

# SLEEP AND BREATHING IN CHILDREN

A Developmental Approach

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**Cultural Influences on Infant and Childhood  
Sleep Biology and the Science That Studies It**  
Toward a More Inclusive Paradigm

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### I. Introduction

... we try to keep in mind cultural influences on the advice we give. We remind ourselves that much of what comes to the pediatrician's attention, as problematic sleep behavior—children who have difficulty falling asleep alone at bedtime, who wake at night and ask for parental attention, or who continue to nurse at night—is problematic only in relation to our society's expectations, rather than to some more general standard of what constitutes difficult behavior in the young child. Our pediatric advice on transitional objects, breast feeding, cosleeping may be unknowingly biased toward traditional Euroamerican views of childrearing, especially those about bedtime and nighttime behavior. Thus, in giving advice about sleep, pediatric health professionals might do well to be aware of their own cultural values, to examine closely their patients' cultural and family contexts, and to assess parental reactions to children's sleep behaviors. (1)

Who sleeps by whom is not merely a personal or private activity. Instead, it is social practice, like burying the dead or expressing gratitude for gifts or eating meals with your family, or honoring the practice of a monogamous marriage, which (for those engaged in the practice) is invested with moral and social meaning for a person's reputation and good standing in the community. (2)

In clinical pediatrics, cosleeping is the political third rail. If you touch it, you die. (3)



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This chapter provides a cultural background to our thinking about what constitutes "normal, healthy, and desirable" infant sleep and show the interconnectedness between scientific research, cultural values, concerns for morality, and sleeping arrangements characteristic of Western society. Specific biological and psychological evidence is put forth supporting Sadeh and Anders (4,5) and Anders' (6) views on the importance of understanding what is "appropriate" infant sleep based on the overall social and physical context within which it occurs.

To illustrate this viewpoint, I selected data on a variety of topics demonstrating how culturally guided parental child-care choices, including those involved in sleeping arrangements, set in motion a cascade of interconnected changes that affect the biology and behavior of the participants appropriate to those choices. I suggest that clinicians generally fail to convey to parents the legitimacy of different choices and that the widely accepted research paradigm fails scientifically to include alternatives to the model of the solitary-sleeping, bottle-, or minimally breast-fed infant. The diversity of sleep-related arrangements and practices alter infant sleep development significantly in the first years of life, and this argues against a simple cultural definition of infant sleep progression implied by the widely accepted (traditional) model.

Relatedly, perhaps no other issue has been so often misrepresented and grossly oversimplified as parent-infant cosleeping. New data on the subject highlight the extent to which cultural ideologies, cultural judgments, and concerns for morality are often mistaken for science in this area. For example, data collected exclusively on the solitary-sleeping, bottle-fed infant continue to provide the basis for definitions of clinically "normal" infant sleep-wake patterns and research into them. These data continue to serve as the "gold standard" against which, eventually, parents and professionals evaluate infant sleep development, despite significant contextual differences that may invalidate the comparisons. Almost no consideration is given to other sleeping arrangements, however healthy they may be.

New data from psychology are presented, raising the possibility that clinicians have overestimated the need for infants to sleep separately in order to assure "independence" from their parents. Recent biological data described here suggest that sleep researchers underestimate the importance of maternal proximity and breast-feeding in regulating infant sleep physiology and thus to understanding "normal" infant sleep. By using data from only one type of sleeping arrangement and implying that there is only one context within which healthy infant sleep emerges—i.e., the solitary one—pediatric sleep research is held captive by Western ethnocentrism.

I conclude that to forge effective partnerships between parents and health professionals in our ever more multicultural society, pediatric sleep medicine must come to terms with cultural biases embedded in sleep research medicine in general and clinical interpretations and advice in particular. At this point in the history of Western societies, where an unprecedented convergence of cultural practices is under way—the least of which involves sleeping arrangements—it is critical that clinicians and researchers broaden their thinking about what constitute appropriate and desirable childhood sleep practices. Failure to do so will continue to limit both the accuracy of pediatric sleep science and the effectiveness of care.

## II. Culture and Childhood Sleep

The importance of local cultural influences, including health professional and family values on infant and childhood sleep, was anticipated more than a decade ago by Lozoff and colleagues (1). In the first of the three passages quoted above, they acknowledge, as eloquently as any group of anthropologists or psychologists have done, the critical if not pivotal role that personal beliefs, experiences, and societal values can play in pediatric research. The same applies to the advice given to parents regarding a range of nighttime sleep-related issues, problems, and possible solutions. Across different cultures, ideas vary about how, where, and why infants and children should sleep as well as what constitutes "normal" sleep and "sleep problems" (2,7,8). Ethnographic studies of this variability worldwide are important because the data help to establish the extent to which specieswide sleep biology and development are subject to environmental manipulation and regulation. Local customs and traditions, irrespective of whether the society is industrialized or is structured around a hunting-and-gathering economy, all play roles (9–14).

