and Control Toddlers



In the Control group, Age was significantly correlated with TTQ scales of Sensory Threshold, $r(34) = .70$; $p < .0001$; and Persistence, $r(34) = -.45$; $p < .01$. Older children had lower sensory thresholds (more responsive to stimuli) and higher capacity to persist and sustain attention on one specific task or event. The only PSI scale that was significantly correlated with Age in this group was Demandingness, $r(34) = .37$; $p < .05$; older children were rated as less demanding.

In the sleep-disturbed group, Age was significantly correlated with the Distractibility and Acceptability scales of the PSI; $r(62) = .28$; $p < .05$; and $r(62) = .25$; $p < .05$, respectively; older children were described as less distractible and more difficult to accept.

Multivariate Analysis

In order to elucidate the group differences and to determine which measures make a valuable and distinct contribution to the understanding of these differences, Stepwise Discriminant Analysis (SAS, 1985) was conducted, including all TTQ and PSI scales and Age as the predictors and Group as the criterion. Age was included in this analysis in order to control for the group age differences (based on the same rationale of using Age as a covariate in ANOVA). The results are summarized in Table 3.

Table 3.

Multivariate Stepwise Discriminant Analysis: The Discriminative Power of the TTQ and PSI Scales in Differentiating between Night Wakers and Control Toddlers

MEASURE	Partial R ²	F	p <	Squared Canonical Correlation	p <
Age ^a	.112	12.2	.0007	.112	.0007
PSI Demand	.120	12.9	.0005	.219	.0001
TTQ Threshold	.069	7.0	.0095	.273	.0001
PSI Distract	.042	4.1	.0448	.304	.0001

No other Scales with significant discriminative power were found.

^a Age was entered to control for group age difference.

The Age variable explains 11.2% of the group differences ($F = 12.2$; $p < .0007$). This reflects the group age difference that was statistically controlled in this study. The scale found to have the highest contribution was the PSI Demandingness scale that explained an additional 12.0% of the group differences ($F = 12.9$; $p < .0005$). The second important scale was the Sensory Threshold that explained additional 6.95% of the variance ($F = 7.02$; $p < .0095$). Finally, the last measure with significant explanatory power was the PSI Distractibility scale that explained additional 4.26% ($F = 4.14$; $p < .05$).

When these 4 measures were used in a discriminant analysis for predicting group affiliation of each child in the sample, correct assignment was predicted in 80% of the control toddlers and in 74.6% of the sleep-disturbed toddlers.

Correlations between sleep measures and temperament in the sleep-disturbed and control toddlers

The correlations between sleep-wake measures and temperament ratings for the control toddlers have been partially reported elsewhere (Scher et al., 1992), the following findings are based on partial-correlation analysis (with Age partialled out) for the entire sample and for each separate group.

Only a limited number of significant partial correlations were found in this large correlation matrix (containing 180 correlations). Sleep onset time was significantly correlated with the TTQ Approach scale in the control group ($r = .48; p < .005$), and with the PSI Reinforcing scale for the total sample and for the control group ($r = .27; p < .01$; and $r = .49, p < .005$; respectively). Toddlers who tended to fall asleep later were rated as less rewarding and reinforcing to their mothers and more difficult in approaching and contacting new, unfamiliar people. Sleep duration was significantly correlated with TTQ Persistence scale in the total sample and in the control group ($r = -.22; p < .05$; and $r = -.44, p < .01$; respectively). Toddlers who slept longer were rated as more persistent on different tasks and games. Sleep percent was correlated significantly with TTQ Adaptability scale ($r = -.26; p < .05$), and PSI Distractibility scale ($r = -.25; p < .05$) in the total sample. Toddlers who slept most of the time they spent in bed with shorter periods of wakefulness were rated as more adaptive and less distractible. Finally, the number of night-wakings was significantly correlated with the TTQ Sensory Threshold scale ($r = .23; p < .05$), and the PSI Demandingness scale ($r = .23; p < .05$) in the total sample. Increased number of night-wakings was associated with increased sensitivity to sensory stimulation and increased demandingness of the child.

Discussion

The present study was aimed at re-examining temperament and other child characteristics in night-wakers compared to control children. In contrast to other comparable studies in the literature, the assignment to sleep-disturbed and control groups was validated by an objective monitoring method and the group differences in sleep patterns were therefore soundly established beyond parental subjective reports. However, the main limitation of the present study was that temperament assessment was solely based on parental reports that include a significant subjective component (Zeanah, Keener, Stewart & Anders, 1985). A related inherent limitation is that when comparing clinical and control group of infants, a response bias of the "clinical parent" (who tends to perceive or describe his or her child in more negative terms while seeking help) may exist and play a role in studies relying on parental reports. In such studies, the specificity of the findings, may help to appreciate the significance of the findings beyond the anticipated response bias.

