

*BEHAVIOR MANAGEMENT OF INFANT SLEEP DISTURBANCE*

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Using a nonconcurrent multiple baseline design, we evaluated the effects of extinction and stimulus control on nighttime sleep disturbances exhibited by 7 infants. Results showed that frequency and duration of night wakings decreased for all subjects, with corresponding improvements reflected through changes in responses to the sleep behavior scale. Observed improvements maintained at 3 and 24 months posttreatment.

DESCRIPTORS: infants, behavior management, parent training, infant sleep disturbance, night waking

The most common infant sleep disturbance is night waking, a phenomenon exhibited by one fifth to one half of all infants in the age range of 6 to 24 months (Basler, Largo, & Molinari, 1980; Bernal, 1973; Blurton-Jones, Rossetti-Ferreira, Farguar-Brown, & McDonald, 1978; Moore & Ucko, 1957; Richman, 1981a, 1981b). Often noted by parents as a significant child-rearing difficulty (Ragins & Schachter, 1971; Richman, 1981a), night wakings have also been linked with an increased rate of maternal malaise (Richman, 1981a; Van Tassel, 1985), marital discord (Chavin & Tinson, 1980; Richman, 1981a), and even child abuse (Chavin & Tinson, 1980).

There is evidence that infant sleep disturbance has a physiological and maturational basis. For example, Anders, Carskadon, and Dement (1980) describe frequent REM bursts in infants that cause them to be more likely than older children to wake regularly during the night.

No clear causal relationship between parental behavior and infant sleep disturbance has been established (Bernal, 1973). However, the successful application of behavioral interventions, such as withdrawal of reinforcement and the use of stimulus control in establishing bedtime routine, is sugges-

tive of a role for parental attention (Jones & Verduyn, 1983; Richman, Douglas, Hunt, Lansdown, & Levere, 1985; Rickert & Johnson, 1988; Seymour, Bayfield, Brock, & During, 1983; Seymour & France, 1984; Williams, 1959). Parents of sleep-disturbed infants try a wide range of management techniques (Blurton-Jones et al., 1978; Moore & Ucko, 1957). This may result in maintenance of night waking by intermittent parental attention.

To the extent that parents may play a role in maintaining night waking by reinforcing behaviors such as spontaneous calling, and so may become a setting event for resumption of sleep (Ferber, 1985), then stimulus control in combination with extinction may be an effective intervention package for the management of infant sleep disturbance.

There is little or no evidence that the problem remits without treatment (Jenkins, Bax, & Hart, 1980). Through a longitudinal study, Basler et al. (1980) found an increased rate of night waking at 4 to 5 years of age compared to that observed during earlier years, and several authors have found an association between earlier and later sleep problems (Blurton-Jones et al., 1987; Chavin & Tinson, 1980; Holliday, Sibbald, & Tooley, 1987; Kataria, Swanson, & Trevathan, 1987).

Investigators using extinction, stimulus control, and other operant strategies (Jones & Verduyn, 1983; Richman et al., 1985; Rickert & Johnson, 1988; Seymour et al., 1983; Seymour & France, 1984) have failed to separate infants from other age groups despite clear developmental differences

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in the organization of sleep stages and the availability of language-mediated techniques among older children. In addition, several of these studies lack experimental rigor in that they do not apply the same interventions across subjects (Jones & Verduyn, 1983; Richman et al., 1985) or they use AB designs (Williams, 1959). Alternatives to behavioral management techniques have been limited largely to prescriptions of medications (Richman, 1985; Russo, Gururaj, & Allen, 1976), such as trimeprazine and diphenhydramine, that may meet with low acceptability among consumers and are typically only effective in the short term.

The present study sought to establish, using a nonconcurrent multiple baseline design across subjects, the efficacy of extinction and stimulus control in the management of infant sleep disturbances, including night waking and other relevant behaviors.

## METHOD

### *Subjects and Setting*

Subjects were 2 girls and 5 boys, ranging in age from 8 to 20 months, who were referred by community health nurses because of sleep disturbance. Parents were informed of the aims of the study and consented to their child's participation. Criteria for inclusion were that subjects be between 6 and 24 months of age, with sleep disturbance being of concern to parents. Potential subjects with physical illness (e.g., asthma), developmental delay, emotional disturbance (e.g., separation anxiety), or other family problems (e.g., severe marital discord) in addition to sleep disturbance would have been excluded, but these criteria applied to none of those referred.

