Eur J Pediatr (1984) 142:170–173

European Journal of
Pediatrics
© Springer-Verlag 1984

A developmental approach to the management of children with sleep disturbances in the first three years of life

Remo H. Largo* **and Urs A. Hunziker**

Universitäts-Kinderspital, Steinwiesstr. 75, CH-8032 Zürich, Switzerland

Abstract. A developmental approach to the management of sleep disturbances was successful in 85% (44/52) of the children (aged 2–36 months) within 2–6 weeks. No drugs were used.

The approach was based on the following two principles: taking into account the characteristics of sleep behavior in infants and young children by setting up seven rules of normal sleep behavior, and dealing with the expectations and anxieties of the parents by means of a sleep chart.

Key words: Developmental approach – Sleep disturbances – Infants and young children

Introduction

Sleep disturbances are one of the most frequent behavioral problems encountered in a pediatric setting. The overall prevalence rates of sleep disturbances reported in children vary between 10% and 20%; those of severe sleep disruptions between 6% and 10% [4,6,18,26].

According to Tobler et al. [29], two-thirds of the sleep disturbances seen by Swiss pediatricians occurred in infancy and early childhood. The high prevalence rate and the adverse impact sleep disturbances have on child and parents have given rise to a large number of books and articles offering solutions [5,11,12,16,27, to mention just a few]. In contrast, only a few clinical studies have been carried out on the management of sleep problem children [13,19,28].

It was the aim of this study to devise a developmental approach to the management of sleep disturbed children which took into account the characteristics of sleep behavior in infants and young children by setting up seven rules of normal sleep behavior. In addition, a sleep chart was used to deal with the expectations and anxieties of the parents.

Subjects

Fifty-two children (30 boys and 22 girls) with sleep disturbances who had been referred to our outpatient clinic during the period 1980–82 were included in this study. Their ages ranged between 2 and 36 months (mean age 12 months). All the children had been treated with hypnotics or sedatives prior to admission. The incidence, duration and severity of the different types of sleep disturbances present in these children are given in Table 1. In all the children the primary complaint was night awakening, with associated disturbing behavior such as crying or waking the parents. Most children had had a history of sleep problems for many months. Sleep disturbances occurred at least every second night. Some children woke their parents up to nine times a night.

Table 1. Sleep disturbances present before initiation of treatment

Types of sleep disturbances	Affected Children $n = 52$	Duration (months)	Disturbed nights per week	Events per night
Night awakening	52	11 (2–30)	5 (4–7)	3 (1–9)
Evening wakefulness	13	5 (1–10)	4 (1–7)	
Nightmares	4	3 (1–5)	1 (1–3)	1
Night terrors	1	5	0.5	

Methods

During the first visit a sleep history was taken and a routine clinical examination of the child was carried out. The principles of the sleep chart (Fig. 1) were explained to the parents, and they were asked to keep a chart for 10–14 days. If one parent was absent on the first visit, we emphasized the importance of both parents being present on the subsequent visits. A commitment by both parents was more likely to be successful as it reduced the occurrence of passivity or even sabotage of the program by one partner.

On the two following visits the expectations and anxieties of the parents regarding appropriate sleep behavior were discussed with the help of the sleep chart. Counselling was carried out taking into account the following seven rules of normal sleep behavior in infants and young children.

1) Sleep is an active, highly organized behavior which undergoes major maturational changes during the first years of life [10,24]. Thus, the age at which an infant sleeps through the night depends to a considerable extent on the developmental rate of this maturational process. This process cannot be accelerated by the use of solid food or drugs [14].

2) The laws governing circadian rhythm functions are such that instantaneous changes of sleep behavior do not occur, e.g., jet lag [9,30,31]. To achieve a definite change in a child's sleep behavior, consistency and regularity are required for at least 7–14 days.

