ARTICLE

OPTIMIZING PARENT–INFANT SLEEP FROM BIRTH TO 6 MONTHS: A NEW PARADIGM

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ABSTRACT: Currently, the dominant paradigm for infant sleep from birth to 6 months is behavioral sleep interventions that aim to entrain the infant's biological patterns of sleep using techniques such as delayed response to cues, feed–play–sleep routines, sleep algorithms, and education of parents about "tired cues" and "overstimulation." A recent systematic literature review has identified that while behavioral sleep interventions may modestly increase the length of time an infant sleeps at night without signaling, they are not associated with improved infant or maternal outcomes and may have unintended negative consequences (Douglas & Hill, 2013). This article reviews the empirical literature on behavioral infant sleep interventions, sleep regulation, and sleep disturbance. Based on the available scientific literature, a new paradigm for infant sleep intervention, from birth to 6 months of age, is proposed. This new approach, the Possums Sleep Intervention, integrates interdisciplinary knowledge from developmental psychology, medical science, lactation science, evolutionary science, and neuroscience with third-wave contextual behaviorism, acceptance and commitment therapy, to create a unique, new intervention that supports parental flexibility, cued care, and the establishment of healthy biopsychosocial rhythms.

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THE CURRENT PARADIGM IS BROKEN

Between 23 to 27% of parents report infant sleep problems in the first 6 months of life (Armstrong, Quin, & Dadds, 1994). The dominant paradigm for intervention is behavioral sleep intervention, and such interventions are widely applied preventatively from birth or after the first 6 to 12 weeks. Specific interventions vary, but all aim to entrain the infant's biological patterns and increase the duration of the infant's nocturnal self-regulated sleep. The dominant paradigm includes a variety of techniques: delayed response to infants' cues (or responses that are deliberately not as the infant intends), feed–play–sleep cycles, lists of "tired cues," estimates of how long a baby should be awake or asleep, and avoiding "overtiredness" and "overstimulation."

A recent systematic literature review has concluded that while existing behavioral sleep interventions, and parental practices that are modeled on behavioral approaches, have been associated with modest increases in self-settling and in infant sleep duration, they have not been shown to decrease infant crying, to prevent sleep and behavioral problems in later childhood, or to protect against postnatal depression (more than occurs with any supportive health professional contact, regardless of content) (Douglas & Hill, 2013). Further, applied as a population strategy of prevention from the first weeks and months, behavioral sleep interventions risk unintended outcomes, including increased amounts of problem crying, premature cessation of breast-feeding, worsened maternal anxiety, and, if the infant is required to sleep either day or night in a room separate from the caregiver, an increased risk of sudden infant death syndrome (SIDS) (Blair, Platt, Smith, & Fleming, 2006; Douglas & Hill, 2013; Sirvinskiene, Zemaitene, Zaborskis, Markuniene, & Jusiene, 2012; St James-Roberts et al., 2006; Task Force on Sudden Infant Death Syndrome, 2011). Subsequently, a large Australian randomized controlled trial also has shown no effect of a behavioral sleep intervention delivered at 4 weeks of age, with a telephone consultation at 6 to 8 weeks and a group session at 12 weeks, on infant crying and sleep problems at 4 or 6 months (Hiscock et al., 2014).

Multiple researchers and health professionals have raised concerns about behavioral sleep interventions and have suggested an alternative paradigm in which infant night-waking is normalized (Ball, 2013; Blunden, Thompson, & Dawson, 2010; Cassels et al., 2013; Infant Sleep Information Source, 2014). We draw on their important work concerning normal parent–infant sleep ecology. However, we contend that some parent–infant sleep in this age

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group is unnecessarily disrupted and amenable to repair, and also that some parents will benefit from specific strategies to support their own healthful sleep and well-being. We have aimed to develop a new paradigm for infant sleep, by returning to the scientific literature on infant sleep and on the biological regulation of sleep, sharpening our theoretical lens, and questioning common assumptions. As a result, we have developed the Possums Sleep Intervention.