Considerable background information was obtained. Parents' ages ranged from 25 to 45 years; fathers' occupations ranged from professional and administrative work to skilled work (Elley & Irving, 1972). All mothers were full-time homemakers; one father had shift work, the remainder, regular work hours. All infants were members of nuclear, two-parent families; 4 infants were only children,

and 3 had one older sibling. Three families used a regular babysitter; the rest had never done so. Six infants slept in their own room in a cot; 1 slept in her parents' bed. Three infants had experienced disruptions caused by relocation of and/or alterations to the home. Two families reported behavior problems exhibited by an older sibling. One infant had a feeding problem and 1 infant was described as being overactive. Each pair of parents had consulted the community health nurse and their mothers or mothers-in-law about the sleep problem. Four couples had consulted their family doctor and/or friends, and one each had consulted a pharmacist, a counselor, and books.

A developmental history was obtained for each child. This included details of pregnancy, birth history, feeding (6 infants were established on solid food), crying (2 babies had suffered colic prior to 3 months of age), activity levels, early sleep pattern (4 infants having had a regular sleep pattern at 3 months), and medical history. All babies were healthy at the time of the interview.

Four of the children had never settled to sleep through the night, and the other 3 developed sleep disturbance from 4 months of age, with illness being identified as the clear precipitant in 2 of these latter 3 subjects. All parents had used reassurance as well as other management approaches, such as taking the child to the parents' bed (2), night feeding (4), and verbal reprimands (1). Four parents had unsuccessfully used ignoring, and 5 parents had unsuccessfully used one or more anticholinergic sedatives, specifically trimeprazine, doxylamine, promethazine, and/or chlorpheniramine. No child was on medication at the time of the interview.

### *Target Behaviors*

Night waking was defined as any noise from the child, sustained for more than 1 min, heard between the time of sleep onset (first substantial period of quiet) and an agreed upon waking time (usually 6 a.m.). Although it was not possible to discriminate systematically between sleep and quiet wakefulness, this was not considered to be problematic given

that, together, both constitute typical sleep patterns (Anders, 1980). Parental attention was defined as any interaction between the parents and the child.

### *Design and Procedures*

Enrolled children were assigned to a nonconcurrent multiple baseline design (Watson & Workman, 1981). An initial screening and history-taking interview was conducted with parents prior to baseline. Baselines, during which parents were instructed to respond to their child as they typically did, were at least 7 days long. During parent training, emphasis was given to the infant's vulnerability to waking based on REM-NREM sleep cycles (Anders et al., 1980), the probable role of reinforcement in maintaining the behavior, and the importance of achieving stimulus control with a standard bedtime ritual. When necessary, assistance was given to parents in deciding alternative sleeping arrangements. The principle of extinction was described, as was the importance of consistent planned ignoring. Parents were instructed to discontinue the use of previous management techniques and were prepared to expect an initial increase in the frequency and variability of awakenings. They were also cautioned against effecting intermittent schedules of reinforcement.

The following standard program was prescribed:

At bedtime, carry out your usual bedtime routine (story, song, etc.). Then, place (*child's name*) in bed. Bid him or her "Good night" and immediately leave the room. Do not return unless absolutely necessary. If absolutely necessary, check your child (when illness or danger is suspected), but do so in silence and with a minimum of light.

Parents were also questioned regarding their ability to determine illness and distress in their child and were instructed to call the experimenter (available 24 hr per day) if there was any concern about the program or the child's well-being. In the case of illness, parents discontinued the program until symptoms abated. Parents were telephoned daily to check and reinforce compliance. When the child

had slept through the night on two or three occasions and the parents were comfortable with less frequent contact (usually after 1 week), frequency of contacts decreased to an average of one to two per week. The child's need for continued daytime interaction with parents was stressed. In each case the intervention program was in effect for 4 weeks.

Contingent upon the development of a stable sleep pattern (defined as the elimination of night waking more than once or twice in a week), a maintenance program was instituted and record keeping was discontinued. During the maintenance phase, parents were instructed to check on their child if he or she called, but to leave immediately if there was no acceptable reason (e.g., illness) for the call. Should waking in excess of once or twice a week resume, parents were instructed to return to the initial program.

