ENCYCLOPEDIA
on Early Childhood
Development

Development of the Sleep-Wake System and its Relationship to Children's Psychosocial Development

Avi Sadeh, DSc

Tel Aviv University, Israel

March 2013, 2e éd.

Introduction

The maturation of the sleep-wake system and the consolidation of nocturnal sleep is a very prominent and rapid process in early childhood.[1,2] This process is influenced by the child's psychosocial context[1,3-14] and has a significant impact on the child's neurobehavioural and emotional functioning.[15-18] Furthermore, the child's sleep patterns or sleep disruptions have significant effects on the well-being of the parents.[5,7,19]

Subject

Sleep is affected by the child's psychosocial setting and has a significant impact on child development. The bi-directional relationships between sleep and psychosocial facets of the developing child constitute an important topic for child-care professionals. It is crucial for professionals to identify factors that could facilitate children's sleep, and to be sensitive to the

impact poor or insufficient sleep can have on child development.

Problems

Sleep-wake patterns evolve rapidly during early development and are considered to be one of the major developmental or health concerns during this period. Surveys indicate that 20 to 30 percent of children are considered to be poor sleepers during the first three years of life.[3,14,20-24] High rates of poor sleep have also been documented in preschool and kindergarten children.[11,25] The high prevalence of sleep problems and their potential adverse effects on psychosocial development are the main research and clinical issues in early childhood.

Research Context

A variety of research methods have been employed to study the relationship between sleep and psychosocial environment and development. Sleep in infants and young children has been studied using methods such as polysomnography,[26,27] time-lapse video,[1,28] actigraphy,[25,29,30] direct observations[31,32] and parental reports.[3,15,20] Most studies have been cross-sectional. Longitudinal studies in this field are extremely rare. Furthermore, most studies were correlative in nature and therefore preclude causal interpretations. Some experimental studies on the effects of sleep manipulation have been performed in older (school-age) children.

Key Research Questions

The extensive research in this field can be divided into three main research questions:

a. How do psychosocial factors affect the evolving sleep-wake patterns of the child?
b. What is the impact of poor or insufficient sleep on the child’s psychosocial development? and
c. Which are the most effective psychosocial interventions for improving children’s sleep?

Recent Research Results

A. *Psychosocial effects on children's sleep*

Parental characteristics such as personality, psychopathology, employment and education have been repeatedly associated with sleep in early childhood.[7-9,13,33-35] Parent-child bedtime interactions have been consistently shown to be linked to children’s sleep. It has been demonstrated that

parental presence and active involvement in soothing the child to sleep are associated with an increase in reported sleep problems.[1,3,36,37] Furthermore, most behavioural intervention methods for early childhood sleep problems are based on withdrawal of excessive parental involvement in the child's process of falling asleep or resuming sleep following a night-waking.[38-42] Another psychosocial factor that has received wide attention vis-à-vis sleep in young children is the issue of co-sleeping. Co-sleeping can represent a culturally or socially acceptable choice or a parental response to the child's sleep difficulties. In most studies, co-sleeping was associated with more frequent night-wakings and complaints about sleep,[43-46] although the association between co-sleeping and sleep problems appears to be dependent on socio-cultural factors. A fierce debate exists regarding the advantages and disadvantages of co-sleeping.[47-51] Among the more serious disadvantages of co-sleeping is the risk for very young babies to be suffocated or injured in the parental bed.