Even within a single society, infant and childhood sleeping patterns and the social values and relationships that influence them are diverse, and significant differences cut across subgroups in unexpected but important ways (15–17). For example, Anders and Taylor (8) point out that infants and children who are not able to sleep alone and "through the night" are not uniformly regarded in our own culture as having a "sleep problem." Most conceptualizations of sleep problems are based on culturally and parentally constructed definitions and expectations, not biology. In reality, infant sleep development plays out extraordinarily differently in diverse family settings, wherein infant feeding and nighttime nurturing behaviors as well as parental needs and goals vary. These, in turn, affect both long and short term developmental processes. Yet the legitimacy of these variations continues to be largely ignored in both professional as well as popular discourse and a "one size should fit all" approach to sleeping arrangements continues to be advocated (18).

### A. How Do Social Values and Cultural Goals Influence Infant Sleep Practices?

That a critical relationship exists between the cultural ideologies underlying sleep practices and desired developmental outcomes (even when they are not achieved) is made dramatically clear when one compares Asian, Guatemalan, and American values, conceptualizations of infants at birth, and desired developmental outcomes. For example, interdependence and group harmony are positively valued in Japan, where parent-child cosleeping is practiced. As Christopher describes it, "One monkey that does perch on the back of nearly all Japanese is a deeply engrained feeling that individual gratification is possible only in a group context—a feeling which, like the taste for dependence, clearly stems from childhood experiences (19).

American children are presumed to be trained to be self-reliant and to display their individuality by sleeping alone, and Japanese children are taught to "harmonize

with the group" and hence "cosleep" with their parents. These observations relate to the different attitudes that Japanese and American parents have concerning the "nature" of the infant at birth, what developmental outcomes are desired, and what sleeping arrangement are presumed necessary to achieve them. For example, Caudill and Weinstein (20), cited in Shand (21), state that: "In Japan, the infant is seen more as a separate biological organism who from the beginning, in order to develop, needs to be drawn into increasingly interdependent relations with others. In America, the infant is seen more as a dependent biological organism who in order to develop, needs to be made increasingly independent of others."

Indeed, according to Brazleton (22), "the Japanese think the U.S. culture rather merciless in pushing small children toward such independence at night." Kawakami (23, as cited in 24) describes American and Japanese differences this way: "An American mother-infant relationship consists of two individuals.... On the other hand, a Japanese mother-infant relationship consists of only one individual, i.e., mother and infants are not divided." Japanese infants and children usually sleep next to their mothers on futons, with space availability playing a minor role in this arrangement; in general, children sleep with someone (fathers or extended family members) through the age of 15 (24,25).

Like the Japanese, Mayan mothers from Guatemala *do not believe in separate sleeping quarters for infants, children, and parents*. In fact, sleeping alone is considered so difficult for adult Guatemalans that, in the absence of family members, it is not uncommon for adults to seek out friends with whom they can share sleep (24). Upon hearing that American babies are made to sleep alone, Mayan women respond with "shock, disapproval and pity" and think of the practice as "tantamount to child neglect" (24). This evaluation contrasts dramatically with one offered by Ferber of the United States, who advocates that all infants should be taught to sleep alone. In his popular book, *How To Solve Your Child's Sleep Problems*, Ferber provides mothers who may be emotionally predisposed to sleep with their infants with a reason to ponder the status of their own mental health. He advises: "If you find that you actually prefer to have your child in bed, you should examine your feelings very carefully" (26).

The study of Guatemalan (Mayan) women is one of the best cross-cultural (comparative) studies of childhood sleep to date. Morelli et al. examined a group of middle-class American (Caucasian) and contemporary Mayan (Guatemalan) mothers and found that all the 14 Mayan mothers slept in the same bed with their infants and 8 older toddlers slept with their fathers. In the middle-class American sample, none of the newborn infants regularly slept with their mothers. Mayan parents believe that cosleeping is the only "reasonable way" for a parents and infants to sleep, while the Americans in the sample of Morelli et al. felt comfortable keeping newborns and neonates next to their beds "to make sure that they were still breathing" (24) but were not comfortable having them in the same bed. After their children's third to sixth months of life, the Americans parents felt that their infants were no longer so vulner-

able. Fearful of interfering with the infant's progress toward independence and autonomy, most American parents in the sample moved their infants to a separate room.