### *Data Recording and Reliability Assessment*

Data recording was conducted by the parent(s) using a sleep behavior record sheet. On this sheet they recorded the time, location, and duration of daytime sleep; planned and actual bedtime; time from placement in bed to silence; type of noise emitted by the child (e.g., crying or chatting); number, time, and duration of awakenings; nature of parental attention and time of morning awakening. The record sheets were completed daily during both baseline and intervention phases. Follow-up data were collected for 2-week periods at approximately 3 months and 2 years after initiation of the maintenance program.

Each infant's sleep pattern was assessed using mean weekly scores on the sleep behavior scale (Richman, 1981a), with higher scores indicating more sleep disturbance. This scale has no established psychometric properties but does provide a standard, comparable method of summarizing a wide range of observations, thus accommodating variability in the topography of infant sleep disturbance. Sleep-relevant behaviors assessed by the scale included sleep onset latency, defined as elapsed time from being put to bed until silence; the number of nights per week in which night waking was

observed; mean number of awakenings each night; weekly mean time awake per awakening; mean total hours spent sleeping per day; and total hours spent in parents' bed per week. Scores on individual items were summed to give a daily score of 0 to 24.

Two methods of checking the reliability of parental records were used. A record was kept of parents' descriptions of their child's sleep pattern during the daily telephone checks; this was compared with the written record sheets when the latter were collected. By the second follow-up, a reliability measurement system had been developed using a voice-activated relay (VAR), with a microphone 1 m from the child's head calibrated to operate at 80 dB and a switch-mat (1 m by 0.5 m) placed on the floor next to the child's bed designed to detect movement of either parent or child at the side of the bed. Both of these recording devices were coupled to individual channels on an Esterline-Angus event recorder. They were employed with Children 3, 4, and 6. Child 1 was not available for the second follow-up assessment. Child 2 was distressed by the equipment (which made a slight noise during operation). Child 5 shared a bedroom with a sibling, making it impossible to ascertain which child had vocalized, and Child 7 lived out of town. In these cases, the other parent was asked to record independently.

Using a point-by-point ratio (Kazdin, 1982), levels of interobserver agreement were calculated separately for frequency and duration of awakening. Positive agreement for an awakening was defined as both observers or recording systems noting its occurrence within a 15-min period. For duration of awakening, agreement was scored if the two values were within 5% of one another. The mean level of agreement between the VAR and parent records was 95% (range, 93% to 100%), for both number and duration of awakenings. The mean level of agreement between switch-mat recordings and parents' records was 97% (range, 93% to 100%). The mean level of agreement between both parents' records was 96% (range, 87% to 100%) for number of awakenings and 89% (range, 82% to 100%) for duration. The mean level of agree-

ment between the parents' written and telephone verbal reports was 90% (range, 73% to 100%) for the number of wakings and 82% (range, 73% to 100%) for duration.

## RESULTS

By the end of the intervention, all subjects demonstrated improvements over baseline on all measures. These improvements were maintained during both follow-up assessment intervals.

### *Frequency of Awakenings per Night*

Figure 1 presents the frequency of awakenings across subjects and experimental conditions. All subjects showed decreases in the number of awakenings per night from baseline ( $M = 3.31$ ; range, 1.36 to 5.14) to intervention phases ( $M = 0.83$ ; range, 0.34 to 1.68). In all cases, except that of Child 3, these decreases were marked and were maintained at both first ( $M = 0.45$ ; range, 0.00 to 1.23) and second ( $M = 0.16$ ; range, 0.00 to 0.50) follow-up assessments, with corresponding decreases in variability. Child 3's means for the intervention phase (1.68 awakenings per night) and follow-up assessments (1.23 and 0.29 awakenings per night, respectively) were inflated artificially by suspension of the program because of illness.

### *Duration of Awakenings per Night*

Figure 2 presents the duration of awakenings across subjects and experimental conditions. All subjects showed decreases in the duration of awakening each night from baseline ( $M = 50.3$ ; range, 9.9 to 100.7 min) to intervention phases ( $M = 17.1$ ; range, 3.7 to 30.3 min). These improvements were maintained during both follow-up periods ( $M = 7.1$ ; range, 0.0 to 29.5 min;  $M = 2.8$ ; range, 0.0 to 9.9 min, respectively). Child 3's illness also affected the duration of his awakenings.