* Corresponding author

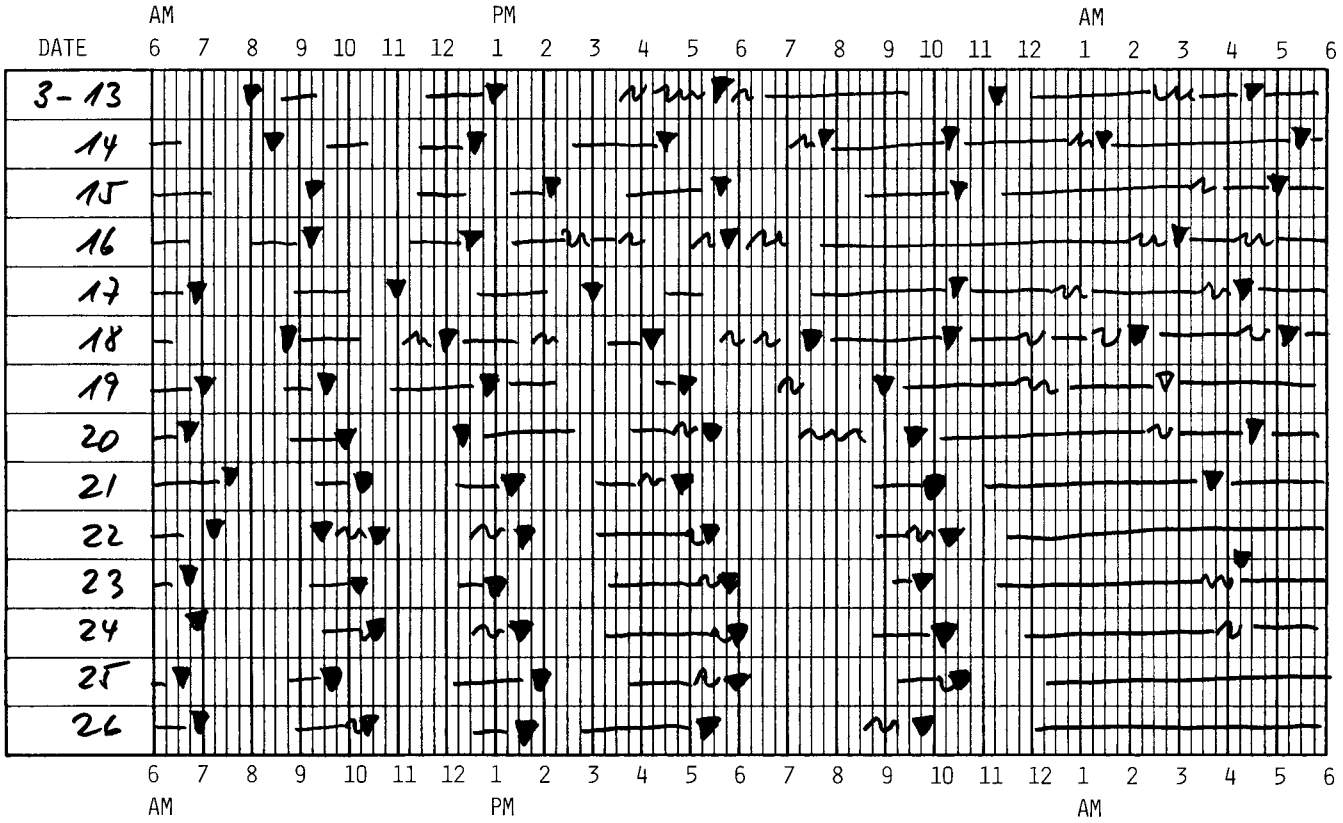

Fig. 1 Sleep chart of a 6-month-old girl. During intervention the irregular sleep awake pattern changes into a more regular pattern of longer periods of sleep and being awake. —— sleep, (Blank) awake, ▼ feeding, ≋ crying

3) At all chronological ages the duration of sleep has a large interindividual variability (standard deviations of approximately 1 h [4,21]. Thus, no rules about a child's sleep requirement can be laid down based on his chronological age; the duration of sleep has to be assessed individually (e.g., with the help of a sleep chart).

4) The duration of sleep has a small intraindividual variability [4,17,21]. In the individual child, sleep duration is quite consistent for months or even years. His sleep requirement is biologically determined to a considerable degree. If the time spent in bed is much longer than the sleep duration, evening wakefulness, night awakening and/or waking up very early in the morning will result.

5) The duration of day sleep is negatively correlated to that of night sleep [4,21]. Thus, the more a child sleeps during the day, the less he sleeps at night, and vice versa.

6) Bedtime and awakening time are positively correlated with each other [4]. Therefore, the earlier a child is put to bed, the earlier he will wake up in the morning, and vice versa.