In another study, conducted in Australia, an immigrant Vietnamese mother was told about the sudden infant death syndrome (SIDS), with which she was unfamiliar. She surmised that "the custom of being with the baby must prevent this disease. If you are sleeping with your baby, you always sleep lightly. You notice if his breathing changes.... Babies should not be left alone." Further to the point, another of the Vietnamese mothers added: "Babies are too important to be left alone with nobody watching them" (27).

Of 40 Chinese women interviewed (in Chinese) at Guangzhou University Hospital by Wilson (28), over 66% of new mothers were intending to have their infants sleep with them in the marital bed, and all of her sample were planning to have their infants sleep alongside their beds. One informant represented many when she stated that the baby is "too little to sleep alone" and that cosleeping "make babies happy." Another Chinese informant tells Wilson: that "the parents' breathing affects the baby, so cosleeping is good" and, later, that cosleeping permits mothers to know "if the baby [was] too hot or too cold" and "to hear the baby's sounds" (28).

#### B. Is Moral Character a Function of the Sleep Environment?

What might come as a surprise to some researchers is the work of cultural psychologist Shweder and his colleagues at the University of Chicago (e.g., the second passage quoted at the opening of this chapter). They show explicitly that concerns for "moral goods" (taken here to mean concerns or preferences for particular personal qualities or behavior and personality or character outcomes) are deeply embedded in and reflective of notions about proper sleeping arrangements, regardless of whether these notions are scientifically based or simply folk assumptions (2). Their cross-cultural comparisons reveal that in choosing sleeping arrangements, parents feel a powerful concern for what looks morally acceptable and for practices they have come to believe lead to certain moral traits. At least initially, it is believed not only that certain types of sleeping arrangements produce certain types of children but that these arrangements reflect certain types of parents (i.e., good or moral parents) who are themselves judged by family, friends, and community on where they place their infants or children for nighttime sleep (2,29).

Schweder and colleagues showed specifically that where and with whom some American children are allowed to sleep is guided by concerns for three specific moral issues: the sacredness-separateness (from children) of the husband-wife relationship; the appearance of incest avoidance; and the importance of teaching the child self-reliance and independence by enforcing the practice of sleeping alone.

Perhaps the overriding importance of these moral goods in certain segments of American society helps to explain why culture-based "folk" and scientific understandings of infant and childhood sleep often intermingle and mutually reinforce one

another. In pediatric sleep medicine, for example, it is often difficult to distinguish between what is passed on to parents as proven scientific findings—in relation to how sleeping arrangements affect marriages, personality development, self-confidence, independence, and/or overall satisfaction with life—and what is simply personal judgment on the part of the advice giver (18,22).

Interestingly, the “moral” outcomes parents desire to instill in their children through choices for particular sleeping arrangements contrast and often conflict with the sleep-management strategies parents think they need to employ to obtain those outcomes. For example, Western parents generally seek to instill sensitivity, kindness, trust, and empathy in their children (30). At the same time, they want to create separateness, self-reliance, and/or autonomy through enforced solitary sleep, which can be facilitated through first withdrawing and then eliminating nighttime feedings and parental contact (26). Such emotionally conflicted parents will often display inconsistent (on-again, off-again) enforcement of solitary sleep, alternating between some form of cosleeping and separate sleeping arrangements. This pattern of cosleeping, first introduced by Madansky and Edelrock (31), is referred to as “reactive cosleeping” and has proven to be distinct in form and function from situations where parents elect or prefer to cosleep. Reactive cosleeping only exacerbates parent-child sleep struggles, and certainly does not eliminate them, as these investigators’ study illustrates (31).

### C. Do Solitary or Social Infant Sleeping Arrangements Produce Independent, Satisfied (Moral) Children and Adults? Is This the Right Question?

The absence of systematic studies on the relationship between acquired infant/child personality characteristics and routine sleeping arrangements probably explains why Western conventional understandings about the relationship between solitary infant sleeping arrangements and early independence are imprecise and misleading at best. Recent systematic studies are beginning to provide evidence that contradicts conventional wisdom on solitary sleep in early childhood. Consider:

Heron’s (17) recent cross-sectional study of middle-class English children shows that among the children who “never” slept in their parents’ bed, there was a trend to be harder to control, less happy, and to exhibit a greater number of tantrums. Moreover, he found that those children who were never permitted to bedshare were actually *more* fearful than children who always slept in their parents’ bed for all of the night (17).

In a survey of adult college-age subjects, Lewis and Janda (32) report that males who coslept with their parents between birth and 5 years of age had significantly higher self-esteem, experienced less guilt and anxiety, and reported greater frequency of sex. Boys who coslept between 6 and 11 years of age also had higher self-esteem. For women, cosleeping during childhood was associated with less discomfort about physical contact and affection as adults.

(While these traits may be confounded by parental attitudes, such findings are clearly inconsistent with the folk belief that cosleeping has detrimental long-term effects on psychosocial development.)