### *Sleep Behavior Scale*

Figure 3 presents mean weekly scores on the sleep behavior scale across subjects and experimental conditions. All subjects showed decreases in their scores (baseline:  $M = 10.24$ , range, 6.9 to 16;

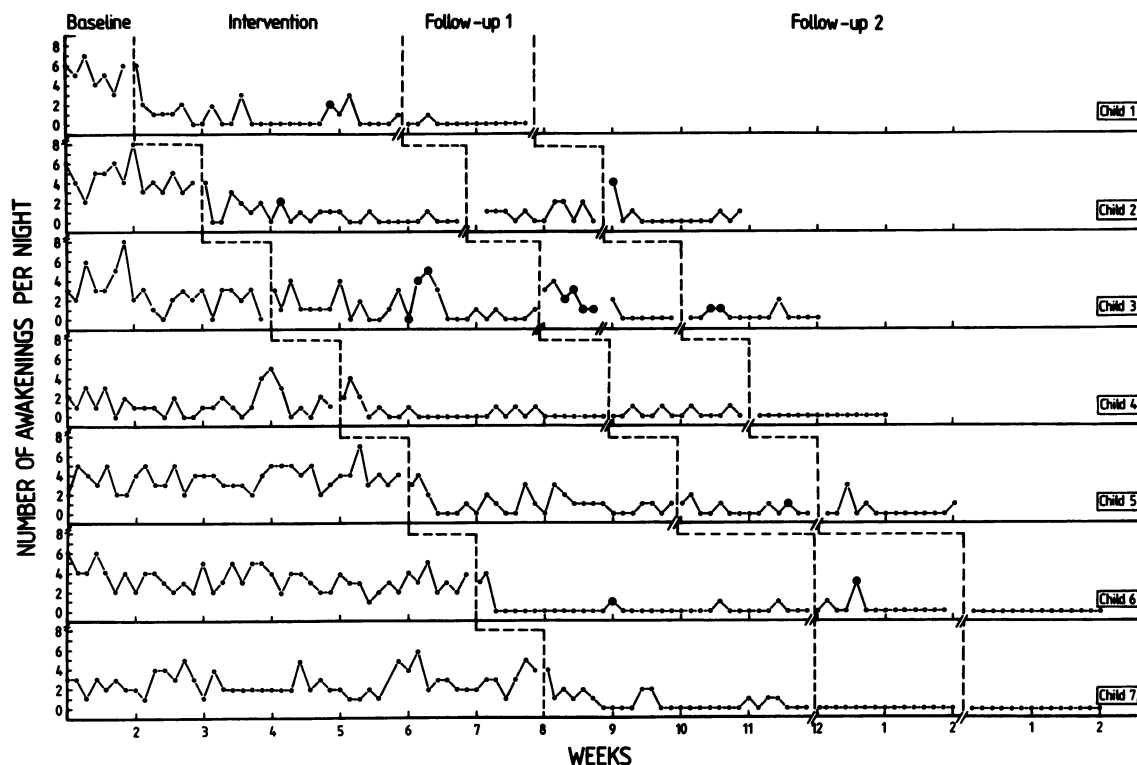


Figure 1. Frequency of night wakings across subjects and experimental conditions (● denotes nights of illness).

intervention:  $M = 3.82$ , range, 1.75 to 7.0; Follow-up 1:  $M = 2.29$ , range, 0.5 to 4.5; Follow-up 2:  $M = 3.34$ , range, 1.5 to 6.5). In all cases, these improvements were marked, with the exception of Child 3 who, as a result of illness, showed only moderate improvement. At the second follow-up assessment, Child 3 was again ill and, in addition, was being toilet trained.

*Parental Attention*

Table 1 presents the percentage of awakenings attended to by parents across subjects and experimental conditions. This table does not include attention during infant illness (denoted in Figures 1 and 2). All parents attended regularly to their children during baseline. Reported noncompliance during intervention was negligible except in the cases of Children 3 and 5, whose parents reported attending to them on 13% and 15% of awakenings, respectively. The maintenance program was operating during both the follow-up periods. Parental

responses to night waking during the first follow-up period were variable, with the parents of Children 2 and 4 attending during 10% and 100% of awakenings, respectively, and the parents of all other subjects not attending to any. During the second follow-up, however, all subjects who awakened were attended to every time.

