Sleep and Psychological Characteristics of Children on a Psychiatric Inpatient Unit

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ABSTRACT

Objective: To assess the association of objective measures of sleep-wake patterns and psychological status and abuse history of children hospitalized in a psychiatric inpatient unit. **Method:** Thirty-nine inpatient children participated in the study. They were monitored for one to three consecutive nights with miniature wrist activity monitors for objective assessment of sleep-wake patterns. In addition, a thorough psychiatric and psychosocial assessment was completed with each child and the parents. **Results:** Children's self-ratings of depression, hopelessness, and low self-esteem were significantly correlated with objective sleep measures indicating poorer sleep quality. No significant correlations between intelligence scores and sleep measures were found. Nonabused and sexually abused children had better sleep quality than physically abused children. **Conclusions:** Sleep quality during hospitalization is strongly associated with self experiences of depression, hopelessness, and low self-esteem in children with severe behavior disorders. *J. Am. Acad. Child Adolesc. Psychiatry,* 1995, 34, 6:813–819. **Key Words:** actigraph, sleep, depression, psychopathology, children.

The maturation of the sleep-wake system is one of the first markers of early biobehavioral organization and adaptation (Thoman, 1990). This maturational process involves complex biological, physiological, and psychosocial mechanisms that normally lead to the achievement of consolidated sleep-wake patterns. The vulnerability of these processes is often manifested in the high prevalence of sleep disturbances in early childhood (Mindell, 1993; Richman, 1987; Sadeh and Anders, 1993) and by the close relationships among sleep disturbances, psychopathology, and abuse (e.g., Dahl and Puig-Antich, 1990; Ford and Kamerow, 1989; Sadeh et al., 1994a). In this report, we examine associations among sleep (measured via activity monitoring), child psychopathology, abuse history, and other psychological characteristics.

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Disturbed sleep has been associated with difficult temperament (Carey, 1974; Sadeh et al., 1994b; Schaefer, 1990; Van Tassel, 1985; Weissbluth et al., 1984; Weissbluth and Liu, 1983; Zuckerman et al., 1987). In older children and adolescents, stress (e.g., Fisher and Rinehart, 1990), trauma (e.g., Beitchman et al., 1991a,b; Moore, 1989; Sadeh et al., 1994a), and psychopathology (e.g., Dahl and Puig-Antich, 1990; Ford and Kamerow, 1989; Sadeh et al., 1995) have been related to altered sleep patterns and sleep disturbances.

To date, most sleep-related studies in this field were based on subjective data (parental or self-reports) or on polysomnographic studies. Subjective sleep measures are limited by the restricted and biased knowledge children (and their parents) have about their sleep. Polysomnography, on the other hand, provides very detailed sleep information but compromises the natural sleep settings and is usually limited to one or two nights because of the resources needed.

A related line of investigation has been focused on identifying the links between specific psychiatric conditions and the patients' manifested activity level. Hyperactivity and affective disorders are the most prominent areas of psychopathology where marked

increase or decrease of activity serve as primary diagnostic symptoms. Activity monitoring has been used extensively in the study of child and adult psychopathology (for a comprehensive review, see Tryon, 1991). A number of studies have documented the specific activity patterns of hyperactive children (e.g., Barkley, 1977; Porrino et al., 1983a,b; Tirosh et al., 1993) and of young and adult patients suffering from affective disorders (Benoit et al., 1985; Klein et al., 1991, 1992; Royant-Parola et al., 1986; Teicher et al., 1993; Wehr et al., 1982). Teicher et al. (1993) used activity data to identify unique chronobiological rhythms in depressed children. However, none of these activity studies have focused directly on sleep and psychopathology in children.

Child abuse, in particular sexual abuse, has been often theoretically and empirically associated with sleep problems (e.g., Goldston et al., 1989; Goodwin, 1988; Moore, 1989; Rimsza et al., 1988; Sadeh et al., 1994a). Most of these studies relied on parent-reported sleep measures. For example, in a recent chart review study, sexually abused psychiatric inpatient children were reported by their parents as presenting more sleep problems than physically abused or nonabused hospitalized children (Sadeh et al., 1994a). When these children were observed on the hospital unit, the groups were indistinguishable, presenting only low frequencies of sleep-related difficulties.