DEVELOPING A NEW PARADIGM

Rethinking Behaviorism and Infant Sleep

The behavioral sleep interventions of the dominant paradigm are grounded within first-wave behavioral theory (operant theory), which rose to prominence as a grounding for interventions in the 1950s and 1960s in the Anglosphere. However, in developing a specific intervention from a scientific theory, assumptions are always made. The dominant paradigm reflects the application of operant theory to infant behavior, with the aim of decreasing the number of times parents are woken by infant signaling in the night. It is assumed that doing so will improve parental sleep as well as benefit infant and maternal health.

In fact, as discussed earlier, behavioral sleep interventions in the first 6 months do not benefit infant and maternal health in the short- or long-term (Douglas & Hill, 2013). Further, frequency of infant signaling is not related to maternal sleep efficiency; that is, the time it takes for a mother to get back to sleep after she has been woken. Poor maternal sleep efficiency, in common with sleeping difficulties in adults broadly, is related to elevated sympathetic nervous arousal (Bootzin & Epstein, 2011; Dorheim, Bondevik, Eberhard-Gran, & Bjorvatn, 2009; Goyal, Gay, & Lee, 2009). This explains why exclusively breast-feeding mothers have improved quality and duration of sleep even though they wake more often to their infant's nighttime signals (Dennis & McQueen, 2009; Doan, Gay, Kennedy, Newman, & Lee, 2014; Kendall-Tackett, Cong, & Hale, 2011). Although maternal sleep efficiency (Dorheim et al., 2009; Goyal et al., 2009) predicts postnatal depression, the frequency of infant nocturnal signaling does not (Warren, Howe, Simmens, & Dahl, 2006).

The Possums approach continues to be grounded on operant theory, and thus could be legitimately described, among other things, as a "behavioral" sleep intervention. However, we consider the assumption that increasing the infant's self-regulated sleep duration will improve parental sleep and/or will have additional benefits for the parent–infant dyad to be disproven. We do not take this as the goal; rather, we understand infant sleep contextually, by analyzing the function of the behavior for that infant (i.e., the reinforcers), not by the appearance of the behavior or by the assumed effects on the parent. For example, we understand breast-feeding *to sleep* and thumb-sucking *to sleep* as functionally equivalent whereas we understand breast-feeding *to sleep* and breastfeeding *to quench thirst* as functionally different even though they appear the same. We suggest that infants who "self-settle" and nocturnal signalers who initiate their preferred settling behavior (e.g., breast-feeding) when needed *and successfully downregulate* are equally proficient at settling in a developmentally appropriate manner (and are both equally different to infants who fail to successfully downregulate). From our perspective, the dominant paradigm trains infants to settle to sleep in a manner that does not require parental presence; however, these self-settling behaviors are functionally and developmentally equivalent to the behaviors of many nocturnal signalers. This explains why behavioral sleep interventions do not have lasting effects on sleep into childhood (Hyde, O'Callaghan, Bor, Williams, & Najman, 2012; Price, Wake, Ukoumunne, & Hiscock, 2012).

Rethinking Cued Care

We situate infant sleep within the wider context of the parent–infant relationship, and we understand sleeping patterns, sleeping needs, and sleeping problems as emerging out of this complex and dynamic system (Douglas, Hill, & Brodribb, 2011). The parent–infant relationship is located in the broader systems of family, society, and culture (Jenni & O'Connor, 2005). Postpartum infant stimuli perpetuate a profound maternal morphological and functional neuroplasticity, which began with pregnancy and birth (Kinsley & Amory-Meyer, 2011; Strathearn, 2011). Biologically programmed, or innate, patterns of synchrony operate between the neuroendocrine systems of mother and infant (Rilling, 2013). Infant sleeping patterns are innately connected to other prominent neurobehaviors relevant to mother–infant synchrony; namely, feeding and sensory stimulation (Douglas & Hill, 2013; Galbally, Lewis, McEgan, Scalzo, & Islam, 2013). For this reason, we maintain that an infant's sleeping patterns cannot be understood without also understanding the full complexity of the parent–infant relationship, including feeding patterns, patterns of sensory stimulation and physical contact, and philosophies of care.