Crawford (33) found that women who coslept as children had higher self-esteem than those who did not. Indeed, cosleeping appears to promote confidence, self-esteem, and intimacy, possibly by reflecting an attitude of parental acceptance (32).

A study of parents of 86 children in clinics of pediatrics and child psychiatry (ages 2 to 13 years) on military bases (offspring of military personnel) revealed that cosleeping children received higher evaluations of their comportment from their teachers than did solitary-sleeping children, and they were *underrepresented* in psychiatric populations compared with children who did not cosleep. The authors state:

Contrary to expectations, those children who had not had previous professional attention for emotional or behavioral problems coslept more frequently than did children who were known to have had psychiatric intervention, and lower parental ratings of adaptive functioning. The same finding occurred in a sample of boys one might consider Oedipal victors (e.g., 3-year-old and older boys who sleep with their mothers in the absence of their fathers)—a finding which directly opposes traditional analytic thought. [16]

Again, in England, Heron (17) found that it was the solitary-sleeping children who were harder to handle (as reported by their parents), who dealt less well with stress, and who were rated as being *more* (not less) dependent on their parents than were the cosleepers!

And in the largest and possibly most systematic study to date, conducted on five different ethnic groups from both Chicago and New York involving 1411 subjects, Mosenkis (34) found far more positive adult outcomes for individuals who coslept as a children among almost all ethnic groups (African Americans and Puerto Ricans in New York and Puerto Ricans, Dominicans, and Mexicans in Chicago) than there were negative findings. An especially robust finding, which cut across all the ethnic groups included in the study, was that cosleepers exhibited a feeling of satisfaction with life.

But Mosenkis’s main finding went beyond trying to determine causal links between sleeping arrangements and adult characteristics or experiences. Perhaps his most important finding was that the interpretation of “outcome” of cosleeping had to be understood within the context specific to each cultural milieu and within the relational matrix in which it occurs. For the most part, cosleeping as a child did not correlate with *anything* in any simple or direct way. He concluded that there is no one “function” of cosleeping, but that cosleeping as a child interacts with a variety of cultural, social, and unique developmental characteristics of the relational setting (34)—also that the sleeping arrangement is but a small part of a larger system affecting adult characteristics (34).

#### D. Beliefs About the Consequences of Nontraditional Sleeping Arrangements: Science or Religion?

Judging from public discourse at least, the validity of predicted outcomes associated with particular sleeping arrangements need not be demonstrated or proven scientifically as long as people *believe* that they are valid or that the outcomes promised reflect, complement, or in some way support the prevailing values and goals that justified the recommended practice in the first place. For example, in contrast with situations where parents and children sleep together (cosleep), solitary childhood sleeping arrangements are *believed* to foster more independent infants and children. The problem is that no study has ever defined what exactly is meant by independence, how it should be measured, or—assuming that it can be measured or achieved at a young age—whether this quality or character is causally linked to childhood satisfaction, competence, or happiness. Furthermore, no study has ever determined if the ability to sleep alone through the night at an early age relates to the emergence of other skills or personality characteristics unavailable to infants and children sleeping under different conditions.

When discussions turn to nontraditional sleeping arrangements, much is presumed but little or nothing is proven. For example, it is often implied or stated outright that cosleeping exacerbates or creates a parent-child sleep problems, but this appears to be true where parents do not value cosleeping, as when parents permit a child to sleep in their bed as a response to ongoing sleep difficulties. Furthermore, Hayes et al. (35) studied cosleeping among 51 children 3 to 5 years old and found, in the subgroup considered difficult sleepers, that all but one had developed sleep problems in the context of sleeping alone; that is, originally all the children who developed into "problem sleepers" as defined by their parents had been placed in a separate bed from infancy. Even where cosleeping parents report problems, this does not mean that solitary sleeping is not the preferred sleeping arrangement.

Whether a child is sleeping alone or socially, the functions of the sleep environment change in relation to age (36,37), and/or changing circumstances. For example, the physiological consequences of a mother sleeping beside her 1-month-old infant are enormously different from the physiological consequences associated with her sleeping with this same child 13 months later, when its cognitive and psychological systems are much more mature. At 1 month, and owing to the human infant's extreme neurological immaturity at birth and continuing slow development, the mother's body acts as a cue or trigger in regulating the baby's body temperature, breathing, arousal patterns, cortisol levels, and sleep architecture (38-41). But at 2 and/or 5 or 13 years of age, children will actively interpret the relational meaning and affects of cosleeping with their parents while the initial important physiological effects will diminish. Indeed, whether the consequences of the sleeping arrangement is beneficial, benign, or deleterious (at any given age) will depend not simply on the location—where the sleep occurs—but also on the social meaning and psychological content of the relationship of the participants as expressed within the family, *of which the sleep-*

*ing arrangements per se are but a small reflection and part.* Such critical analytic distinctions are mostly absent when the potential value of nontraditional sleeping arrangements (especially cosleeping) are addressed (42).