During the past few years, activity monitoring has been established as a reliable method for naturalistic studies of sleep-wake patterns in adults and children (e.g., Cole et al., 1992; Sadeh et al., 1989, 1991, 1994c, in press). These studies compared activity-based sleep-wake scoring with concomitant polysomnography (or with direct observation method) and found agreement rates for sleep-wake states across 1-minute epochs ranging between 85% and 95% for most normal and clinical samples. Our assumption was that this methodology could be applied to shed new light on the relationship between sleep-wake patterns, psychopathology, and abuse status in hospitalized children.

The goal of this study was to explore, with a nonintrusive technique, the relations between sleep patterns of hospitalized children—in a structured environment of a psychiatric inpatient unit—and their psychological functioning, psychiatric status, and abuse history. In particular, we used actigraphy to evaluate the relations among sleep patterns and measures of anxiety and depression that have been traditionally associated with sleep disturbances.

METHOD

Subjects

Thirty-nine children, 9 girls and 30 boys, aged 7 to 14 years (mean = 9.51, SD = 1.9) participated in the study. These children were hospitalized in the Children's Inpatient Unit at E. P. Bradley Hospital, Providence, RI, because of severe psychiatric and behavioral problems. Participating children and parents were informed about the research protocol and gave signed consent. The Children's Inpatient Unit is a psychiatric inpatient unit run by a multidisciplinary team of psychiatrists, clinical psychologists, nurses, social workers, and milieu therapists. The average length of stay on the unit at the time of the study ranged between a week and 5 months (2 months on average).

Procedure

A standardized clinical and research protocol was completed for each child participating in the study. Most children were not medicated during the period of this evaluation. For 13 children, however, medication suspension could not be clinically recommended; they continued their medication regimens while being studied (2 were taking methylphenidate, 2 were taking amoxicillin, 2 were taking desipramine, 2 were taking a combination of amoxicillin and clavulanic acid, and 1 child was taking each of the following medications: imipramine, lithium, carbamazepine, diphenhydramine, and fluoxetine). The children's diets were not monitored. The evaluation included medical, behavioral, cognitive, and emotional assessments. These assessments were completed by a multidisciplinary treatment team consisting of nurses, social workers, psychiatrists, and psychologists.

Psychological Testing. The psychological evaluation included the administration of the WISC-R, the Children's Depression Inventory (CDI) (Kovacs, 1985; Kovacs, unpublished), the Piers-Harris Children's Self-Concept Scale (Piers, 1984), the Child Dissociative Checklist (Putnam, 1991), and the Hopelessness Scale for Children (Kazdin et al., 1986). Parents or primary caregivers completed the EAS Temperament Survey for Children (Buss and Plomin, 1984), the Child Behavior Checklist (CBCL) (Achenbach and Edelbrock, 1983), the Revised Children's Manifest Anxiety Scale (Reynolds and Richmond, 1985), and an assessment for the presence and forms of child abuse based on semistructured interviews with the children and their parents and examination of prior documentation of abuse. Standardized psychiatric interviews were conducted with children and their parents to determine *DSM-III-R* diagnoses.

The following measures were derived from instruments administered to the child and the child's primary caregiver: Full Scale IQ, Performance IQ, Verbal IQ, CBCL Total (*T* score), CBCL Internalizing (*T* score), CBCL Externalizing (*T* score), Child Dissociative Checklist score, Hopelessness score, CDI score (CDI), Revised Children's Manifest Anxiety Scale (RCMAS *T* score), Piers-Harris Children's Self-Concept Scale score (*T* score), EAS Shyness, EAS Sociability, EAS Emotionality, and EAS Activity.

Abuse History. The child and parents were separately interviewed about possible history of child abuse. Prior documentation from appropriate social services and law enforcement agencies of child abuse was also obtained. For a child to be in the sexually abused

group, he or she must have experienced contact sexual abuse by someone at least 5 years older. Those in the physically abused group must have experienced hitting, kicking, beating, or other physically injurious behavior that was later substantiated by the Rhode Island Child Abuse Network and Tracking System (for more details on a similar but larger cohort of children, see Sadeh et al., 1994a). Four subgroups of children were identified: nonabused (n = 12), physically abused (n = 8), sexually abused (n = 7), and combined sexually and physically abused (n = 12). The age of the child when the abuse occurred varied considerably and could not have been corroborated in all cases.