The benefits of flexible, cued care are increasingly well-documented (Ainsworth, Blehar, Waters, & Wall, 1978; Biringen & Easterbrook, 2012; Gottman, Katz, & Hooven, 1997; Sroufe, 2005). Cued care optimizes the neurohormonal synchrony between mother and baby which has mutually beneficial physical, behavioral, and psychological effects for both the short- and the long-term (Rilling, 2013; Swain, Lorberbaum, Kose, & Strathearn, 2007). We define cued care as a pattern of care characterized by sensible caregiver responsiveness to the infant's communications, or cues. Responsiveness is not merely responding; it is responding in a manner that replies to the infant's communications and meets the need underlying the infant's cues. According to our definition, deliberately responding to the baby's cues in a manner that is not what baby intends, with the aim of extinguishing signaling, is not cued care. For example, if a parent deliberately refrains from giving the baby physical contact, when he or she reads the baby's cues as asking for physical contact, with the purpose of teaching the baby to stop signaling, then this is not cued care, even if the parent responds with verbal comforting. We define cued care as *sensible* caregiver responsiveness to acknowledge that no caregiver

can be perfectly responsive all of the time. In fact, research has suggested that perfection is not required—there is room for human error in a responsive relationship (Ainsworth et al., 1978; Biringen & Easterbrook, 2012; Gottman et al., 1997; Sroufe, 2005). Parents make sense of their baby's cues through a continual process of experimentation and pattern recognition, taking into account the wider context (Douglas & Hill, 2013). Cued care, therefore, is a process of flexible parent–infant experimentation, which facilitates stabilization of the complex, adaptive parent–baby system through multiple behavioral and neurohormonal feedback loops. Further, cued care promotes parental flexibility and enjoyment, as parental caregiving is maintained through positive reinforcement (e.g., affection, acting in accordance with values) and provides the infant with reinforcement for an ever-broadening behavioral repertoire of signaling behaviors, the precursors of language, social interaction, and connection-seeking (Whittingham, 2014).

Integrating the Science of Sleep

Sleep is a complex neurobehavioral state, and sleep behavior must be viewed within a biopsychosocial framework (Jenni & Carskadon, 2007). Two biological processes dominate the regulation of sleep: the homoestatic sleep factor and the endogenous circadian pacemaker (Markov, Goldman, & Doghramji, 2012). The homeostatic sleep factor is an increase in the need to sleep (sleep pressure) as the duration of wakefulness extends. It gradually increases as the day progresses and reaches its peak at the onset of sleep. If an individual is experiencing high sleepiness, or sleep pressure, he or she will fall asleep unless there are specific inhibitors of sleep acting upon that person. Sleep is homeostatically regulated from early in life (Jenni & Carskadon, 2007). The circadian pacemaker is a biological clock that regulates physiological, metabolic, and behavioral states, including the sleep–wake cycle throughout the 24-hr day. The circadian pacemaker has an intrinsic period of slightly more than 24 hrs, and remains "in sync" with real time through environmental cues or "zeitgebers." Newborn infants do not show a circadian pattern to their sleep–wake cycles at birth (Markov et al., 2012). However, a circadian pattern emerges in the first weeks of life, and with this circadian pattern comes sleep consolidation, with infants taking a greater proportion of their sleep hours during the night (Jenni & Carskadon, 2007). However, two thirds of all infants at 3 months and half of infants at 6 months signal for parental help during an 8-hr period, five of six nights (Henderson, France, & Blampied, 2010). The Possums Sleep Intervention is grounded in the scientific literature on the biological regulation of sleep.