#### III. Conventional Western Understandings of "Healthy, Normal" Infant and Childhood Sleep: Where Did They Come From? Is One Form of Sleep as Good as Any Other?

It is tempting to use the concept of cultural relativism to argue that regardless of differences in the ways infants or children's sleep worldwide, each culturally based strategy is equally valid and appropriate. Such a simplistic perspective is fallacious, however, in a number of ways. First, it presumes that parents in all societies are equally satisfied with the way their infants and children sleep, or that parents (and children) are equally well rested despite differences in how or where they sleep. Though it is hard to make comparisons across all cultures, the impression of many anthropologists is that, in general, parents living in Western industrialized societies are much less satisfied with how their children sleep than are parents in non-Western societies, and that in industrialized societies, nightly infant and childhood sleep comes about under more stressful conditions (43,44).

A second fallacy is the erroneous assumption that any society (including our own) necessarily produces a sleep management strategy that is appropriate for all, and that it is optimal (promotes maximum health) for all, or is always compatible with the short- or long-term biological needs of the infant. Parental caregiving choices that satisfy parental best interests are not, for example, necessarily the same as those which best serve the infant's (40). Although modern lifestyles and/or technology offer some effective substitutes for parental nurturing (contact, protection, and support), it is worthwhile to recall Bruner's warning that "it would be a mistake to leap to the conclusion that because human immaturity makes possible high flexibility in later adjustment, anything is possible for the species.... we would err if we assumed a priori that man's inheritance places no constraint on his power to adapt" (45).

A third problem with the relativist perspective is that it erroneously implies that within any given society each family's values and goals are the same, and that publicly preferred or "ideal" sleeping arrangements are those which are actually practiced. We now have evidence that there is much more variability regarding sleep practices, especially in the United States and the United Kingdom, than has ever been acknowledged (16,46-48).

Obviously, each culture is unique, and there must be some compatibility between family behaviors and the society within which they live. My criticism is that the pediatric sleep community continues to make it uncomfortable for many parents to practice sleeping and nighttime feeding arrangements that differ from their own. More importantly, I regret that the "science" of infant sleep continues, for the most part, to disregard the biological significance of the mother's presence as a regulator

of infant sleep, as it unfolds and develops within the cosleeping/breast-feeding adaptive complex. I argue that this disregard precludes a full understanding of infant sleep physiology and development; therefore, it also precludes a full understanding of the likely etiology of so many sleep-related problems that infants, children, and parents experience in Western societies.

In my own work, no particular sleeping arrangement is advocated for any particular family. Rather, data from ethnographic studies and human infant evolutionary studies are used to provide a perspective from which other kinds of analysis and concerns can proceed. An evolutionary perspective provides a more objective context, I believe, for understanding infant responses to the diverse sleep environments different cultures provide (49–51). As a conceptual tool, evolution offers a beginning point to consider how social factors come to predominate over and influence infant and childhood sleep biology and development (42). For example, anthropological studies that incorporate an evolutionary framework reveal that infant sleep physiology evolved in the context of continuous maternal contact, including baby-controlled nighttime breast feeding (52,53). This fact permits us to argue that in order to understand specieswide infant sleep-wake patterns and/or sleep architecture, infant sleep must first be studied under conditions that mimic this “environment of adaptedness” (54).

In Western cultures (as described above), clinicians generally continue to advocate only one form of sleep for infants and children (i.e., solitary sleep) and sleep management strategies aimed at sharply reducing, as early in life as possible, parental handling and feeding of infants at bedtime. Parents are encouraged not to permit infants to associate falling asleep with food (including breast-feeding) or parental touch (18,26,55,56), the very context within which the infant’s “falling asleep” evolved. Breast-feeding rates in the United States have increased to reach a historic high (57). If the infant falling asleep at the breast is as common and as biologically appropriate as cross-cultural data suggest (43), then the recommendation by Western clinicians to prevent it will not only fail but will continue to prove problematic for many mothers and infants.

