

# Outcomes of Infant Sleep Problems: A Longitudinal Study of Sleep, Behavior, and Maternal Well-Being

Peiyoong Lam, MBBS; Harriet Hiscock, MBBS; and Melissa Wake, MBChB, MD

**ABSTRACT.** *Objectives.* In a community sample of children aged 3 to 4 years with previous infant sleep problems, we aimed to 1) establish proportions with recurring, persisting, and resolving sleep problems; 2) identify early predictors of later sleep problems; and 3) identify comorbidities of persistent or recurrent sleep problems at age 3 to 4 years.

*Methods.* A follow-up community survey was conducted of mothers of children aged 3 to 4 years who had, as 8- to 10-month-old infants with identified sleep problems, participated in a community-based, randomized, controlled trial of a brief sleep intervention from 3 middle-class local government areas in Melbourne, Australia. Infant sleep problems (standardized maternal questionnaire), maternal well-being (Edinburgh Postnatal Depression Scale), child behavior problems (Child Behavior Check List for ages 1.5 to 5 years), marital satisfaction (Dyadic Adjustment Scale), and family functioning (General Functioning Scale, McMaster Family Assessment Device) were measured.

*Results.* Seventy-three percent (114 of 156) of mothers responded, 36 (32%) of whom reported a current problem with their child's sleep. Current sleep problems were similar regardless of infant sleep intervention. Twelve percent (14 of 114) reported that their child's sleep problem had persisted, and 19% (21 of 113) reported that it had recurred. Children with current sleep problems were more likely still to be nursed to sleep by an adult and had slightly higher mean scores on Child Behavior Check List subscales for Aggressive Behavior (54 vs 52) and Somatic Problems (55 vs 53). Their mothers had higher Edinburgh Postnatal Depression Scale scores (median: 8 vs 5) and more difficulties with their partner undermining the management of their child. However, early depression did not predict current sleep problems. Families of children with sleep problems were functioning as well as those without sleep problems.

*Conclusions.* Persistence or recurrence of infant sleep problems in the preschool years is common and is associated with slightly higher child behavior problems and maternal depression scores. Results suggest that depressive symptoms are a result rather than cause of sleep problems. Despite this, families of children with sleep problems are functioning well. *Pediatrics* 2003;111:e203-e207. URL: <http://www.pediatrics.org/cgi/content/full/111/3/e203>; *childhood sleep disorder, per-*

*sistence, longitudinal study, maternal depression, behavior problems.*

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ABBREVIATIONS. EPDS, Edinburgh Postnatal Depression Scale; CBCL, Child Behavior Check List.

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Between 36%<sup>1</sup> and 45%<sup>2</sup> of Australian parents report a problem with their infant's sleep in the second 6 months of life. Despite the prevalence of infant sleep problems and their associated morbidities,<sup>2-7</sup> few studies have examined the natural history of early infant sleep problems.<sup>7-9</sup> These few have suffered from small sample sizes<sup>8,9</sup> or followed infants with severe sleep problems only.<sup>7,9</sup>

Only 1 study has sought to identify predictors of persistent sleep problems and found that maternal depression in infancy was associated with persistent sleep problems in the preschool years.<sup>7</sup> No study has examined family functioning or maternal well-being once an infant with a sleep problem has reached the preschool age. We do not know whether families of infants with sleep problems experience ongoing stress, discord, or maternal depression.<sup>2-4,6,7</sup> Data about the natural history of sleep problems and their consequences could be useful for health professionals who counsel parents about the likely outcomes for their child with sleep problems.

Several randomized, controlled trials have shown that infant sleep problems are amenable to treatment with behavioral interventions in the short term.<sup>8,10,11</sup> However, little is known about the efficacy of behavioral intervention beyond 4 months and whether such interventions are used by parents for subsequent children with sleep problems.

In 1998, we conducted a randomized, controlled trial of a simple, behavioral infant sleep intervention (the Infant Sleep Study) that led to significant reductions in infant sleep problems and maternal report of depression symptoms 4 months later.<sup>10</sup> In 2001, when the children were aged 3 to 4 years, we followed the participants of the earlier trial, all of whom had sleep problems at entry to the Infant Sleep Study. We aimed to 1) establish proportions of children with recurring, persisting, and resolving sleep problems; 2) identify early predictors of later sleep problems; and 3) identify whether persistent or recurrent sleep problems at age 3 to 4 years are associated with comorbidities such as child behavior

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Received for publication Jul 3, 2002; accepted Nov 12, 2002.