It has to be emphasized that, due to the factors mentioned in rule 2, rules 5 and 6 do not apply to single events. For example, in a child who always sleeps in the afternoon, skipping one afternoon nap does not necessarily result in a longer night-sleep duration. However, if the child is not put to bed in the afternoon for 7–14 days, the duration of night sleep will become prolonged.

7) Night awakening occurs in 40%–60% of infants and young children and is, therefore, a normal sleep behavior [1,4]. Night awakening without associated disturbing behavior such as crying or waking the parents is not a sleep disturbance.

Setting the targets for a change of the child's sleep behavior was not our decision but that of the parents. First, the parents were asked to estimate their child's sleep duration per 24 h with the help of the sleep chart. Second, the parents had to decide on their child's need for day sleep. Finally, they set the bedtime, and they were told that the time the child spent in bed ought not to be longer than the calculated sleep duration. The parents were asked to continue with the sleep schedule they had decided on for 14 days and to keep a sleep chart.

Our approach was meant to be applicable in a general pediatric practice. Therefore, no extensive psycho-developmental examination of the child and no thorough psychosocial evaluation of the family was carried out. The maximum duration of intervention (consisting of one to three visits) was restricted to 6 weeks.

Successful treatment was defined as follows. (1) Age-appropriate sleep behavior of the child, which essentially meant evening wakefulness or night awakening with associated disturbing behaviors did not occur more frequently than once a week during a 3 month period. (2) Total sleep duration within the normal range [4,21]. (3) Appropriate expectations of the parents with regard to their child's sleep behavior.

Results

The results are summarized in Table 2. Keeping a sleep chart turned out to have a very positive effect in so far as 38% of the mothers solved the sleep problems of their children by themselves. Keeping a sleep chart made them better observers of

Table 2. Results of a developmental approach to the management of sleep disturbed infants and young children

	Sleep problems solved[a] %
Sleep chart	38
Sleep chart + parent counselling	47
Total	85

[a] For definition see Methods

Table 3. Developmental disorders of the children for whom treatment was not successful and psychosocial problems of their families

Developmental disorders	$n = 8$
Hyperexcitability syndrome	4
Cerebral palsy	2
Mental retardation	2
Blindness	1
Psychosocial problems	
Marital discord	5
Multiple changes of caretakers	3
Maternal psychiatric problems	2

their children, and their expectations regarding appropriate sleep behavior became more realistic. Many mothers stated that keeping a chart gave them additional insights into the personalities of their children, which probably also had an effect on the mother-child interaction.

Counselling was carried out with 62% of the families. Discussion of the sleep chart revealed the following to be the most frequent parental problems.

1) Unrealistic expectations with regard to sleep behavior. Most parents grossly overestimated their child's sleep requirement. Thus, in most children the time spent in bed was much longer than the sleep duration. Night awakening without associated disturbing behavior was regarded as a sleep disturbance by half of the parents.

2) Lack of regularity and consistency. Many parents changed the child's sleep schedule every night, expecting a disappearance of the disturbed behavior within 24h.

3) Anxieties in the parents of risk children. Parents whose children had a history of perinatal complications and/or prematurity often felt extremely protective and concerned about the adverse events which might occur at night (e.g., that their child might suffocate).

In 15% of the children our approach was not successful within 6 weeks and with a maximum of three visits. In these children, developmental testing [8] and a neurological examination, as well as a psychosocial evaluation of their families, were carried out. The neuro-developmental disorders found in these children and the psychosocial problems present in their families are listed in Table 3.

The distribution of the four types of sleep disturbances shown in Table 1 was the same in all three study subgroups (sleep problems solved with sleep chart, sleep problems solved with sleep chart and counselling and unresolved sleep problems).

Discussion

In our approach, sleep disturbances were assumed to be of an interactive nature. What constituted a sleep disturbance was determined on the one hand by the sleep behavior of the child, and on the other hand by the behavior of the parents and their expectations with regard to normal sleep behavior.