DISCUSSION

This study demonstrated that a behavior management package, comprised of extinction and stimulus control components, was effective in reducing both the frequency and duration of night wakings among 7 infants, as well as decreasing other components of sleep disturbance measured by the sleep behavior scale. These improvements were maintained at 3 months and 2 years posttermination. Parents' reported amount of attention decreased as expected in the intervention phase. The marked decrease in all sleep measures in the

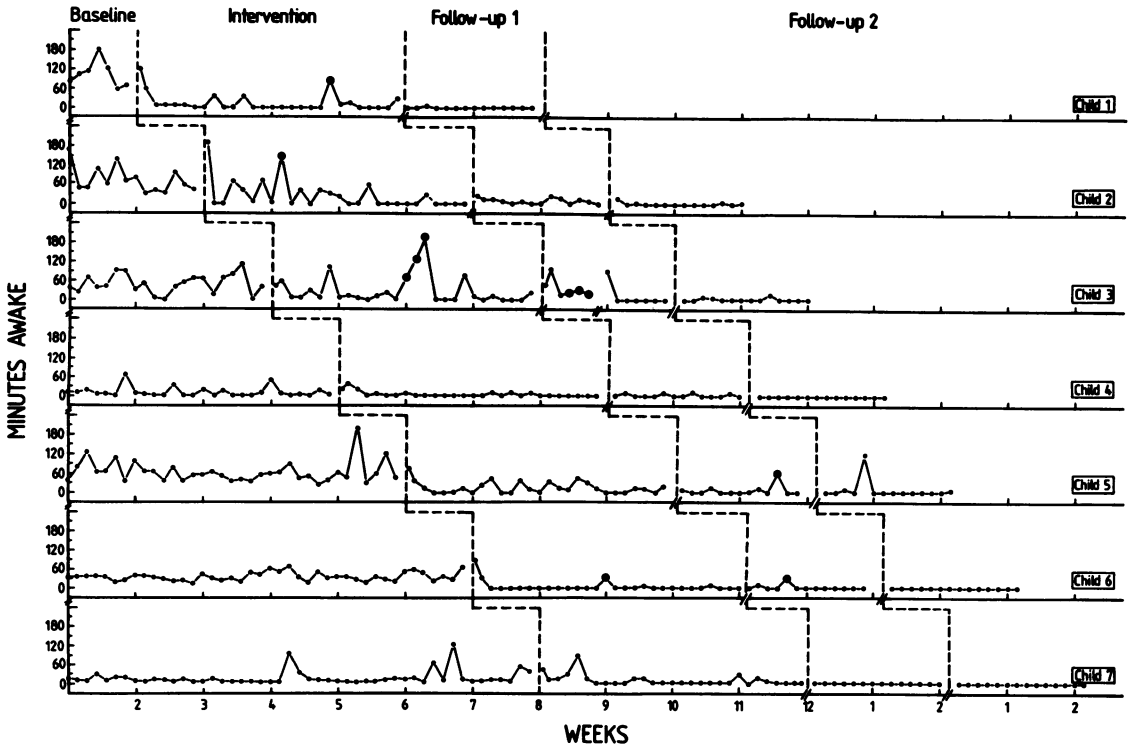


Figure 2. Duration of night wakings across subjects and experimental conditions (● denotes nights of illness).

second follow-up and the ability of parents, at that time, to attend to their children on awakening without an increase in sleep disturbance may be indicative of the robustness of the treatment effects.

These findings are consistent with those of prior studies (Jones & Verduyn, 1983; Richman et al., 1985; Rickert & Johnson, 1988; Seymour et al., 1983; Seymour & France, 1984; Williams, 1959) and perhaps deserve particular note given methodological refinements, such as the use of a multiple baseline across subjects design, enrollment of a larger sample, prospective data collection, and long-term follow-up.

The exact nature of and basis for the effectiveness of the intervention are not clear, given that quiet wakefulness was not discriminated from sleep and that both extinction and stimulus control components were included in the intervention package. The results of this study suggest that parental attention may function to maintain such awakening. The child awakens, then calls, and the parent attends. This attention may reinforce the calling and

possibly the awakening also, and may become a setting event for the resumption of sleep. This resumption of sleep, in turn, reinforces parental attention and so completes the chain. When parents ceased attending, there was a temporary increase in night waking, followed by a rapid decrease, as is typical of extinction.

The possible negative side effects of the intervention center around difficulties parents have in complying with the requirements of extinction. The application of planned ignoring (extinction) has the potential to worsen night waking if the parents inconsistently implement the procedure and, thus, place the child's night waking on an intermittent schedule of reinforcement. This is more likely to be the case when a child is ill and parents have difficulty distinguishing illness behavior, which is in need of attention, from that which is not. This difficulty was reported by the parents of Child 3.