Sleep is also associated with stress and trauma in early childhood.[52] For instance, short-term separation from the mother could result in sleep disruptions.[53,54] However, contrary to common belief, not all stressors lead to disrupted sleep and there are studies that suggest that sometimes escape to sleep is the preferred mode of bio-behavioural regulation of stress.[52]

B. *The impact of poor or insufficient sleep*

Years of research in animals and humans (mostly with adults or older children) have demonstrated that poor or insufficient sleep leads to compromised alertness, cognitive deficits and compromised physiological functioning. The research on this topic in young children is very limited and mostly of a correlative nature. Thus, poor sleep has been associated with difficult temperament.[55-59] However, other studies have failed to find such relationships.[60,61] A recent study of preschool children found that disrupted sleep patterns predicted less optimal adjustment in preschool.[15] Studies of school-age children have demonstrated links between poor or restricted sleep and compromised neurobehavioural functioning.[62-64] Furthermore, there is a growing body of evidence suggesting that sleep-related physiological phenomena (e.g., snoring and periodic leg movement syndrome), which are prevalent in children, are associated with compromised daytime functioning.[65-69]

The long-term effects of poor or insufficient sleep are not known. It has been suggested that sleep deprivation in early childhood during critical periods of brain maturation may lead to chronic adverse effects on psychosocial development. However, only limited data from longitudinal

studies lend some support to this hypothesis.[11,18,70-73] For instance, severe sleep problems in infancy increased the likelihood of a diagnosis of ADHD at 5.5 years of age.[73]

C. *Effective interventions for sleep problems in early childhood*

Extensive research demonstrates the efficacy of behavioural approaches and parents' education in preventing and treating sleep problems in early childhood. Behavioural treatments have yielded very high success rates.[30,39,40,42,74] Prevention programs focused on educating expectant parents or parents of very young infants have shown a decrease in the occurrence of sleep problems.[75-77] Furthermore, a survey has shown that many parents utilize information available in the media to solve their children's sleep problems with high success rates.[78]

It is important to note that the success of these intervention programs is accompanied by positive effects on the family. Parents report an improved sense of competence and lower levels of stress following such interventions.[77,79,80] It is also important to emphasize that sleep problems in early childhood are very persistent if not treated.[8,14] Therefore, early detection and intervention programs for sleep problems in early childhood should become an integral part of any health services for children.

Conclusions

Research has demonstrated that even pediatricians who often serve as the primary source of help for parents with sleep-disturbed children have limited knowledge and education in this field.[81,82] Therefore, it is important to emphasize the need for extensive education of child-care professionals and parents in this area.

The following points highlight the main conclusions:

- Poor sleep can result from medical or behavioural-developmental factors.
- The prevalence of poor sleep and sleep-related disorders is very high in children.
- Poor sleep is associated with compromised neurobehavioural functioning and behaviour regulation in children.
- Children's sleep disruptions have a significant negative impact on the family.
- There are very effective behavioural and medical interventions to improve sleep and prevent sleep disruptions.

- Sleep problems in early childhood are very persistent if not treated.
- Early detection and interventions for sleep problems in children can facilitate child development, reduce family stress and improve parent-child relationships.

Implications

Child-care professionals should obtain training in screening sleep problems in young children. Screening for sleep problems could be performed by obtaining specific information on the child's sleep patterns and level of daytime fatigue. This information could be collected by interviewing the parents or by using specific screening questionnaires. Health services and education systems should have referral resources with experts trained in diagnosing and treating pediatric sleep problems. It is important that such resources be easily accessible to parents so that available effective prevention and early intervention methods can be implemented as early as possible.

It is important to consider educating young children about the importance of sleep. There is a growing health concern that children in our era are getting less sleep than they need and that many of them are chronically sleep-deprived. Early education about the importance of sleep may encourage children not to sacrifice sleep for other attractions.