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problems, maternal depression, and poor family functioning.

## METHODS

### Design

This study comprised a follow-up survey of a group of mothers who, 3 years earlier, had participated in a community-based, randomized, controlled trial ( $n = 156$ ) of a brief sleep intervention designed to improve both infant sleep and maternal well-being (the Infant Sleep Study).<sup>10</sup> The mother–infant pairs were recruited from a large community survey in 3 middle-class local government areas in Melbourne, Australia, which has been described in detail elsewhere.<sup>2</sup> Briefly, mothers who reported a problem with their infant's sleep were randomized into a control group (given written information about normal sleep) or intervention group (behavior management). Behavior management consisted of standard sleep strategies such as controlled crying, "camping out," and phasing out sleep associations such as the use of a pacifier or frequent night feeds.<sup>10</sup> At follow-up, intervention mothers reported significantly fewer infant sleep problems and depression symptoms than control mothers, particularly those mothers who were depressed at recruitment.<sup>10</sup>

When their children were aged 3 to 4 years, all mothers who had taken part in the Infant Sleep Study were mailed an invitation to participate, a study information sheet, and the written study questionnaire. A second questionnaire package was sent to mothers who had not returned the first package after 1 month.

### Measures

#### Baseline (6–12 Months)

Mothers recorded details of their child's sleep over the past 2 weeks and whether they considered their child's sleep to be a problem; if yes, then mothers rated its severity on a 7-point visual analog scale. Maternal symptoms of depression were assessed using the Edinburgh Postnatal Depression Scale (EPDS), a 10-item scale with scores ranging from 0 to 30. Scores  $\geq 10$  and  $> 12$  indicate probable depression in community and clinical samples, respectively.<sup>12,13</sup> Mothers rated their stress levels (1 = "no problems or stresses" to 5 = "many problems and stressful") and coping (1 = "extremely well" to 5 = "not at all") on global 5-point scales.<sup>14</sup> Two additional questions assessed limits on daily functioning as a result of maternal emotional or physical health problems (adapted from a generic health measure, the SF6).

#### Outcome (3–4 Years)

Mothers recorded details of the same child's sleep details over the past 2 weeks and whether they considered their child's sleep to be a problem. If the child's sleep was a problem, then mothers rated its severity on the same 7-point visual analog scale used at 6 to 12 months. Intervention mothers were asked whether they had used sleep strategies taught in the Infant Sleep Study for their child or any additional children who may have developed sleep problems. All mothers were asked whether they had sought extra help for their child's sleep problem. Mothers again completed the EPDS and rated stress, coping, and daily functioning.

The Child Behavior Check List (CBCL; for ages 1.5 to 5 years) was used to quantify behavior issues. It has been validated to detect clinically significant internalizing and externalizing child behavior traits.<sup>15,16</sup> Factors potentially associated with child sleep and behavior problems were assessed, including marital satisfaction (measured by the single-item version of the Dyadic Adjustment Scale)<sup>17</sup> and parenting (measured by 3 study-designed, 4-point global scales addressing day-to-day behavior, sleep issues, and parent cooperation). Family functioning was measured by the General Functioning Scale section of the McMaster Family Assessment Device. Mean scores of 2.0 or more on this 12-item validated scale are considered indicative of unhealthy family functioning.<sup>18,19</sup> Ethics approval was obtained from the Ethics in Human Research Committee of the Royal Children's Hospital, Melbourne, Australia.

### Analyses

Proportions of children with recurrence, resolution, and persistence of sleep problems were calculated. Current sleep problems

(yes/no) and maternal depression scores were compared between those who originally were in the intervention and control groups. Outcome measures were compared between children with and without a sleep problem at outcome. Two logistic regression models were designed to 1) determine significant early (6–12 months) predictors of sleep problems at 3 to 4 years, controlling for group membership, and 2) determine significant concurrent correlates of sleep problems at 3 to 4 years. Categorical data were compared with  $\chi^2$  test, whereas continuous 2-group comparisons were made with 2 sample  $t$  tests or Mann Whitney  $U$  tests as dictated by data distributions. All data were analyzed with Stata, Version 6.0 (Stata Corp, College Station, TX).