A NEW PARADIGM: THE POSSUMS SLEEP INTERVENTION

The Possums Sleep Intervention is a systematic approach to infant sleep problems that is grounded within contextual behavioral science, cued care, and the biology of sleep. Our aim is not to maximize the duration of the infant's nocturnal sleep but to support the healthful biological regulation of sleep for both infant and parent as well as to optimize the parent's sleep efficiency and resilience. Research has shown that poor maternal sleep efficiency, in common with adult sleep difficulties generally, is predicted by elevated sympathetic nervous system arousal (Dorheim et al., 2009; Goyal et al., 2009), and we deliberately target this arousal and the cognitive, metacognitive, and behavioral processes that may underlie it (Harvey, 2002; Ong, Ulmer, & Manber, 2012). In doing so, we adapt practical, evidence-based strategies from the adult sleep intervention literature as well as from contextual cognitive behavioral therapy—in particular, acceptance and commitment therapy.

The Possums approach is clearly distinct from the dominant paradigm as well as from the existing alternative paradigm of education and normalization. Before exploring the unique content of the Possums approach, it is necessary to outline clearly what it does not contain. We do not advocate the use of delayed response to cues, feed–play–sleep cycles, sleep algorithms, lists of tired cues, or the avoidance "overstimulation" and "overtiredness."

We Do Not Teach Delayed Response to Cues

A mainstay of the dominant paradigm is delayed response to infant cues; that is, teaching parents to ignore pre-cry or cry cues. The baby is then more likely to move into full-blown cries and loops of unsoothable crying; that is, sympathetic nervous system and hypothalamic–pituitary–adrenal (HPA) upregulation (Douglas & Hill, 2013). We argue that following these instructions, or instructions to respond but not in the way the baby intends, is not consistent with cued care. It results in parental confusion about what cues to which they should be responding, and what the baby's cues might signal. This confusion undermines parental self-confidence.

We Do Not Use Feed–Play–Sleep Cycles

Feed–play–sleep cycles are a key component of the dominant paradigm and are often applied from birth or from about 6 weeks of age. Feed–play–sleep cycles involve establishing a routine of providing the infant with stimulating play immediately after feeds and encouraging the infant to fall asleep, after play, without a feed. The aim is to decouple sleep from feeds and bodily contact and to condition the baby to self-settle when laid down in a solitary sleeping environment. Feeding is theorized to be a learned stimulus cue for sleep and, in fact, to be an inappropriate stimulus cue. Feed–play–sleep cycles are thought to bring sleep under the regulation of other learned stimulus cues such as bedtime routines, which are deemed to be more appropriate. However, we argue that postprandial somnolence, a tendency to fall asleep after feeding, is not learned through operant conditioning. In fact, it is present at birth. Postprandial somnolence is an innate neurobehavior resulting from the effects of parasympathetic nervous system activation, elevated oxytocin, and elevated plasma cholecystokinin. The decoupling of innate neurobehavioral patterns may have unintended outcomes within the complex system for some mother–infant dyads, such as premature cessation of breast-feeding or frequent high levels of arousal of the sympathetic nervous system and the HPA system

(Douglas & Hill, 2013). In the first weeks and months, this may result in a sensitized stress response. Further, we argue that from a behavioral perspective, the appropriate stimulus control of sleep is not an external stimulus at all. We contend that an appropriate stimulus cue for sleep is the internal state of sleepiness or felt sleep pressure.

Feed–play–sleep cycles not only decouple the innate neurobehavioral link between feeds, bodily contact, and downregulation but also the appropriate stimulus of felt sleep pressure from sleep. This decoupling has been theorized to play a role in insomnia in adults (Ong et al., 2012) and is likely to place some infants at risk of developing sleep problems. In addition, feed–play–sleep cycles may have consequences for the parents, as the promotion of feed–play–sleep cycles falsely suggests to parents that their baby's postprandial somnolence was either created by their actions as parents or is not a legitimate cue. This places unnecessary stress on the parent–infant relationship, including on the breast-feeding relationship, at a vulnerable time.