References

1. Anders TF, Halpern LF, Hua J. Sleeping through the night: a developmental perspective. *Pediatrics* 1992;90(4):554-560.
2. Burnham MM, Goodlin-Jones BL, Gaylor EE, Anders TF. Nighttime sleep-wake patterns and self-soothing from birth to one year of age: a longitudinal intervention study. *Journal of Child Psychology and Psychiatry and Allied Disciplines* 2002;43(6):713-725.
3. Adair R, Bauchner H, Philipp B, Levenson S, Zuckerman B. Night waking during infancy: role of parental presence at bedtime. *Pediatrics* 1991;87(4):500-504.
4. Benoit D, Zeanah CH, Boucher C, Minde KK. Sleep disorders in early childhood: association with insecure maternal attachment. *Journal of the American Academy of Child and Adolescent Psychiatry* 1992;31(1):86-93.
5. Gelman VS, King NJ. Wellbeing of mothers with children exhibiting sleep disturbance. *Australian Journal of Psychology* 2001;53(1):18-22.
6. Guedeney A, Kreisler L. Sleep disorders in the first 18 months of life: Hypothesis on the role of mother-child emotional exchanges. *Infant Mental Health Journal* 1987;8(3):307-318.
7. Hiscock H, Wake M. Infant sleep problems and postnatal depression: A community- based study. *Pediatrics* 2001;107(6):1317-1322.
8. Kataria S, Swanson MS, Trevathan GE. Persistence of sleep disturbances in preschool children. *Journal of Pediatrics* 1987;110(4):642-646.
9. Morrell JM. The role of maternal cognitions in infant sleep problems as assessed by a new instrument, the maternal cognitions about infant sleep questionnaire. *Journal of Child Psychology and Psychiatry and Allied Disciplines*

1999;40(2):247-258.

10. Nishihara K, Horiuchi S, Eto H, Uchida S. Mothers' wakefulness at night in the post-partum period is related to their infants' circadian sleep-wake rythm. *Psychiatry and Clinical Neurosciences* 2000;54(3):305-306.
11. Pollock JI. Night-waking at five years of age: predictors and prognosis. *Journal of Child Psychology and Psychiatry and Allied Disciplines* 1994;35(4):699-708.
12. Sander LW, Stechler G, Burns P, Julia H. Early mother-infant interaction and 24-hour patterns of activity and sleep. *Journal of the American Academy of Child Psychiatry* 1970;9(1):103-123.
13. Van Tassel EB. The relative influence of child and environmental characteristics on sleep disturbances in the first and second years of life. *Journal of Developmental and Behavioral Pediatrics* 1985;6(2):81-85.
14. Zuckerman B, Stevenson J, Bailey V. Sleep problems in early childhood: continuities, predictive factors, and behavioral correlates *Pediatrics* 1987;80(5):664-671.
15. Bates JE, Viken RJ, Alexander DB, Beyers J, Stockton L. Sleep and adjustment in preschool children: sleep diary reports by mothers relate to behavior reports by teachers. *Child Development* 2002;73(1):62-74.
16. Dahl RE. The regulation of sleep and arousal: Development and psychopathology. *Developmental Psychopathology* 1996;8(1):3-27.
17. Thoman EB. Sleep and wake behaviors in neonates: Consistencies and consequences. *Merrill Palmer Quarterly* 1975;21(4):295-314.
18. Thoman EB, Denenberg VH, Sievel J, Zeidner LP, Becker P. State organization in neonates: developmental inconsistency indicates risk for developmental dysfunction. *Neuropediatrics* 1981;12(1):45-54.
19. Papousek M, von Hofacker N. Persistent crying in early infancy: a non-trivial condition of risk for the developing mother-infant relationship. *Child: Care, Health & Development* 1998;24(5):395-424.
20. Beltramini AU, Hertzig ME. Sleep and bedtime behavior in preschool-aged children. *Pediatrics* 1983;71(2):153-158.
21. Kerr S, Jowett S. Sleep problems in pre-school children: a review of the literature. *Child: Care, Health & Development* 1994;20(6):379-391.
22. Scher A, Tirosh E, Jaffe M, Rubin L, Sadeh A, Lavie P. Sleep patterns of infants and young children in Israel. *International Journal of Behavioral Development* 1995;18(4):701-711.
23. Richman N. Surveys of sleep disorders in child in a general population. In: Guilleminault C, ed. *Sleep and its disorders in children*. New York: Raven Press; 1987:115-127.
24. Ottaviano S, Giannotti F, Cortesi F, Bruni O, Ottaviano C. Sleep characteristics in healthy children from birth to 6 years of age in the urban area of Rome. *Sleep* 1996;19(1):1-3.
25. Tikotzky L, Sadeh A. Sleep patterns and sleep disruptions in kindergarten children. *Journal of Clinical Child Psychology* 2001;30(4):581-591.
26. Coons S, Guilleminault C. Development of sleep-wake patterns and non-rapid eye movement sleep stages during the first six months of life in normal infants. *Pediatrics* 1982;69(6):793-798.
27. Tirosh E, Sadeh A, Munvez R, Lavie P. Effects of methylphenidate on sleep in children with attention- deficient hyperactivity disorder. An activity monitor study. *American Journal of Diseases of Children* 1993;147(12):1313-1315.
28. Anders TF, Sostek AM. The use of time lapse video recording of sleep-wake behavior in human infants. *Psychophysiology* 1976;13(2):155-158.
29. Sadeh A, Lavie P, Scher A, Tirosh E, Epstein R. Actigraphic home-monitoring sleep-disturbed and control infants and young children: a new method for pediatric assessment of sleep-wake patterns. *Pediatrics* 1991;87(4):494-499.