## RESULTS

### Sample Characteristics

A total of 114 of the 156 mothers from the original Infant Sleep Study completed the survey, a response rate of 73%. The mean age of mothers was 37 years (standard deviation: 4; range: 28–51). The majority of the mothers were employed (52%) and were married or in a de facto relationship (94%) with partners who were employed (97%). The mean age of the children was 43 months (standard deviation: 4; range: 36–51), 57% were male, and 88% of families had 2 or more children.

There was no significant difference between responders and nonresponders in the initial severity of their child's sleep problem, initial EPDS score, presence of a sleep problem at the end of the Infant Sleep Study, maternal employment status, or the number of children in the family. However, nonresponders were more likely to be from the control than intervention group of the Infant Sleep Study ( $\chi^2 = 4.69$ ;  $P = .03$ ).

### Sleep Patterns

Night waking at 3 to 4 years of age continued to be common. Seventy-eight percent of mothers reported that their child awoke overnight at least once during the week, and of these waking children, 43% (38 of 89) were reported to awake 4 or more nights per week. Mothers most often responded to their child overnight (53%); in only 7% of cases did no one respond to the child overnight (Table 1).

### Persistence, Resolution, and Recurrence of Sleep Problems

Despite the prevalence of night waking, just 32% (36 of 114) of mothers reported a current problem with their child's sleep. Of these, 49% rated the severity of the sleep problem as being  $\geq 4$  out of a possible 7 (Table 1). Forty-seven percent of all mothers reported that their child had had additional problems with sleep since completing the Infant Sleep Study.

Twelve percent (14 of 114) of children had a persistent sleep problem, ie, had a sleep problem both at the end of the Infant Sleep Study and at the time of this survey. Of these children, 57% of mothers rated the severity of their sleep problem as being  $\geq 4$  out of a possible 7.

Nineteen percent of children (21/113 as 1 mother completed this survey but not the questionnaire at the conclusion of the Infant Sleep Study) had recurrent sleep problems, ie, had no sleep problem at the

**TABLE 1.** Sleep Characteristics of 3- to 4-Year-Old Children

Variable	<i>n</i>
Sleep problem (%)	32
Severity of sleep problem (%; range 1–7)	
≤3	51
4–5	38
6–7	11
Adult nurses child to sleep (%)	22
Sleep site (%)	
Own bed in own room	64
Own bed in sibling's room	22
Parent's bed	11
Other	3
Evening bedtime (PM)	
Mean (SD)	7:53 (42 min)
Range	6:30–10:00
Time taken to fall asleep (min; median [range])	15 (1–75)
Number of disturbed nights per week (%)	
0	22
1	11
2	16
3	18
4 or more	33
Number of wakings per night (%)	
0	39
1	47
2	13
3	2
Who responds to the waking child overnight (%)	
No one	7
Mother	53
Father	17
Child comes to parent's bed	15
Other	8
Duration of night waking (min)	
Median	5
Range	1–30
Morning rising (AM)	
Mean	6:55 (38 min)
Range	5:30–8:00
Number of naps per day (%)	
0	52
1	48
Length of usual nap (min)	
Mean (SD)	80 (30)
Range	25–180

SD indicates standard deviation.

conclusion of the Infant Sleep Study but were reported to have a sleep problem at the time of this survey. Of these children, 38% of mothers rated the severity of their sleep problem as being  $\geq 4$  out of a possible 7.

Of the 78 (68.5%) children in the original study who were not perceived to have a sleep problem at follow-up, 12% (9 of 78) were in fact awaking 4 or more times per week. There was no significant difference in the prevalence of perceived sleep problems in the children of the original intervention versus control group (36% vs 26%,  $\chi^2 = 1.3$ ,  $P = .3$ ).

