

# Does Sleep Matter? Impact on Development and Functioning in Infants

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Pennestri and colleagues<sup>1</sup> article “Uninterrupted Infant Sleep, Development, and Maternal Mood” is a glimpse into the question driving much of sleep research: “does sleep matter?” The knee-jerk answer is “of course it does.” Ask any parent of an infant or health care practitioner and the perception is that sleep has to affect development. However, a closer look at the literature provides different answers depending on the study.

Pennestri et al<sup>1</sup> followed 369 infants at 6 and 12 months, completing the Bayley Scales of Infant Development II (BSID-II) at both time points (although it was unclear how many completed the BSID-II at each point). The authors measured the percentage of infants that slept consecutively, as an indication of sleep consolidation, for 6, 8, or 12 hours on the basis of the Self-Administered Questionnaire for the Mother (SQAM). They found no relationship between this measure of sleep and concurrent or predictive mental or motor development as well as no relationship with maternal mood.

Looking beyond the study at hand, there have been a few studies in which researchers investigated the relationship between sleep and development in young children. As in the current study, some authors have found no relationship between the two. For example, J.A.M. conducted a longitudinal study of 117 infants and toddlers (ages 6–18 months) in the United States and found limited relationships between sleep consolidation (on the basis of the Brief

Infant Sleep Questionnaire [BISQ]) and social-emotional functioning (Infant Toddler Social Emotional Assessment)<sup>2</sup> or cognitive development (Bayley Scales of Infant Development III [BSID-III]). We even found modest relationships between an increased number of night wakings and better cognitive outcomes. In another study of 1351 infants in Brazil (ages 3–13 months), J.A.M. found no relationship between any aspect of sleep (BISQ) and developmental outcomes (Ages and Stages Questionnaire [ASQ]).<sup>3</sup> In contrast, there have been several studies noting that fragmented sleep is associated with negative developmental outcomes. In a study of 593 young children, followed from 3 months of age, researchers found that short sleep duration was associated with decreased cognitive development at 2 years of age, as measured via the BSID-III.<sup>4</sup> In a study of 50 infants (10 months of age) in Israel,<sup>5</sup> authors found a significant relationship between more fragmented sleep (number of wakings and sleep efficiency, via actigraphy) and lower mental development on the BSID-II. In another study<sup>6</sup> of 52 infants (12 months of age) in New Zealand, researchers found positive relationships between sleep efficiency (actigraphy) and cognitive development (ASQ). Additionally, in a study of 159 infants in Singapore (Growing Up in Singapore Towards Healthy Outcomes [GUSTO] study),<sup>7</sup> authors found that wake-after-sleep onset at 3 months (BISQ) predicted poorer cognitive, language, and

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motor domain scores (BSID-III). Finally, in a recent study in China,<sup>8</sup> researchers found no association between sleep duration (BISQ) and cognitive development (Bayley Scales of Infant Development I) in 2- to 30-month-olds, although more frequent nighttime awakenings were associated with poorer cognitive performance. Furthermore, infants with a moderate number of night awakenings (approximately twice per night) had better cognitive performance than those with no night wakings or those with  $\geq 3$  wakings per night.

It is intriguing that results of these studies yield no clear consensus. There is a number of possible explanations. First, there are significant measurement differences across studies for both sleep (SQAM versus BISQ versus actigraphy) and development (Bayley Scales of Infant Development I versus BSID-II versus BSID-III versus ASQ). The age of the infants as well as where the studies were conducted also differ, which may reflect age-related and cross-cultural differences<sup>9</sup> in effects of sleep on development. Furthermore, the primary sleep outcomes (sleep duration; sleep consolidation: longest stretch or number and duration of night wakings) differ across studies.

More importantly, it may be that we are not asking the right questions. Broad cognitive and motoric development are likely highly affected by factors such as genetics, nutrition, parent-child interaction, and parental education. Thus, sleep may be a drop in the bucket for broad development but, instead, have a more significant impact on next-day functioning. Additionally, there may be subgroups of infants differentially affected by sleep, such as those with neurodevelopmental

conditions. Furthermore, there may not be a direct relationship between sleep and development but rather it may be more complex. For example, differential biological reactivity may lead some children to express poorer developmental outcomes in the context of poor sleep and better outcomes in the context of good sleep, whereas other children are more resilient to insufficient or disrupted sleep. By looking at group data, individual differences in response to sleep problems may get lost.

Rather than investigating gross development, we propose that day-to-day functioning and skill development may be better indicators of the impact of sleep on development in early childhood. For example, studies have revealed that sleep in infants is important for memory consolidation<sup>10</sup> and language learning.<sup>11,12</sup>

Does sleep matter? The answers likely depend on targeted questions that involve complex relationships and assess day-to-day functioning in young children and their families. Thus, the jury is still out.

#### ABBREVIATIONS

ASQ: Ages and Stages Questionnaire  
 BISQ: Brief Infant Sleep Questionnaire  
 BSID-II: Bayley Scales of Infant Development II  
 BSID-III: Bayley Scales of Infant Development III

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