30. Sadeh A. Assessment of intervention for infant night waking: parental reports and activity-based home monitoring. *Journal of Consulting & Clinical Psychology* 1994;62(1):63-68.

31. Thoman EB, Whitney MP. Sleep states of infants monitored in the home: Individual differences, developmental trends, and origins of diurnal cyclicity. *Infant Behavior and Development* 1989;12(1):59-75.

32. Thoman EB, Acebo C. Monitoring of sleep in neonates and young children. In: Ferber R, Kryger M, eds. *Principles and Practice of Sleep Medicine in the Child*. Philadelphia: W. B. Saunders; 1995:55-68.

33. Seifer R, Sameroff AJ, Dickstein S, Hayden LC. Parental Psychopathology and Sleep Variation in Children. *Child & Adolescent Psychiatric Clinics of North America* 1996;5(3):715-727.

34. Thunstrom M. Severe sleep problems among infants in a normal population in Sweden: prevalence, severity and correlates. *Acta Paediatrica* 1999;88(12):1356-1363.

35. Rona RJ, Li L, Gulliford MC, Chinn S. Disturbed sleep: effects of sociocultural factors and illness. *Archives of Disease in Childhood* 1998;78(1):20-25.

36. Wolf AW, Lozoff B. Object attachment, thumbsucking, and the passage to sleep. *Journal of the American Academy of Child & Adolescent Psychiatry* 1989;28(2):287-292.

37. Morrell J, Cortina-Borja M. The developmental change in strategies parents employ to settle young children to sleep, and their relationship to infant sleeping problems, as assessed by a new questionnaire: The Parental Interactive Bedtime Behaviour Scale. *Infant & Child Development* 2002;11(1):17-41.

38. France KG, Hudson SM. Management of infant sleep disturbance: A review. *Clinical Psychology Review* 1993;13(7):635-647.

39. Mindell JA. Empirically supported treatments in pediatric psychology: bedtime refusal and night wakings in young children. *Journal of Pediatric Psychology* 1999;24(6):465-481.

40. Kuhn BR, Weidinger D. Interventions for infant and toddler sleep disturbance: A review. *Child & Family Behavior Therapy* 2000;22(2):33-50.

41. Sadeh A, Anders TF. Infant sleep problems: Origins, assessment, interventions. *Infant Mental Health Journal* 1993;14(1):17-34.

42. Ramchandani P, Wiggs L, Webb V, Stores G. A systematic review of treatments for settling problems and night waking in young children. *British Medical Journal* 2000;320(7229):209-213.

43. Lozoff B, Askew GL, Wolf AW. Cosleeping and early childhood sleep problems: effects of ethnicity and socioeconomic status. *Journal of Developmental & Behavioral Pediatrics* 1996;17(1):9-15.

