



## Sleep-Wake States and Problems and Child Psychosocial Development

*THOMAS F. ANDERS, M.D.*

*University of California at Davis, USA*

*(Published online January 12, 2004)*

### **Topic**

*Sleeping behaviour*

### **Introduction**

There are many studies related to the biological maturation of sleep and waking states in early development.<sup>1-4</sup> Rapid eye movement (REM) and non-rapid eye movement (NREM) sleep states change in structure and in temporal organization during the first one to two years of development.<sup>5,6</sup> These changes, which actually begin in-utero, are presumably biologically determined.<sup>7</sup> The REM-NREM ultradian sleep cycle lengthens and REM/NREM timing shifts during sleep. Four stages of NREM sleep emerge as electroencephalographic (EEG) patterns mature. REM sleep decreases proportionately as NREM sleep increases; NREM Stage IV sleep moves to the beginning of the sleep period.<sup>6,8</sup> The circadian sleep-wake cycle also changes from a polyphasic rhythm during the newborn period to a diurnal rhythm by four to six months of age, as sleep consolidates at night, and waking, except for two brief naps, consolidates in the daytime.<sup>2,6,9</sup> But to what extent are these post-natal changes driven by biology? How do psychosocial influences on early development affect sleep-wake state development? Are there interactions between biological and psychosocial influences that result in infant and toddler sleep problems?

### **Subject**

Parents' concerns about infant sleep problems are the most common complaint brought to physicians and infant clinics at the time of well-child visits.<sup>10,11</sup> A large literature addresses infant sleep problems,<sup>12-25</sup> but relatively little is known about what causes them and whether the problem is really an infant problem or a parent problem. That is, if the baby awakens and cries regularly during the night, are the effects of the awakenings and the presumed loss of sleep harmful for the baby? Or are the effects more distressing to the parent, especially the working parent exhausted by repeated middle-of-the night ministrations to the child?

### **Research Context**

The research context for understanding the unfolding of infant sleep-wake problems in early development is the family's sleep environment, their individual histories of sleep

behaviours and the parents' values, knowledge and skills pertinent to child-rearing and sleep behaviour. The infant's age and developmental status are also relevant.

### **Key Research Questions**

Questions requiring further research far outnumber answers currently available. There are some theories about why sleep is important for all mammals, why all mammals exhibit both REM and NREM sleep, and why during the early development of all mammalian species the proportionate amount of REM sleep exceeds NREM sleep, in contrast to adults.<sup>26-29</sup> But there are no solid, scientific explanations for any of these questions. And for families concerned about sleep problems, there are few data-based answers. How is problem sleep defined in infancy? At what age should parents and/or practitioners be concerned about too much sleep or too little sleep? Is co-sleeping salutary or harmful for the infant's health, well-being and autonomous development? When should medication for sleeplessness be prescribed? Which, if any, infant, parent or psychosocial factors lead to good sleep? Do children with disrupted night-time sleep exhibit daytime sleepiness or secondary behaviour disorders? What is the relationship between night-time sleep and daytime behaviour? What kinds of treatment (behavioural, psychopharmacologic, psychotherapeutic) should be employed and when? What are the public-health implications of sleep disorders in early childhood? Even the basic issue of how sleep should be studied, in the laboratory, in the home, by objective measures or by parent report measures, has not been resolved. Advice from grandmothers and popular authors abounds. However, studies of large community-based samples using parental and objective measures are lacking.

### **Recent Research Findings**

A number of studies have described the developmental shifts in REM and NREM sleep during early development. The proportionate time spent in REM sleep decreases from 50% at birth to 30% by age three and 20% by adolescence. In contrast, NREM sleep increases from 50% at birth to 80% by adolescence. The REM-NREM ultradian sleep cycle lengthens from 50 minutes at birth to 90 minutes by adolescence. REM/NREM sleep periods begin to consolidate and shift to the night-time by three to four months of age, and waking periods similarly consolidate and shift to the daytime. By one year of age, typically developing children are sleeping continuously for six to eight hours at night with only two to three brief arousals. Morning and afternoon naps constitute daytime sleep. The morning nap is usually given up in the second year of life and the afternoon nap in the third or fourth year.<sup>8,30,31</sup>

There are two main kinds of sleep problems during the first few years of life: 1) repeated awakenings associated with crying (signalling), occurring in one- to two-year-olds; and 2) difficulty in falling asleep at bedtime with repeated requests for attention, occurring in two- to three-year-olds.<sup>32-35</sup> Most often, these problems are defined by parents rather than by objective, quantitative metrics. In typically developing infants and toddlers, temperament (a maternally defined trait), attachment classification, parental stress and maternal depression have been associated with these problems. In atypically developing infants, sleep problems are often attributed to neurological or physical abnormalities, although psychosocial factors must also play a role.<sup>36</sup> It is not yet clear 1) whether night

waking problems lead to problems with falling asleep (sleep onset) at the older age; or 2) how frequently they co-occur.