Sleep Assessment. Each child was monitored with the actigraph (AMA-32, Ambulatory Monitoring Inc., Ardsley, NY) for 1 to 3 consecutive nights (25 children were monitored for 3 nights, 6 were monitored for 2 nights, and 8 were monitored for 1 night [a total of 95 nights]). Although the initial plan was to monitor each child for 3 nights, some children required medication or other interventions during the monitoring period and therefore only 1 or 2 nights' monitoring was obtained for those children. Sleep monitoring started as soon as informed consent was obtained (usually within 1 week from admission). Actigraphic raw data were translated to sleep measures using the Actigraphic Scoring Analysis program for an IBM-compatible personal computer. These sleep-wake measures have been validated against polysomnography with agreement rates for sleep-wake identification higher than 90% (Sadeh et al., 1989, 1991, 1994c).

Actigraphic sleep measures included (1) sleep onset time; (2) total sleep period (from sleep onset time to morning awakening); (3) sleep percent (percent of actual sleep time from total sleep period); (4) true sleep time (sleep time excluding all periods of wakefulness); (5) longest sleep period (the longest period of continuous sleep without any wakefulness); and (6) quiet sleep (percent of sleep without any motion).

RESULTS

Global characteristics of our sample are described in Table 1. The most prevalent *DSM-III-R* diagnoses were conduct disorder (in 25 children), attention-deficit hyperactivity disorder (22 children), major depression (22 children), and posttraumatic stress disorder (8 children). Twenty-seven children met the criteria of at least two diagnostic categories.

The analysis of the sleep-wake measures included analyses of sex differences, age-related trends, assessment of measures of day-to-day stability, and the evaluation of the relations between sleep-wake measures and the psychological and diagnostic status of the child.

Age-Related Trends

To evaluate age trends in the psychological and actigraphic measures, Pearson correlations between these measures and the child's age were calculated. None of the psychological measures were significantly correlated with age. Age was significantly correlated with actigraphic sleep onset time (r = .53, p < .0005), total sleep period (r = −.36, p < .05), and true sleep time (r = −.40, p < .05). Older children tended to fall asleep at a later hour and spend less time in sleep. It should be emphasized that the unit's schedule dictates earlier bedtime for younger children, which may influence the age effect noticed.

Sex Differences

Analysis of covariance (ANCOVA) with sex as the independent variable and age as a covariate revealed no differences between the boys and the girls in our sample. Therefore, the results are reported for the combined sample.

Stability of Actigraphic Sleep Measures

To assess the stability of the actigraphic sleep measures, Pearson correlations between day 1 and day 2 were computed for each measure. Significant correlations were found for all measures: sleep onset time, r = .35, p < .05; sleep period, r = .35, p < .05; sleep percent, r = .61, p < .0001; longest sleep period, r = .36, p < .05; quiet sleep percent, r = .81, p < .0001; and true sleep time, r = .53, p < .005.

Correlations between Sleep and Psychological Measures

To assess the relations between sleep and the psychological measures, partial correlations were computed with age covaried (Table 2). Two psychological measures were significantly correlated with the temporal measures of sleep (sleep onset time, sleep duration, and true sleep time). Children with a high score on the Hopelessness Scale tended to fall asleep earlier than their peers (r = .45, p < .05). Children with a high score in Emotionality on the EAS tended to sleep longer (r = .45, p < .05). A number of sleep quality measures correlated with the psychological scales indicating better sleep organization associated with more healthy psychological functioning. Increased sleep percent was associated with more favorable scores on the following scales: CBCL Internalizing Scale (r = −.34, p < .05); Hopelessness Scale (r = −.53, p < .001); CDI (r = −.58, p < .0005); Piers-Harris Children's Self-Concept Scale (r = .48, p < .05); EAS Sociability (r = .41, p < .05); and EAS Activity (r = .42, p < .05). Children with more favorable CDI and EAS Emotionality scores had longer periods of continuous uninterrupted sleep (r = −.37, p < .05, and r = .42, p < .05, respectively). Finally, children with more

TABLE 1
Sample Characteristics: Intelligence, Psychopathology, and Sleep Measures