We Do Not Use Sleep Algorithms

The use of sleep algorithms involves advising parents on average sleep patterns and encouraging parents to fit their infant's sleeping patterns to the average. There is marked variability in sleep across cultures and throughout history (Ball, 2008; Ekirch, 2005; Jenni & Carskadon, 2007; Markov et al., 2012). For example, a nighttime sleep pattern of two 4-hr sleeps separated by 2 to 3 hr of quiet wakefulness was common in pre-industrial Western cultures (Ekirch, 2005). The current cultural norm for adults of sleeping in an uninterrupted 8-hr block during night hours is neither necessary nor universal. Variability is a particularly pronounced feature of infant sleep in the first 6 months (Galland, Taylor, Elder, & Herbison, 2012; Henderson et al., 2010; Jenni & Carskadon, 2007). For example, a systematic review of 22 studies of normal infant sleep has concluded that at 2 months of age, the amount of sleep taken in a 24-hr period varies between 9.3 and 20 hr. Similarly, at 3 and 6 months of age, the total normal amounts vary by over 8 hr (Galland et al., 2012). Further, not only is there extensive variation in sleeping patterns between individuals but also very wide variation in each baby's total sleeping times from day to day (Wooding, Boyd, & Geddis, 1990). Historically, for the past 2 centuries, sleep recommendations for children are consistently higher than actual sleep ($\backsim$37 min higher) (Martricciani, Olds, Blunden, Rigney, & Williams, 2012). In other words, there is a consistent cultural tendency in the West to believe that children need more sleep than they are having. There is little empirical evidence to support specific sleep recommendations; that is, the optimal average sleep duration for long-term health is unknown.

The use of sleep algorithms places infants with a low sleep need at particular risk. Algorithms encourage the parents of such babies to ensure that their baby sleeps to longer than his or her individual biological need. This is likely to exacerbate sleeping difficulties because it disrupts the healthy regulation of sleep via the homeostatic sleep regulator, and also may result in cry/fuss problems. In addition, sleep algorithms teach the infant to sleep according to external cues imposed by the parent rather than allowing for appropriate stimulus control of sleep—cued by the internal state of felt sleep pressure.

We Do Not Give Lists of Tired Cues

Having asked parents to ignore or override the powerful biological cue of sleepiness at the end of feeds many times a day, the dominant intervention paradigm then teaches parents to recognize specific infant behaviors as "tired cues" (e.g., yawning, difficulty focusing, or pulling at ears). However, parents learn to make sense of their baby's cues through experimentation, familiarity with context, and pattern recognition. There is significant individual variation in infant cues, and a single behavior in a particular infant may have a variety of different possible meanings depending upon the context. Prescriptive lists of tired cues teach parents to read their babies through a "tired" filter—constantly looking for and finding signs that their baby needs more sleep (Reyna & Pickler, 2009; Swain et al., 2007). Thus, parents may encourage their infant to sleep beyond biological need during the day, which interferes with consolidation of nocturnal sleep and exacerbates sleep difficulties. Further, tired cues often signal states other than tiredness, such as the need for more varied sensory experience. Parental misinterpretation of boredom cues as tiredness represents an opportunity cost to both parent and infant: missed developmental opportunities for environmental enrichment and shared experience. We recognize that with time and flexible experimentation, parents will become adept at reading their own baby's cues.

We Do Not Problematize Stimulation

The dominant intervention paradigm regularly cautions parents about overstimulation and overtiredness. Overstimulation, receiving "too much" stimulation, is thought to make the initiation of sleep more difficult. Further, babies are thought to easily become overtired if parents miss early tired cues, and an overtired baby is thought to have greater difficulty in falling asleep. In fact, with increased tiredness comes a greater tendency to fall asleep—the very definition of sleepiness (high homeostatic sleep pressure) is that the individual, given opportunity, falls asleep. Sleep efficiency can be disrupted by elevated sympathetic nervous system arousal, and the downregulation of arousal is a natural precursor to sleep. However, in infants, this downregulation in arousal of the sympathetic nervous system, with accompanying activation of the parasympathetic nervous system, is most efficiently triggered through feeding and physical contact.