Some clinical sleep disorders, such as obstructive sleep apnea in infants and toddlers, night terrors, sleepwalking and narcolepsy, have been better defined.<sup>37</sup> Better medical care is available for these disorders because of the emergence of pediatric sleep specialists and diagnostic sleep laboratories. However, these disorders are relatively rare compared to the “insomnias” described above that plague so many parents.

### **Conclusions**

Sleep occupies a central role in human life. It seems to play an especially important role in early development. It is important to understand the developmental functions of sleep and its biological and psychosocial determinants, especially since sleep problems are such a prevalent complaint of parents of typically developing children, as well as parents of children with neurodevelopmental disorders and other behavioural, psychological and physiological conditions. Drugs to promote sleep remain the most inappropriately prescribed medication. More research is needed.

### **Implications for Policy and Services**

Understanding sleep and its disorders is a lifespan issue of significant scope. The public-health and economic burdens of sleep disorders are staggering. Road fatalities related to sleepiness, especially when coupled with alcohol/drug use, are crippling. Work-related injuries and work-related errors (particularly in the health professions) related to sleep loss and daytime sleepiness are also serious. In childhood, disorders such as attention deficit hyperactivity disorder and behavioural disruptions in autism, traumatic stress disorder and depression may relate to underlying sleep disorders. Children with fragmented or insufficient sleep may exhibit learning, retention and recall problems in school. They may be less able to inhibit emotional responses and thus be prone to impulsive or violent outbursts. Finally, in young infants and toddlers, disrupted and/or problematic sleep is a stress on the entire family. Child abuse may result from the worst-case scenario; parental inability to function appropriately at work (especially in families with two parents working outside the home) may result from the best. The costs of disordered sleep to society, to the healthy development of children and to the well-being of families are huge. Early exposure to good sleep hygiene is imperative.

## REFERENCES

1. Kohyama J, Iwakawa Y. Developmental changes in phasic sleep parameters as reflections of the brain-stem maturation: Polysomnographical examinations of infants, including premature neonates. *Electroencephalography & Clinical Neurophysiology* 1990;76(4):325-330.
2. Anders T, Sadeh A, Appareddy V. Normal Sleep in Neonates and Children. In: Kryger M, Ferber, R, eds. *Principles and practice of sleep medicine in the child*. 2nd Ed. Philadelphia, PA: W.B. Saunders Co; 1995:7-18.
3. Scher MS, Steppe DA, Salerno DG, Beggarly ME, Banks DL. Temperature differences during sleep between fullterm and preterm neonates at matched post-conceptual ages. *Clinical Neurophysiology* 2003;114(1):17-22.
4. de Weerd AW, van den Bossche RA. The development of sleep during the first months of life. *Sleep Medicine Reviews* 2003;7(2):179-191.
5. Anders T. Night waking in infants during the first year of life. *Pediatrics* 1979;63(6):860-864.
6. Anders TF, Keener MA. Developmental course of nighttime sleep-wake patterns in full-term and premature infants during the first year of life: I. *Sleep* 1985;8(3):173-192.
7. Mirmiran M, Kok JH, Boer K, Wolf H. Perinatal Development of Human Circadian Rhythms: Role of the Foetal Biological Clock. *Neuroscience & Biobehavioral Reviews* 1992;16(3):371-378.
8. 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 & Psychiatry & Allied Disciplines* 2002;43(6):713-725.
9. de Roquefeuil G, Djakovic M, Montagner H. New data on the ontogeny of the child's sleep-wake rhythm. *Chronobiology International* 1993;10(1):43-53.
10. Leach P. Sleeping "problems" in babies and children: 1. When babies are wakeful, who has the sleeping problem? *Professional Care of Mother & Child* 1999;9(5):117-120.
11. Lozoff B, Wolff A, Davis N. Sleep problems seen in pediatric practice. *Pediatrics* 1985;75(3):477-483.
12. Richman N. Sleep problems in young children. *Archives of Disease in Childhood* 1981;56(7):491-493.
13. Crawford W, Bennet R, Hewitt K. Sleep problems in pre-school children. *Health Visitor* 1989;62(3):79-81.
14. Sadeh A, Anders TF. Infant sleep problems: Origins, assessment, interventions. *Infant Mental Health Journal* 1993;14(1):17-34.
15. Schacter F, Fuchs M, Bijur P, Stone R. Cosleeping and sleep problems in Hispanic American urban young children. *Pediatrics* 1989;84(3):522-530.
16. Salzarulo P, Chevalier A. Sleep problems in children and their relationship with early disturbances of the waking-sleeping rhythms. *Sleep* 1983;6(1):47-51.
17. Madansky D, Edelbrock C. Cosleeping in a community sample of 2- and 3-year-old children. *Pediatrics* 1990;86(2):197-203.