The results indicate that children suffering from sleep disruptions are likely to be perceived by their mothers as being more difficult than controls across a number of specific behavioral domains. These findings are consistent with earlier documentation of the association between sleep disturbances and generalized behavior problems in older children (Richman, Stevenson & Graham, 1982; Zuckerman, Stevenson & Bailey, 1987).

The results of our study replicated Carey's earlier finding of a difference in the parent reported sensory thresholds of night wakers and normal infants (Carey, 1974). In both studies night-wakers were rated as having lower sensory thresholds, in other words, they were more responsive to external sensory stimulation. The differential age trends on this specific measure and its unique contribution in the multivariate Stepwise Discriminant Analysis, lend additional support to the assumption that there is a distinct, underlying mechanism interfacing with sensory stimulation in children who are vulnerable to sleep disruptions. These children may be more prone to respond with night waking to externally or internally induced sensory stimulation during sleep.

On the basis of his findings, Carey (1974) concluded that infants' vulnerability to night waking may be biologically determined by a less effective barrier for sensory stimulation. Carey also claimed that the role of parental behavior in childhood sleep disturbances might have been overemphasized while the contribution of the child's constitution has been undermined. Also pertinent to this physiological-vulnerability hypothesis, is the finding that sleep behavior is related to stress-induced physiological arousal response in older children (Fisher & Rinehart, 1990); suggesting the existence of links between sleep and physiological arousal response to induced stress during wakefulness. It has also been observed that night wakers who were treated successfully tended to relapse and present similar sleep problems in response to stress induced by changes in their lives (e.g., house moving, starting a daycare program) (Sadeh, 1992).

Another possible explanation for the links between sleep problems and temperament comes from the field of sleep research and the study of the function of sleep. It could be argued that night wakers' sleep quality and its restorative power are negatively affected by their sleep fragmentation, and that the increased responsiveness to sensory stimulation (or hypervigilance) as well as other distinct characteristics (lower adaptability, increased demandingness and distractibility) are the sequela of sleep loss in this age group. Little is known about the manifestations of sleep loss or sleep fragmentation in early childhood. Some findings suggest that hyperactivity and impulsiveness may be the primary signs of sleepiness in older children (Anders, Carskadon, Dement & Harvey, 1978; Navelet, Anders & Guilleminault, 1976) and these behaviors could be manifested or referred to as "difficult" temperament in younger children.

Both rationales can account for the difficult characteristics of night wakers found in the present study. An underlying biological-temperamental factor may play a significant role in children described as less adaptive, more distractible, less reinforcing and more demanding. It should not be ignored, however, that there is a growing body of data documenting the relationships between specific parent characteristics or parent-child interaction styles, and sleep-wake patterns in early childhood (e.g., Paret, 1983; Sadeh & Anders, 1993; Sander, Stechler, Julia & Burns, 1970; Van Tassel, 1985; Zuckerman, Stevenson & Baily, 1987). For instance, recent studies have shown that parental involvement at bedtime as well as maternal attachment style play a significant role in night waking in early childhood (Adair, Bauchner, Philipp, Levenson, Zuckerman, 1991; Benoit, Zeanah & Boucher, 1992). Therefore, it could be argued that parental difficulties with issues of separation and limits setting can have direct influence on infants' sleep problems, as well as on other child characteristics such as demandingness, adaptability, or "difficult" temperament.

It is impossible to assess the relative contributions and the causal relationships between sleep, temperament and external factors using the existing research and clinical data. Research focused on the consequences of induced sleep loss in young children and longitudinal studies of temperament and sleep-wake patterns in early childhood using objective methods to assess these aspects can significantly contribute to elucidate this issue.

The evidence that severe sleep disruptions in early childhood are associated with negative parental assessment of the child's temperament highlights the importance of systematic inquiry of sleep patterns in young children seen by pediatricians or other clinicians due to temperamental difficulties or behavior problems. Similarly, temperamental difficulties should be explored in children who are presented with sleep problem.

Appropriate attention to these aspects could lead to a better understanding of the origins of the problem. Various methods of prevention and treatment of infant sleep problems seem to lead to high rates of successful resolution of infant sleep problems (e.g., Sadeh, 1994; Wolfson, Lacks & Futterman, 1992) and therefore may prevent long-term problems associated with difficult temperament.

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