We Do Make Lifestyle Recommendations Shown to Support Healthful Sleep

The Possums Sleep Intervention includes education on the biological regulation of sleep via the circadian pacemaker and the homeostatic regulator as well as on lifestyle factors known to support healthful sleep regulation. Lifestyle practices known to support

healthful sleep include daily exercise, starting the day at a consistent time, obtaining sunlight in the morning, strategic napping, limiting environmental noise at night, and care with caffeine and alcohol intake (Brown, Buboltz, & Soper, 2002; Cheek, Shaver, & Lentz, 2004). In addition, we encourage the caregiver to maintain an active and satisfying lifestyle that includes valued social, physical, and occupational activities, with the baby accompanying him or her. An active and rewarding lifestyle, with baby in tow, establishes healthy biopsychosocial rhythms for both parent and infant, provides the infant with a rich sensory diet, and helps prevent postnatal depression. In fact, the deliberate scheduling of pleasant, valued activities (behavioral activation) is an evidence-based treatment for depression (Jacobson, Martell, & Dimidjian, 2001). We suggest that the baby should be within sensory distance from the caregiver during daytime naps and should be exposed to normal circadian cues of daylight and noise to prevent oversleeping during the day and to help consolidate sleep at night.

We Do Identify Obstacles to Healthy Regulation of Infant Sleep

The Possums approach aims to remove obstacles placed in the way of the healthy function of the homeostatic sleep regulator and the circadian regulator. This includes a systematic assessment for and management of clinical problems which may result in or interact with sleep problems in the first months of life due to upregulation of the sympathetic nervous system and the HPA axis, including unidentified infant feeding problems and infant cry/fuss problems (Douglas & Hill, 2011; Douglas & Shirley, 2013; Douglas & Hill, 2013). We also use lifestyle strategies which help realign a disrupted circadian pacemaker (e.g., obtaining sunlight in the morning).

We Do Support Healthful Stimulus Control of Sleep for Parent and Infant

We understand the appropriate stimulus control of sleep, for both parent and infant, to be the internal state of felt sleep pressure. Within the adult sleep-disturbance literature, the decoupling of sleepiness from sleep is theorized to play a role in the development and maintenance of insomnia (Ong et al., 2012). We contend that it is likely to also place infants at risk of developing sleep problems. In contrast to the dominant paradigm, we recommend that parents allow their infant's sleep to be regulated by sleepiness, allowing infants to fall asleep immediately following a feed. Further, we recommend that parents support appropriate stimulus control of their own sleep by initiating sleep when they themselves feel sleepy (rather than calculating a specific bedtime to obtain a prescribed number of hours of sleep). If parents have come to associate bed with wakefulness, then we recommend that they break this association by reserving their bed for sleeping, breast-feeding, and sexual activity (Taylor & Roane, 2010). After 15 to 20 min of attempting to fall asleep, we recommend that they perform a relaxing activity instead and return to attempting sleep when they experience sleepiness (felt sleep pressure).

We Do Promote Safe Sleep

The Possums Sleep Intervention recommends safe sleeping practices, consistent with the latest evidence (Blair et al., 2006; SIDS and Kids, 2014; Task Force on Sudden Infant Death Syndrome, 2011). In particular, we recommend that the safest place to sleep infants in the first 6 months of life is in the same room as the caregiver, day or night.

We Do Promote Parent and Infant Relaxation

Relaxation training is an effective intervention for insomnia (Irwin, Cole, & Nicassio, 2006), with progressive muscle relaxation, in particular, often used (Taylor & Roane, 2010). Relaxation training promotes sleep by decreasing sympathetic nervous system arousal, and sympathetic nervous system arousal is known to predict adult sleep efficiency (Bootzin & Epstein, 2011). The Possums Sleep Intervention includes specific exercises for physical and psychological relaxation. In addition, parents are encouraged to deliberately schedule pleasant, relaxing activities into their day. Infant relaxation is best promoted through cued care and a rich sensory diet.