Given the historical context within which infant sleep studies were begun, these contemporary recommendations are better understood. Both clinicians and pediatricians encounter parents who need practical, immediate solutions to ongoing problems associated with solitary infant/child sleeping arrangements. Thus, a clinician’s impressions is colored by families in crisis and mostly limited to them. Clinicians hear little testimony from parents who have found alternative sleeping arrangements (to the solitary model) and who enjoy alternative choices. Recall that infant sleep studies were first conducted by researchers in the fifties and sixties, a time period in which breast-feeding rates were at an all-time low. Mother-infant cosleeping was regarded as being aberrant, a sleeping arrangement definitely to be avoided. Since the significance of mother-infant cosleeping with nighttime breast-feeding was considered neither biologically nor culturally appropriate, it is not surprising that patterns of childhood sleep development considered clinically “healthy” and “normal” were those patterns expressed by bottle-fed infants sleeping alone in sleep laboratories.

#### A. The Traditional Sleep Research Paradigm Is Inadequate for the Diversity of Family Sleep Practices It Must and Should Accommodate

It is hypothesized that the progressive organization of sleep and wakefulness at night in infancy reflects the integration of constitutional propensities of the infant (temperament) in interaction with the infant’s multiple contexts.... Contextual relationships are mediated by the infant’s primary relationships, which are different from, but have their origins in, the infant’s social dyadic interactions. (6)

Anders suggests, in the quote above, that patterns of “normal” and “appropriate” infant sleep development are extremely variable and responsive to a variety of environmental—i.e., contextual—processes. Some of these processes involve family interactional factors that characterize the nature and affectional structure of the social relationships each parent experiences with his or her infant or child during the day (58). If fully realized by researchers and clinicians alike, the “transactional” model that Anders (6) and Sadeh and Anders (4) envision offers a revolutionary approach to studying and understanding infant sleep development and for creating the inclusive paradigm for which this chapter argues.

Indeed, a transactional approach takes Lozoff and her colleagues one step further. The approach acknowledges at the outset that “normal” infant sleep development can vary not only within different cultural subgroups but also from one infant to the next, depending upon the interplay of intrinsic and extrinsic variables significant to each developing child. Intrinsic factors can include but are not limited to infant temperament, growth rate, and neurological status (constitutional needs) at birth. Extrinsic factors, with which intrinsic variables interact, can involve such things as whether infants are breast- or bottle-fed (59); whether or not the infant feeds on its own or on its parent’s schedule (60); whether the infant sleeps in the same bed, in the same room, or in a different room (alone) (61,62); whether the infant sleeps on its back, side, or belly (63); whether the family generally favors nighttime contact or discourages or resists it (17); and whether the infant has siblings or is an only child. All of these factors (and others) can alter the trajectory of infant sleep development in important ways.

Unfortunately for parents, popular discourse about how babies should sleep does not ordinarily make reference to these factors, and neither do clinicians. Harkness et al. (64) point out that the traditional theoretical models, explanations, and clinical treatments of infants with dysomnias and parasomnias continue to be predicated on the notion that the ontogeny or maturation of infant sleep is, in the vernacular, fairly clean, neat, and predictable. Changes in infant sleep architecture, particularly the reversal of the predominance of active to quiet sleep, is reported to follow an orderly, unfolding pattern *dominated by endogenous mechanisms*. For example, during the first year of life, a more stable “adult-like” pattern of sleep emerges. The infant sleeps for longer and longer (relatively uninterrupted) periods in increasingly deeper (delta-wave) sleep, which is thought to reflect an increase in the level of “integrity and maturity” of the central nervous system (64). Indeed, the ability of infants to return to sleep unassisted after awakening (to self-soothe)—to “sleep through the night” as

early in life as possible with minimal parental contact—continues to be a developmental benchmark against which infants and their caregivers are evaluated, even when sleeping through the night is not an important issue for the parents. Such a criterion used to evaluate “developmental progress” may do more harm than good, if the sleeping arrangements actually practiced are not the same as the one for which the method of evaluation was intended.

**B. Examples of How Culturally Guided “Choices” Concerning Sleeping Arrangements and Related Sleep Practices Matter Biologically to the Infant and Change “Normative” Sleep Development**

*Infant Sleep Position and Susceptibility to Sudden Infant Death Syndrome*

It is worthwhile to consider how sensitive the infant’s sleep behavior, physiology, and health is to culturally guided decisions about how, where, and with whom (if anyone) infants should sleep. Indeed, while Lozoff and her colleagues hinted at it, they never could have anticipated the degree to which culturally based decisions regarding infant and childhood sleep affect development and nightly sleep physiology, including the chances of an infant dying from the sudden infant death syndrome (SIDS). In fact, the sleeping position of the infant has proven to be the single most important factor for reducing the chances of an infant dying of SIDS (65), although the reasons for increased risk remain unknown. The discovery that, merely by placing infants in the supine rather than in the prone sleep position, SIDS rates could decline as much as 90% in some countries continues to astonish many SIDS researchers worldwide (66). The decision to recommend the prone sleeping position emerged from the widely accepted belief that if prone sleeping helped premature infants to breathe and sleep better, it could probably do the same for older, term infants. The possibility that supine infant sleep could make the infant vulnerable to choking (esophageal reflux) only added to the resolve of physicians to place infants prone for sleep (67).