44. Schachter FF, Fuchs ML, Bijur PE, Stone RK. Cosleeping and sleep problems in Hispanic-American urban young children. *Pediatrics* 1989;84(3):522-530.

45. McKenna JJ, Mosko SS. Sleep and arousal, synchrony and independence, among mothers and infants sleeping apart and together (same bed): an experiment in evolutionary medicine. *Acta Paediatrica Supplement* 1994;397:94-102.

46. Lozoff B, Wolf AW, Davis NS. Cosleeping in urban families with young children in the United States. *Pediatrics* 1984;74(2):171-182.

47. Medoff D, Schaefer CE. Children sharing the parental bed: A review of the advantages and disadvantages of cosleeping. *Psychology: A Quarterly Journal of Human Behavior* 1993;30(1):1-9.

48. Hunsley M, Thoman EB. The sleep of co-sleeping infants when they are not co-sleeping: Evidence that co-sleeping is stressful. *Developemental Psychobiology* 2002;40(1):14-22.

49. Byard RW. Is co-sleeping in infancy a desirable or dangerous practice? *Journal of Pediatrics and Child Health* 1994;30(3):198-199.

50. Rath FH, Jr., Okum ME. Parents and children sleeping together: cosleeping prevalence and concerns. *American Journal of Orthopsychiatry* 1995;65(3):411-418.

51. McKenna JJ, Thoman EB, Anders TF, Sadeh A, Schechtman VL, Glotzbach SF. Infant-parent co-sleeping in an evolutionary perspective: implications for understanding infant sleep development and the sudden infant death syndrome. *Sleep* 1993;16(3):263-282.

52. Sadeh A. Stress, Trauma, and Sleep in Children. *Child & Adolescent Psychiatric Clinics of North America* 1996;5(3):685-700.

53. Field TM. Young children's adaptations to repeated separations from their mothers. *Child Development* 1991;62(3):539-547.

54. Field TM, Reite M. Children's responses to separation from mother during the birth of another child. *Child Development* 1984;55(4):1308-1316.

55. Carey WB. Night waking and temperament in infancy. *Journal of Pediatrics* 1974;84(5):756-758.

56. Schaefer CE. Night waking and temperament in early childhood. *Psychological Reports* 1990;67(1):192-194.

57. Keener MA, Zeanah CH, Anders TF. Infant temperament, sleep organization, and nighttime parental interventions. *Pediatrics* 1988;81(6):762-771.

58. Sadeh A, Lavie P, Scher A. Sleep and temperament: maternal perceptions of temperament of sleep-disturbed toddlers. *Early education and development* 1994;5(4):311-322.

59. Owens-Stively J, Frank N, Smith A, Hagino O, Spirito A, Arrigan M, et al. Child temperament, parenting discipline style, and daytime behavior in childhood sleep disorders. *Journal of Developmental & Behavioral Pediatrics* 1997;18(5):314-321.

60. Halpern LF, Anders TF, Garcia Coll C, Hua J. Infant temperament: Is there a relation to sleep-wake states and maternal nighttime behavior? *Infant Behavior and Development* 1994;17(3):255-263.

61. Scher A, Tirosh E, Lavie P. The relationship between sleep and temperament revisited: evidence for 12-month-olds: a research note. *Journal of Child Psychology and Psychiatry and Allied Disciplines* 1998;39(5):785-788.

62. Sadeh A, Gruber R, Raviv A. Sleep, neurobehavioral functioning and behavior problems in school-age children. *Child Development* 2002;73(2):405-417.

63. Fallone G, Acebo C, Arnedt JT, Seifer R, Carskadon MA. Effects of acute sleep restriction on behavior, sustained attention, and response inhibition in children. *Perceptual & Motor Skills* 2001;93(1):213-229.