We Do Target Parental Cognitive and Metacognitive Processes

Adult sleep difficulties, including in parents, are associated with sleep-related cognitive and metacognitive activity (cognitions about cognitions), including rigid beliefs about sleep, attempts to suppress cognitive activity, and rumination (Harvey, 2002; Ong et al., 2012). All of these cognitive and metacognitive processes increase arousal and hence, ironically, disrupt sleep. Messages about the negative effects of sleep deprivation or deliberate efforts to monitor and reduce infant nocturnal signaling may worsen these sleep-harming cognitive and metacognitive processes, and thus worsen parental sleep (Ong et al., 2012). The Possum's approach aims to disarm this escalating metacognitive trap by encouraging the parent to focus not on attempting to obtain more sleep but on living a meaningful, healthy, and rewarding life.

The Possum's approach targets parental cognitive and metacognitive processes directly with strategies drawn from contextual cognitive behavioral therapy, particularly acceptance and commitment therapy. Mindfulness and acceptance exercises are taught to disrupt cognitive and metacognitive processes, instead supporting psychological presence in the lived moment. Mindfulness has been shown to improve sleep quality in women with breast cancer and to improve sleep efficacy in patients with chronic primary insomnia (Gross et al., 2011; Shapiro, Bootzin, Figueredo, Lopez, & Schwartz, 2003). Further, the use of mindfulness also is likely to prevent postnatal depression through disrupting the dysphoric metacognitive processes that are associated with depressive episodes (Segal, Williams, & Teasdale, 2002).

A full summary of the comparisons between the Possums Sleep Intervention and existing paradigms is given in Table 1.

TABLE 1. *Comparison of the Possums Sleep Intervention to Existing Paradigms*

	Dominant Paradigm: Conventional Behavioral Approaches (0–6 months)	Existing Alternative Paradigm: Normalizing Night-Waking (0–6 months)	New Paradigm: Possums Sleep Intervention (0–6 months)
Aims	To improve well-being of mother and baby in the short- and long-term	To improve well-being of mother and baby in short and long-term	To improve well-being of mother and baby in the short- and long-term
Assumptions	Increased duration of sleep at night without signaling to parents improves maternal mental health and infant development in the short- and long-term. Intervention to condition the infant to self-settle with sleep routines is applicable.	Infant night-waking and irregular daytime sleep are normal, and intervention is not required.	The support of neurobiological synchrony, and parental flexibility and empowerment improve maternal mental health and infant development in the short- and long-term. Parent–infant sleep is a complex adaptive system. The biology of the infant's sleep may be disrupted, for example, through unidentified feeding problems or misalignment of sleep regulators. The biology of maternal sleep may be disrupted, for example, through elevated sympathetic nervous system arousal and related metacognitive processes and behaviors. Intervention to support the healthy biological regulation of infant and maternal sleep is applicable. Intervention to support maternal sleep efficiency, by addressing elevated sympathetic nervous system arousal and related metacognitive processes, is applicable.
Core focus	Entrainment of biology of infant sleep and feeds	Normalizing night-waking and irregular daytime sleep	Removal of unnecessary obstacles to healthy function of sleep regulators in baby, parental empowerment and flexibility (meta-cognition and behavior) to improve maternal sleep efficiency and vital living, direct targeting of elevated sympathetic arousal to improve maternal sleep efficiency
Theoretical base	Operant theory	Evolutionary anthropology	Interdisciplinary Integrates contemporary contextual behavioral science (including operant theory), complexity science, evolutionary anthropology, neuroscience, clinical lactation science, developmental theory
Sleep architecture	Explanations of infant sleep architecture (active and quiet sleep) conveyed to parents in graphs and time algorithms	Infant sleep architecture (active and quiet sleep) determined by observation of baby's cues	Infant sleep architecture (active and quiet sleep) determined by observation of baby's cues
Sleep duration	Expected sleep durations conveyed to parents in time estimates	No time estimates given	No time estimates given
Biological regulation of sleep	Long periods in quiet dark room during day and very early bedtimes at night, which inadvertently result in misalignment of circadian clock with real time	Parents are advised to sleep baby in same room day and night, which helps consolidate sleep nocturnally due to environmental cues.	Parents are taught about two biological sleep regulators and their potential for misalignment; advised to sleep baby in same room day and night, which helps consolidate nocturnal sleep due to environmental cues.
Cues	Parents are advised to *deliberately delay* their responses to baby's cues to entrain biology of baby's sleep.	Parents are advised to respond to their baby's cues.	Parents are taught that cued-care is a *pattern of care characterized by intentionally and sensibly responding* to their baby's cues.
Feeds	Parents are taught to deliberately override the cue of postprandial somnolence and to space out feeds.	Not targeted	Parents are taught to use postprandial somnolence to support healthy function of sleep–wake homeostatic regulator; parents are taught that excessively frequent feeds and associated excessive night-waking in breast-fed babies signal an underlying feeding problem, requiring professional assistance.
Sensory nourishment	Parents are taught strategies (e.g., quiet dark room for daytime sleep, staying at home to develop daytime sleep routines) which inadvertently result in an unbalanced sensory diet.	Parents are taught to sleep baby near enough to exchange sensory cues day and night, and to sleep in an environment with normal light and noise during daytime naps.	Parents are taught to sleep baby near enough to exchange sensory cues day and night, and to sleep in an environment with normal light and noise during daytime naps; encouraged to lead an active and rewarding lifestyle accompanied by the baby, to optimize rich and healthy sensory diet.