Do infantile arousal mechanisms needed to protect infants during respiratory crises follow the same time course of development as the neurological mechanisms that promote longer periods of deeper sleep (delta wave, stages 3 and 4)? This is an important question as pertains to susceptibility to SIDS (68). Over 20 years ago, Douthitt and Brackbill (69) found that prone-sleeping newborns slept longer and deeper (aroused less and slept longer) than did supine-sleeping infants. They showed that infants sleeping on their backs experienced twice as many motor activities during sleep and more awakenings than did prone-sleeping newborns, findings recently confirmed by Kahn et al. (70). Since the goal of both parents and health professionals in Western societies was and continues to be to promote sleep and not awakenings, it is easy to understand why these earlier data provided support for the argument that infants should be placed in the prone position to sleep. Yet, it has been suggested that some infants who die of SIDS perhaps cannot arouse or awaken easily or fast enough to terminate a cardiorespiratory crisis during sleep, especially while in deep

sleep, where arousal thresholds are higher (68). These findings raise the possibility that supine sleep might well be safer *precisely because of the increased arousal and motor activity accompanying it*, even though the implications of this possibility conflict with cultural strategies to promote early “deep” sleep in infants as early in life as possible.

There are other parent-controlled “social” precautions that lower the risks of SIDS. Mitchell (71) found that the presence of a responsible adult sleeping in the same room as an infant reduced the chances of the infant’s dying from SIDS by fourfold. This protective effect did not generalize to cosleeping among siblings, indicating that a responsible role played by the caregiver is likely critical in reducing the chances of the infant dying. Moreover, the largest epidemiological study to date, conducted in Great Britain, also shows increased risks for infants sleeping in rooms alone as well as for babies sleeping in their mother’s beds, *if the mother smokes*. Other dangerous conditions include the use of a duvet pulled up over the infant’s head as well as the use of a soft mattress. Overheating by overwrapping an infant also significantly increased the SIDS risk. All of these new data illustrate the extent to which infant sleep physiology is directly mediated by parental intervention (see Chap. 21).

*Feeding Practices*

Bottle-fed infants exhibit significantly different nightly sleep profiles than do breast-fed infants. Infants who are breast-fed for a year or more develop different sleep patterns than do infants breast-fed for only the first 3 months (15). Oberlander et al. (72) found that among newborns, a complete milk formula feed increased postfeed sleep by 46% and 118% compared respectively to water and carbohydrate-only feedings. Furthermore, the most recent Ross survey of breast-feeding in the United States indicates that 62% of contemporary mothers are breast-feeding when they leave the hospital (57). New evidence suggests that at least for the first 3 or 4 months of life, mothers continue to provide their infants with at least two breast-feedings or more from midnight through to the morning (59).

That so many more mothers are now breast-feeding their infants for increasingly longer periods makes sleep models based entirely on data from infants fed artificial or cow’s milk (from bottles) highly problematic for at least half of the population of contemporary American infants. And while breast-feeding drops to 26% at 6 months, the number of mothers who breast-feed in the United States continue to rise (57). This is particularly significant since, as described below, in addition to sleep differences induced by breast versus cow’s milk, sleep proximity to mother also influences the frequency and duration of feedings (59). Maternal proximity in the form of bed sharing, in addition to breast feeding, especially changes the infant’s nightly sleep architecture, including arousals and sleep period time. Developmental models of infant sleep in the first year of life that do not take into account feeding method and frequency in relationship to sleeping arrangements are therefore not appropriate for many infants.

That feeding affects sleep physiology, including infant cardiac patterns, was



demonstrated over 25 years ago. In fact, Harper and colleagues (73) argued that feeding behavior plays an underestimated role in regulating infant sleep physiology and sleep architecture. He and his colleagues found that among bottle-fed, solitary-sleeping infants, the waking periods associated with feeding increased the probability of a subsequent rapid-eye-movement (REM) period, a finding consistent with previous work on small mammals. They suggested that because REM sleep and quiet sleep followed each other in sequential fashion, a change in the relative distribution of REM sleep altered the likely sequence of state. Their laboratory research on bottle-fed infants showed that feeding tended to entrain the subsequent REM-QS cycle in that the percentage of REM increased after feeding and then dropped sharply approximately 20 min later, with a corresponding increase in quiet sleep. They concluded that "the interpretation of behavior resulting from maternal-infant interaction should be viewed within the framework of incorporation of food, in that satiety play a large role in regulation of state integration and cardiac response" (73). Despite this finding, infant sleep research papers rarely include information on feeding method and frequency.