Measure	*n*	Mean	SD	Min	Max
Age (yr)	39	9.5	1.9	7	14
Full Scale IQ	38	93.1	14.8	70	134
Performance IQ	38	94.6	13.8	71	136
Verbal IQ	38	92.7	16.8	66	127
CBCL Total	36	77.2	9.5	52	91
CBCL Internalizing (*T* score)	36	72.2	10.4	49	90
CBCL Externalizing (*T* score)	36	74.6	8.5	44	88
CDCL	31	13.3	8.8	1	37
Hopelessness Scale	31	6.1	3.7	1	17
CDI	38	17.9	11.3	0	42
RCMAS	37	51.9	13.6	10	75
Piers-Harris Self-Concept	31	48.6	10.6	32	67
EAS Shyness	33	2.6	1.0	0	4.2
EAS Sociability	33	3.2	0.9	0	4.6
EAS Emotionality	33	3.2	1.0	0	4.6
EAS Activity	33	3.9	1.1	0	5
Actigraphic Sleep Measures					
Sleep onset time (hr-pm)	39	10.3	0.6	8.47	11.6
Total sleep period (min)	39	544	41	451	624
Sleep percent (%)	39	91.9	3.6	80.7	97.2
True sleep time (min)	39	500	43	423	587
Longest sleep period (min)	39	162	50	81	302
Quiet sleep percent (%)	39	62.9	9.7	42.1	78.8

Note: CBCL = Child Behavior Checklist; CDCL = Child Dissociative Checklist; CDI = Children's Depression Inventory; RCMAS = Revised Children's Manifest Anxiety Scale.

favorable scores on the Piers-Harris Children's Self-Concept Scale spent a greater percentage of their sleep time in quiet (motionless) sleep.

Sleep and Abuse History

To investigate the relationships between abuse history and sleep on the unit, we conducted an ANCOVA with abuse history as the independent variable, age as a covariate, and sleep measures as the independent measures. The results of this analysis are summarized in Table 3. Physically abused children spent less of their bedtime in sleep than did sexually abused and nonabused children ($F = 2.91$, $p < .05$). Physically abused children (with or without a history of sexual abuse) spend proportionally less time in quiet-motionless sleep ($F = 3.54$, $p < .05$). No other significant group differences were found for the other actigraphic sleep measures.

Diagnostic and Medication Factors

The relatively small number of children in our sample and the variety of medications used precluded a systematic and statistically robust examination of possible effects associated with these factors. Multivariate logistic regression analysis and related statistical tests revealed no significant medication or diagnosis-related effects.

DISCUSSION

In this study we examined the relationship between activity-based sleep measures and psychological measures in behaviorally disordered children hospitalized in a psychiatric inpatient unit. Significant day-to-day stability was found for the actigraphic sleep-wake measures, although there were meaningful day-to-day variations in sleep parameters. No significant gender differences were found. The only significant age tendency was for older children to have a late sleep onset time and a shorter sleep period and sleep time. These trends are consistent with established developmental trends, but inasmuch as an early "lights off" time is dictated on the unit for younger children, these findings might be a reflection of the unit's schedule.

The results of this study indicate that even among a highly disturbed group of children, variations in sleep

TABLE 2
Partial Correlations between Actigraphic Sleep Measures and Child's Cognitive and Emotional Measures (with Age Partialled Out)

Measure	Sleep Onset Time	Total Sleep Period	Sleep Percent	True Sleep Time	Longest Sleep Period	Quiet Sleep Percent
Full Scale IQ	.12	−.03	.17	.05	.14	.03
Performance IQ	.07	−.08	.01	−.07	.13	−.16
Verbal IQ	.15	.00	.28	.12	.13	.17
CBCL Total	−.01	−.08	−.19	−.14	−.14	−.15
CBCL Internalizing	−.08	−.05	−.34*	−.20	−.15	−.24
CBCL Externalizing	.06	−.06	−.09	−.10	−.12	−.18
CDCL	−.06	−.09	−.01	−.08	−.11	−.23
Hopelessness Scale	−.43*	.28	−.53**	−.10	−.19	−.17
CDI	−.20	.10	−.58***	−.28	−.37*	−.22
RCMAS	.02	.01	−.11	.01	−.15	.03
Piers-Harris Self-Concept	.40	−.11	.48*	.15	.11	.47*
EAS Shyness	−.14	−.15	.07	−.10	.18	−.27
EAS Sociability	.08	.00	.41*	.17	.22	.22
EAS Emotional	−.27	.40	.23	.45*	.42*	.17
EAS Activity	−.07	.15	.42*	.31	.11	.31

Note: CBCL = Child Behavior Checklist; CDCL = Child Dissociative Checklist; CDI = Children's Depression Inventory; RCMAS = Revised Children's Manifest Anxiety Scale.
* $p < .05$; ** $p < .001$; *** $p < .0005$.

patterns were associated with self- and parental reports of child behavior and psychological status. It is interesting to note that the self-report scales of depression, hopelessness, and self-esteem showed the highest correlations with sleep quality. To have a lower sleep percent, these children need to spend more time awake after sleep onset, which can result from prolonged or multiple night awakenings. This finding may also serve as a possible explanation for the "circadian dysregulation" reported in depressed children and adolescents (Teicher et al., 1993), since modified sleep patterns are likely to be reflected in time series analysis of activity data.