### Use of Sleep Strategies

Of the mothers who had reported a problem with their child's sleep, 58% (31 of 53) of mothers from the original intervention group reported using sleep strategies taught during the Infant Sleep Study for ongoing management of their child's sleep behavior. Of the mothers who had  $>1$  child, 53% (54 of 101) reported that they had other children with sleep problems. Of these 54 mothers, 30 had been in the

intervention group in the Infant Sleep Study and 75% of them reported that they had used the sleep strategies learned from the Infant Sleep Study for their other children.

### Factors Associated With Persistent Sleep Problems

In the logistic regression models, no infant, maternal or family factors from the original Infant Sleep Study (conducted when the children were aged 6–12 months) predicted the presence of sleep problems at the age of 3 to 4 years. Current sleep patterns associated with a sleep problem included frequent night waking ( $P < .0001$ ) and requiring the presence of an adult to nurse the child to sleep ( $P = .003$ ). Neither the presence of daytime napping, male gender or where the child spent most of the night were associated with maternal report of a sleep problem.

### Child Behavior

The mean CBCL scores obtained for all individual subscales were close to mean values for the normative sample, as were the mean summary scores for internalizing and externalizing behavior.<sup>15</sup> With the exception of the Sleep Problems subscale, the maximum values obtained all were below the clinically significant cutoff of the 98th percentile. Although not reaching the clinically significant cutoff, children with sleep problems had significantly higher mean scores on Internalizing and Externalizing Behavior and the Aggressive Behavior and Somatic Problems subscales of the CBCL than children without sleep problems (Table 2).

### Maternal Well-Being

Twenty-seven percent of mothers scored  $\geq 10$  on the EPDS, and 16% scored  $>12$ . This is similar to the prevalence (15.4%) in a representative sample of mothers in the same Australian state.<sup>20</sup> There was no significant difference in the median EPDS scores for mothers who had received an intervention during the Infant Sleep Study and the mothers in the control group (7 vs 5.5,  $z = 0.62$ ,  $P = .54$ ).

Mothers of children with sleep problems at 3 to 4 years had higher median EPDS scores (8 vs 5;  $P = .008$ ; 95% confidence interval:  $-4.5$ – $0.7$ ), reported more limitations of daily functioning as a result of physical health problems ( $P = .03$ ), and reported that their partner undermined their management of their child's behavior ( $P = .04$ ). Mothers of children with and without sleep problems did not differ in how they were coping, their stress, their family functioning, or their marital satisfaction (Table 2).

### DISCUSSION

This is the first study to examine the long-term outcomes of sleep problems in a community sample of infants, together with the long-term impact of a behavioral sleep intervention on infant sleep problems. Sleep problems were identified in approximately one third of the 3- to 4-year-old children surveyed, all of whom had had significant sleep problems as infants. These children at 3 to 4 years were more likely to need an adult to nurse them to sleep. They also had higher Internalizing and Exter-

**TABLE 2.** Association Between Independent Variables at age 3 to 4 Years and Current Sleep Problems

Variable	Sleep Problem		$\chi^2/z$	P Value
	No (n = 78)	Yes (n = 36)		
Child behavior				
Adult nurses child to sleep (%)	14	39	8.8	.003
CBCL subscale scores				
Anxious/Depressed				
Mean (SD)	53 (4)	53 (5)		
Range	50–68	50–63	–0.35	.7
Withdrawn				
Mean (SD)	53 (4)	54 (5)		
Range	50–67	50–66	–1.16	.2
Somatic Problems				
Mean (SD)	53 (4)	55 (6)		
Range	50–70	50–75	–2.34	.02
Aggressive Behavior				
Mean (SD)	52 (4)	54 (5)		
Range	50–68	50–70	–2.3	.02
Destructive Behavior				
Mean (SD)	51 (3)	52 (3)		
Range	50–63	50–61	–0.7	.5
Internalizing Behavior				
Mean (SD)	45 (10)	50 (8)		
Range	30–67	30–64	–2.0	.05
Externalizing behavior				
Mean (SD)	45 (8)	49 (8)		
Range	30–63	36–64	–2.4	.02
Maternal well-being				
EPDS score				
Median	5	8		
Range	0–18	2–20	–2.7	.008
Limits to functioning as a result of problems with emotional health (%)				
None — a little	88	83		
Some — lots	12	17	0.6	.5
Limits to functioning as a result of problems with physical health (%)				
None — a little	78	58		
Some — lots	22	42	4.8	.03
Coping				
Mean (SD)	3.7	3.8		
Range	2–5	2–5	0.09	.9
Degree of stress				
Mean (SD)	2.6	2.5		
Range	1–4	2–4	0.6	.6
Parenting and Family Functioning				
Family Global Functioning Score				
Median	1.6	1.7		
Range	1–2.8	1–2.4	–0.2	.8
Marital satisfaction				
Mean (SD)	4.7	4.5		
Range	2–6	1–7	0.76	.4
Parental agreement on management of child’s behavior (%)				
Never–sometimes	15	11		
Most of the time	57	77		
All of the time	28	12	4.5	.1
Parental agreement on management of child’s sleep (%)				
Never–sometimes	13	17		
Most of the time	60	69		
All of the time	27	14	2.1	.3
Partner undermines management (%)				
Never	59	45		
Sometimes	37	40		
Most of the time	1	14		
All of the time	1	0	8.6	.04