18. Minde K, Faucon A, Falkner S. Sleep problems in toddlers: effects of treatment on their daytime behavior. *Journal of the American Academy of Child & Adolescent Psychiatry* 1994;33(8):1114-1121.
19. Minde K, Popiel K, Leos N, Falkner S, Parker K, Handley-Derry M. The evaluation and treatment of sleep disturbances in young children. *Journal of Child Psychology & Psychiatry & Allied Disciplines* 1993;34(4):521-533.
20. Neveus T, Cnattingius S, Olsson U, Hetta J. Sleep habits and sleep problems among a community sample of schoolchildren. *Acta Paediatrica* 2001;90(12):1450-1455.
21. Eckerberg B. Treatment of sleep problems in families with small children: is written information enough? *Acta Paediatrica* 2002;91(8):952-959.
22. Lam P, Hiscock H, Wake M. Outcomes of infant sleep problems: a longitudinal study of sleep, behavior, and maternal well-being. *Pediatrics* 2003;111(3):E203-E207.
23. Compliment JM, Abdelmalek M, Post JC. Identifying the etiology of sleep problems in children. *Nurse Practitioner* 2002;27(12):43-46.
24. Thunstrom M. Severe sleep problems among infants in a normal population in Sweden: prevalence, severity and correlates. *Acta Paediatrica* 1999;88(12):1356-1363.
25. Ralston G. Settling and sleep problems in babies and young children. *Australian Family Physician* 2002;31(11):1003.
26. Hofer MA, Shair H. Control of sleep-wake states in the infant rat by features of the mother-infant relationship. *Developmental Psychobiology* 1982;15(3):229-243.
27. Anderson J. Ethology and ecology of sleep in monkeys and apes. In: Rosenblatt J, Beer C, Busnel M, Slater P, eds. *Advances in the study of behavior*. Vol 14. Orlando, Fla: Academic Press; 1984:166-229.
28. Benca RM, Obermeyer WH, Shelton SE, Droster J, Kalin NH. Effects of amygdala lesions on sleep in rhesus monkeys. *Brain Research* 2000;879(1-2):130-138.
29. Herman M, Denlinger S, Patarca R, Katz L. Developmental phases of sleep and motor behaviour in a cat mother-infant system: A time-lapse video approach. Special Issue: Sleep. *Canadian Journal of Psychology* 1991;45(2):101-114.
30. Anders T, Goodlin-Jones B, Sadeh A. Sleep Disorders. In: Zeanah C, ed. *Handbook of Infant Mental Health*. New York, NY: The Guilford Press; 2000: 326-338.
31. Anders T, Keener M, Kraemer H. Sleep-wake state organization, neonatal assessment and development in premature infants during the first year of life. *Sleep* 1985;8(3):193-206.
32. Burnham MM, Goodlin-Jones BL, Gaylor EE, Anders TF. Use of sleep aids during the first year of life. *Pediatrics* 2002;109(4):594-601.
33. Goodlin-Jones BL, Burnham MM, Gaylor EE, Anders TF. Night waking, sleep-wake organization, and self-soothing in the first year of life. *Journal of Developmental & Behavioral Pediatrics* 2001;22(4):226-233.

## SLEEPING BEHAVIOUR

34. Gaylor E, Goodlin-Jones B, Anders T. Classification of young children's sleep problems: A pilot study. *Journal of the American Academy of Child & Adolescent Psychiatry* 2001;40(1):61-67.
35. Goodlin-Jones B, Burnham M, Anders T. Sleep and sleep disturbances: Regulatory processes in infancy. In: Sameroff A, Lewis M, Miller S, eds. *Handbook of Developmental Psychopathology*. New York, NY: Kluwer Academic/Plenum Publishers; 2000:309-325.
36. Wiggs L, Stores G. Behavioural treatment for sleep problems in children with severe learning disabilities and challenging daytime behaviour: effect on daytime behaviour. *Journal of Child Psychology & Psychiatry & Allied Disciplines* 1999;40(4):627-635.
37. Anders T, Eiben L. Pediatric sleep disorders: A review of the past 10 years. *Journal of the American Academy of Child and Adolescent Psychiatry* 1997;36(1):9-20.

To cite this document:

Anders TF. Sleep-wake states and problems and child psychosocial development. In: Tremblay RE, Barr RG, Peters RDeV, eds. *Encyclopedia on Early Childhood Development* [online]. Montreal, Quebec: Centre of Excellence for Early Childhood Development; 2003:1-6. Available at: <http://www.child-encyclopedia.com/documents/AndersANGxp.pdf>. Accessed [insert date].

Copyright © 2003