In light of the confusing findings in the literature on the relationships between sleep and psychopathology in children, the present findings suggest that sleep patterns, when studied by objective means in a highly structured environment such as an inpatient unit, are closely related to the psychological status of the child. Internalizing children with a psychological profile of depression, hopelessness, and low self-esteem and sociability tended to have relatively poorer sleep. It is important to emphasize, however, that there were no clinically significant sleep disturbances in our sample. This finding is consistent with our previous finding that even children reportedly presenting sleep problems before admission exhibit no such problems in the hospital, as documented by unit staff (Sadeh et al., 1994a). The lack of sleep problems in these children

TABLE 3
Actigraphic Sleep Measures According to Abuse History: Group Means and Standard Deviations

Measure	Abuse History: No Abuse	Sexual Abuse	Physical Abuse	Sexual & Physical	*F*
Sleep onset time (military time)	22.2 ± 0.46	22.1 ± 0.76	22.0 ± 0.83	21.8 ± 0.57	0.45
Total sleep period (min)	541 ± 31	556 ± 38	540 ± 59	545 ± 4	0.28
Sleep percent (%)	93.1 ± 3.7[a]	93.9 ± 1.4[a]	89.2 ± 4.8[b]	91.2 ± 2.5[a,b]	2.91*
True sleep time (min)	504 ± 40	522 ± 31	481 ± 58	497 ± 38	1.49
Longest sleep period (min)	178 ± 56	178 ± 50	124 ± 30	162 ± 43	2.40
Quiet sleep percent (%)	67.8 ± 9.7[a]	67.3 ± 6.1[a]	58.3 ± 7.1[b]	58.5 ± 10.3[b]	3.54*

* $p < .05$; means with the same superscript letter are not significantly different.

raises an important issue of the contextual factor in sleep studies of traumatized children, or, in other words: where is it safe enough for these children to sleep? (Moore, 1989).

The relationship between abuse status and sleep was examined in small subgroups, thus restricting the power of this analysis. Nonetheless, abuse history was significantly related to sleep measures on the unit. Physically abused children (with and without a history of sexual abuse) seemed to sleep worse than nonabused and sexually abused children. To date, we are not aware of any similar findings in the literature suggesting that physical abuse may lead to greater sleep disturbances than sexual abuse. In fact, there are indications to the contrary (Sadeh et al., 1994a; Young, 1992). We can only speculate that this finding may be related to the fact that these were hospitalized children, studied on a structured unit, where safety from sexual assaults is relatively assured, whereas physical abuse might still be a more active concern due to experiences of restraints, use of the seclusion room, etc. Further research is needed to examine the specificity of this finding and its implications.

A critical evaluation of the advantages and limitations of the method used in the present study is warranted. Actigraphic monitoring provides a direct and nonintrusive way to document children's sleep-wake patterns. The method offers new opportunities for longitudinal, naturalistic clinical studies of sleep-related issues. However, since the method is solely based on activity recording, possible artifacts should be considered as potential sources for error (i.e., medication that produces tremor or increases in activity level, or a child manipulating the device without supervision). In the present study, such artifacts were less likely to occur, because the children were under close supervision around the clock. In addition, most of the children were not medicated during the period of the monitoring. The small number of children taking medication and the variety of medications used did not enable systematic study of possible drug effects, and no distinguishable effects could be detected in these cases.

Based on our present findings and our review of the literature on the use of actigraphy for sleep studies in psychiatric research, we suggest that the method might play an important role for longitudinal assessment of medication and other therapeutic effects on the sleep-wake system. Considering the ample data suggesting that sleep-wake patterns are very sensitive to many forms of psychopathology, actigraphic monitoring appears to provide a cost-effective method for obtaining objective outcome measures so desirable in clinical research of psychopathology and biobehavioral disorders (e.g., Klein et al., 1992; Sadeh, 1994; Tirosh et al., 1993; Wehr et al., 1982).

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