SD indicates standard deviation.

nalizing Scores and Aggressive Behavior and Somatic Problems subscale scores of the CBCL than children without sleep problems. Their mothers had higher EPDS scores as well as difficulties with their partner undermining the management of their child. Despite this, the children and their families were

generally functioning well, and 69% of mothers reported that their child’s sleep problem had resolved from infancy. The resolution of sleep problems in children who had received an infant sleep intervention was similar to those who had not.

Thirty-two percent of our cohort had sleep prob-

lems at 3 to 4 years, slightly lower than the 41% reported in another longitudinal study of 308 infants.<sup>7</sup> However, in that study, no behavioral intervention was offered and persistence of a sleep problem might therefore be more likely.<sup>7</sup>

We were interested in the generalizability over time of the behavioral interventions taught during the Infant Sleep Study. Of the mothers who were in the intervention group and had another child with sleep problems, 75% were able to use the sleep strategies learned from the Infant Sleep Study to manage these problems. We could find no other study that reported on generalizability of sleep behavior interventions.

Our study also explored the relationship among child sleep problems and maternal well-being, family functioning, and child behavior. Maternal depression has been repeatedly associated with sleep disturbance in childhood,<sup>7,21</sup> and in at least 1 study, it predicted persistent child sleep problems.<sup>7</sup> In contrast, maternal EPDS score at age 6 to 12 months did not predict sleep problems at the age of 3 to 4 years in this study. However, current maternal EPDS score was significantly higher in mothers who had children with a sleep problem. This suggests that high EPDS scores may be a consequence rather than a cause of childhood sleep problems. Previous studies have suggested that children with sleep problems are more likely to display more externalizing behavior problems.<sup>4</sup> Although a similar pattern was seen in our cohort, the severity of externalizing behavior problems in children with persistent sleep problems did not fall into the clinical range.<sup>5</sup>

The strengths of this study include the prospective nature of the data collection. The high response rate (73%) in this sample suggests that our results are likely to be representative of a middle-class Australian population. Response bias was likely to be minimal as mothers who did not respond were no more likely to be depressed or report more severe infant sleep problems at baseline than mothers who did respond. However, because data were collected from middle-class families, results of this study may not generalize to a wider population. Mothers reported on child sleep, child behavior, and their own well-being. Although depressed mothers may be more likely to perceive their child as having difficulties with sleep, this was not evident in our previous community sample ( $n = 738$ ).<sup>2</sup> In fact, child sleep patterns were identical for problem sleepers whether they were reported by depressed or nondepressed mothers.<sup>2</sup>

Despite the high incidence of night waking in our cohort, families and children are generally functioning well. Most sleep problems do resolve, but almost 1 in 5 will return. This may be because the nature

of the sleep problem may have changed such that the sleep strategies taught in the original study may no longer be appropriate. Alternatively, "booster sessions" may be required to maintain treatment effects. Therefore, families should be encouraged to generalize the use of simple sleep strategies to other children when appropriate or seek additional help if sleep problems recur.

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*Pediatrics* 2003;111;e203

DOI: 10.1542/peds.111.3.e203

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