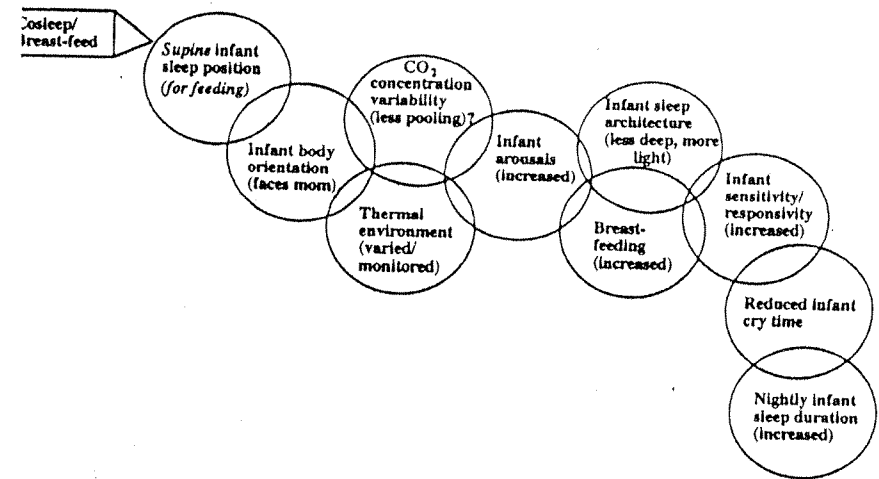
"Choice" of sleeping arrangement was found to greatly increase not only the number of breast-feedings but the total nightly duration of breast-feeding and the average intervals between the feeding sessions. For example, among 70 nearly exclusively breast-feeding mothers of Latin-American descent and their 2- to 4-month-old infants, we found that when mother and child were bed sharing, the average interval between the breast feedings was approximately 1½ hr. When they were sleeping apart in separate bedrooms (but still within earshot), however, the interval was at least twice as long (about 3 hr). Moreover, on their bed-sharing nights, we found that babies breast-fed twice as often for three times the total nightly duration than they did when they slept alone (59).

These differences in feeding were part of a broader complex of differences, a cascade of interconnected changes induced by the presence of the mother. Mother-infant cosleeping altered not only feeding behavior within what was supposed to be a homogenous breast-feeding group but also infant and maternal arousal patterns (74–76), sleep architecture (61), mother-baby body orientations in bed (77), infant respiratory behavior (78)—in short, almost every major parameter important in understanding infant and maternal sleep physiology (see Figs. 1 and 2 and discussion below).

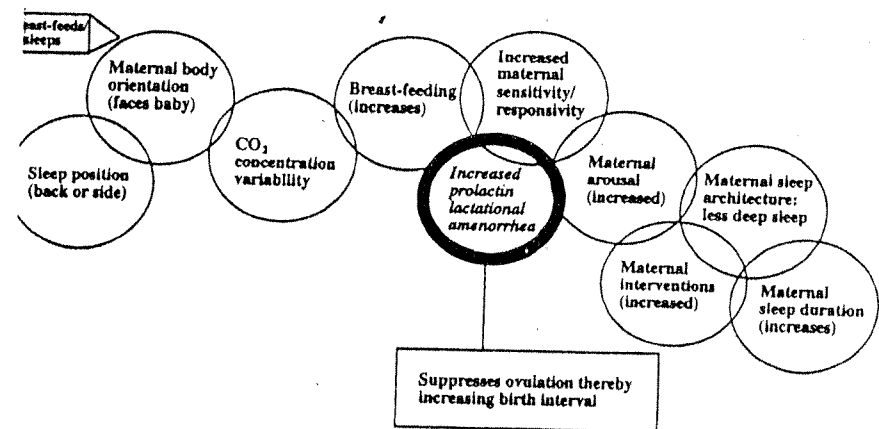
#### *Infant and Maternal Arousals, Temporal Correspondences, and Sleep Architecture Among Solitary and Bed-sharing Mother-Baby Pairs*

Separate normative values for infant sleep need to be developed for infants who bed-share, and existing norms should be reinterpreted within the cultural context in which they were established. (61)

In three in-house laboratory studies of one form of mother-infant cosleeping—bed sharing—we used standardized polysomnography and infrared photography to quantify differences in the behavior and physiology of mother-infant pairs as they shared a bed or slept apart. These data show that during bed sharing, a significant amount of



**Figure 1** For the breast-fed infant, "Choice" of sleeping arrangement sets in motion a cascade of potentially beneficial biobehavioral effects for the mother-infant dyad (from the infant's perspective).



**Figure 2** Cosleeping sets in motion a cascade of biobehavioral effects and events relevant to mothers (from the mother's perspective).