64. Randazzo AC, Muehlbach MJ, Schweitzer PK, Walsh JK. Cognitive function following acute sleep restriction in children ages 10-14. *Sleep* 1998;21(8):861-868.

65. Ali NJ, Pitson DJ, Stradling JR. Snoring, sleep disturbance, and behaviour in 4-5 year olds. *Archives of Disease in Childhood* 1993;68(3):360-366.

66. Blunden S, Lushington K, Kennedy D, Martin J, Dawson D. Behavior and neurocognitive performance in children aged 5-10 years who snore compared to controls. *Journal of Clinical & Experimental Neuropsychology* 2000;22(5):554-568.

67. Chervin RD, Archbold KH, Dillon JE, Panahi P, Pituch KJ, Dahl RE, et al. Inattention, hyperactivity, and symptoms of sleep-disordered breathing. *Pediatrics* 2002;109(3):449-456.

68. Teculescu DB, Caillier I, Perrin P, Rebstock E, Rauch A. Snoring in French preschool children. *Pediatric Pulmonology* 1992;13(4):239-244.

69. Picchietti DL, England SJ, Walters AS, Willis K, Verrico T. Periodic limb movement disorder and restless legs syndrome in children with attention-deficit hyperactivity disorder. *Journal of Child Neurology* 1998;13(12):588-594.

70. Lombroso CT, Matsumiya Y. Stability in waking-sleep states in neonates as a predictor of long- term neurologic outcome. *Pediatrics* 1985;76(1):52-63.

71. Gertner S, Greenbaum CW, Sadeh A, Dolfin Z, Sirota L, Ben-Nun Y. Sleep-wake patterns in preterm infants and 6 month's home environment: implications for early cognitive development. *Early Human Development* 2002;68(2):93-102.

72. Freudigman KA, Thoman EB. Infant sleep during the first postnatal day: an opportunity for assessment of vulnerability. *Pediatrics* 1993;92(3):373-379.

73. Thunstrom M. Severe sleep problems in infancy associated with subsequent development of attention-deficit/hyperactivity disorder at 5.5 years of age. *Acta Paediatrica* 2002;91(5):584-592.

74. Owens JL, France KG, Wiggs L. Behavioural and cognitive-behavioural interventions for sleep disorders in infants and children: A review. *Sleep Medicine Reviews* 1999;3(4):281-302.

75. Kerr SM, Jowett SA, Smith LN. Preventing sleep problems in infants: a randomized controlled trial. *Journal of Advanced Nursing* 1996;24(5):938-942.

76. Wolfson AR. Working with parents on developing efficacious sleep/wake habits for infants and young children. In: Briesmeister JM, Schaefer CE, eds. *Handbook of parent training: Parents as co-therapists for children's behavior problems*. 2nd ed. New York, NY: John Wiley and Sons, Inc.; 1998:347-383.

77. Wolfson A, Lacks P, Futterman A. Effects of parent training on infant sleeping patterns, parents' stress, and perceived parental competence. *Journal of Consulting & Clinical Psychology* 1992;60(1):41-48.

78. Johnson CM. Infant and toddler sleep: a telephone survey of parents in one community. *Journal of Developmental & Behavioral Pediatrics* 1991;12(2):108-114.

79. Mindell JA, Durand VM. Treatment of childhood sleep disorders: generalization across disorders and effects on family members. *Journal of Pediatric Psychology* 1993;18(6):731-750.

80. Hiscock H, Wake M. Randomised controlled trial of behavioural infant sleep intervention to improve infant sleep and maternal mood. *British Medical Journal* 2002;324(7345):1062-1065.

81. Mindell JA, Moline ML, Zendell SM, Brown LW, Fry JM. Pediatricians and sleep disorders: training and practice. *Pediatrics* 1994;94(2):194-200.

82. Owens JA. The practice of pediatric sleep medicine: Results of a community survey. *Pediatrics* 2001;108(3):U95-U110 Art. no E51.