Inconsistency may also result from parental doubt regarding the acceptability of the procedure. In view of this, alternative approaches such as gradual ex-

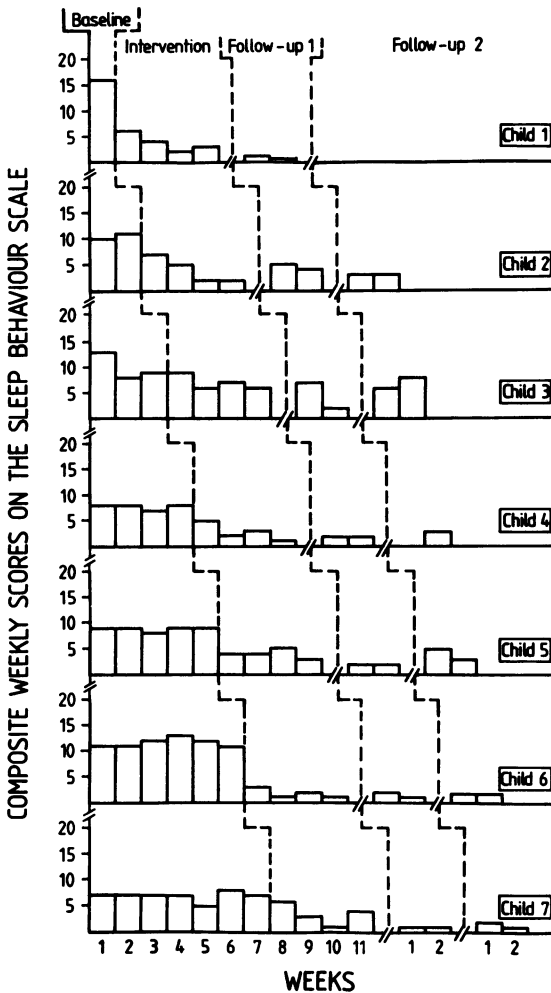


Figure 3. Composite weekly scores on the sleep behavior scale across subjects and experimental conditions.

tinction (Jones & Verduyn, 1983) and scheduled awakenings (Rickert & Johnson, 1988) may sometimes be preferable. However, it is not known if these alternative approaches in fact lessen parental anxiety and infant distress. Some parents in this study were initially resistant to implementing the recommended procedures but responded favorably to repeated explanations of the procedures and their likely benefits. Some of these parents commented after the program that an intensive approach was, with hindsight, easier than a more gradual one. Referral screening, however, may have removed those parents who were initially opposed to the procedures.

Table 1  
Parental Attention Across Experimental Conditions\*

Subject	Condition			
	Baseline	Intervention	Follow-up 1	Follow-up 2
Child 1	100	4	0	—
<i>n</i> <sup>b</sup>	36	24	1	—
Child 2	100	4	10	100
<i>n</i>	62	18	10	2
Child 3	100	13	0	100
<i>n</i>	58	27	5	1
Child 4	100	0	100	—
<i>n</i>	42	12	4	0
Child 5	99	15	0	100
<i>n</i>	122	26	4	6
Child 6	100	0	0	—
<i>n</i>	140	9	1	0
Child 7	100	0	—	—
<i>n</i>	135	9	0	0

\* The values represent percentages of night wakings attended to by parents.

<sup>b</sup> Number of night wakings.

The procedure may also have positive side effects such as decreases in parental anxiety, increases in parental self-efficacy, improved parental sleep, improved parent-child relationships, and improvement in the child's daytime behavior. It is interesting to note that Child 1's severe eating problem was resolved on the second day of the intervention phase. As yet, however, these possible positive side effects have not been investigated systematically.

Although in some respects this study may be more rigorous methodologically than previous studies, it has shortcomings that could be addressed through future research. The reliability measures, involving the correspondence between parental descriptions of sleep patterns during daily telephone checks and the subsequent written parental records, may only reflect the parents' memory or reading ability. Better reliability measures need to be developed. The 80-dB calibration of the VAR was chosen to avoid the high rates of false positives that resulted from lower settings; however, this setting risks false negatives. The switch-mat, designed to detect movement around the child's bed (particularly parental attention) was quite avoidable; a photoelectric device may be more sensitive.

The possible impact of operant techniques on infant sleep organization is an important developmental question, worthy of investigation in its own right. Another developmental question not considered in this study concerns possible differences in responsiveness to the intervention among infants of different ages. It is possible that developmental changes during the 6- to 24-month period are important.

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