(*Continued*)

TABLE 1. *Continued*

	Dominant Paradigm: Conventional Behavioral Approaches (0–6 months)	Existing Alternative Paradigm: Normalizing Night-Waking (0–6 months)	New Paradigm: Possums Sleep Intervention (0–6 months)
Maternal mental health	Not targeted	Not targeted	Acceptance and commitment therapy (ACT) strategies for improved maternal sleep efficiency, improved mental health, and vital living
Safe sleep	Baby slept in separate room during day to avoid "overstimulation."	Baby slept in same room day and night.	Baby slept in same room day and night.
Stimulus control	Appropriate stimulus control of infant sleep is theorized to be external stimulus cues, such as being placed in cot. Feeding is considered an inappropriate stimulus cue.	Not targeted	Appropriate stimulus control of infant sleep theorized to be the internal stimulus of sleepiness or felt sleep pressure.
Parental cognitive and metacognitive processes	Not targeted. Metacognitive and cognitive processes interfering with sleep may be inadvertently worsened in parents.	Not targeted	Parents are taught techniques drawn from ACT.
Relaxation	Infant relaxation may be targeted in sleep routines. However, the easiest methods for promoting infant relaxation, physical contact, sensory nourishment, and feeding are inadvertently restricted. Parent relaxation not targeted and may be inadvertently undermined.	Not targeted	Infant relaxation supported with physical contact, sensory nourishment, and acceptance of falling asleep at the end of feeds or in arms. Parents are taught strategies to support relaxation and techniques from ACT for living a rewarding, active life.

Implications for Practice and Research

The Possums Sleep Intervention was developed from the scientific literature; however, it also will be necessary to test it empirically, and we intend to do so. The Possums approach is deliverable in a flexible and tailored manner by all health practitioners who support parents during early infancy. It also can be delivered directly to parents through web-based modalities. We are currently developing online health practitioner training as well as online information for parents. It is our intention to continue to develop this new paradigm with clinical practice, health practitioner education, and scientific research occurring in tandem, reinforcing and informing each other.

CONCLUSION

In summary, the Possums Sleep Intervention promotes the optimization of neurobehavioral and neurohormonal synchrony between parent and child by supporting sensible cued care; supports parental flexibility and experimentation as the keys to resilience; promotes healthful sleep in parent and infant by supporting the healthy operation of the homeostatic regulator and the circadian pacemaker; targets cognitive and metacognitive processes known to decrease maternal sleep efficacy through mindfulness and acceptance and relaxation strategies; prevents postnatal depression by disrupting ruminative cognitive-affective processes through mindfulness and acceptance; promotes flexible, values-driven actions to increase positive reinforcement; and is consistent with the latest evidence on safe sleeping and SIDS prevention.

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