As far as the child was concerned, our approach took present knowledge of sleep physiology [4,20,21,22] into account. Recent sleep research strongly indicates that the sleep requirement in the individual is biologically determined to a considerable degree. Thus, a child can only adapt to unrealistic parental expectations and unfavorable environmental conditions to a certain extent. For example, when a 2-year-old child with a total sleep requirement of 10h per 24h takes an afternoon nap of 2h and is put to bed at seven o'clock in the evening, he will either be awake at three o'clock in the morning or may not fall asleep in the evening for hours, or he will wake up once or several times during the night. The individual needs of a sleep disturbed child with respect to sleep have to be met in order to solve his sleep problems. This was done by setting up seven rules of the characteristics of sleep behavior in infants and young children. These rules were very helpful in parent counselling.

In a pilot study a sleep chart was used primarily to obtain more reliable and more detailed information about the behavior of sleep disturbed children. A sleep chart as shown in Fig. 1 turned out to be much more accurate than any sleep history, and it reflected the temporal relationships between the various aspects of sleep behavior better than any sleep record. In addition, sleep charts kept by the parents for 10–14 days had a strong impact on the parents' perception of their child, and probably also on the parent-child matrix. Parents confused by the contradictory information on child rearing provided by journals, books and the media began to rely more and more on their own observations, which they made with the help of the sleep chart. Subsequently, the parents changes their expectations, which led to the disappearance of the sleep problems in one-third of the children. The sleep chart also provided an excellent means of discussing with the parents their expectations regarding an appropriate sleep behavior and their anxieties. For some parents, the recognition of their child's limited sleep requirements initially presented a problem, particularly if they wanted the evening to themselves. For example, parents of an 18-month-old child who required only 9h sleep per night had to realize that if they wanted their child to wake up *after* seven o'clock in the morning, he could not be put to bed before ten o'clock in the evening, which they felt would spoil their evening. However, the father was in fact subsequently very pleased by the more extended contact he had with his child in the evening.

In 8 out of the 52 children our approach was not successful. In recent years the use of polysomnographic recordings has led to the detection of a number of endogenous defects in sleep organization, such as narcolepsy, and of sleep-state-related disturbances of respiratory control, such as obstructive or central sleep apnea [2,3,15]. A delay or even dysfunction of sleep organization might be present in some of the children already suffering from developmental disorders such as the hyperexcitability syndrome [25] and mental retardation [7]. In the future, polysomnographic recordings may reveal an organic nature of the sleep disturbances in these children. The persistence of

sleep problems might also be attributed to the severity of the psychosocial problems present in most of these eight families. Overwhelming psychosocial problems made it very difficult or even impossible for the parents to observe their children, to keep a reliable sleep chart and to carry out the program they had decided on. Finally, a negative interaction between the sleep disturbed behavior of the child and adverse psychosocial factors can be assumed in some of these families. For example, in a blind, sleep disturbed child, the absence of light-dark entraining rhythm demanded a very high degree of parental consistency and regularity with respect to daily activities such as feeding. However, the severe psychosocial problems ruined every effort made by the parents, and the sleep problems of the child put additional strain on the parents.

"All too often drugs are prescribed merely as a substitute for counselling—and this is bad medical practice" [16]. There is a general agreement in the literature that drugs in sleep disturbed children should be used only in emergencies and for a limited period of not more than 1 week [16,27]. In reality, drugs are widely used. In an English study, 25% of 159 first-born children had received sedatives by 18 months of age [23]. In a recent Swiss pediatric survey on sleep disturbances, treatment included drugs such as hypnotics or sedatives in 89% of the children [29]. Our study demonstrates that a large majority of sleep problem children can be treated successfully within 2–6 weeks without the use of potentially harmful drugs.

References

1. Anders TF (1979) Night waking in infants during the first year of life. Pediatrics 63:860–864
2. Anders TF, Keener MA (1983) Sleep-wake state development and disorders of sleep in infants, children and adolescents. In: Levine MD, Carey WB, Crocker AC, Gross RT (eds) Developmental-behavioral pediatrics. Saunders, Philadelphia, pp 596–606
3. Association of Sleep Centers (1979) Diagnostic classification of sleep and arousal disorder. 1st edn prepared by the sleep disorders classification committee, Rottwarg GP (chairman) Sleep 2:1–137
4. Basler K, Largo RH, Molinari L (1980) Die Entwicklung des Schlafverhaltens in den ersten fünf Lebensjahren. Helv Paediatr Acta 35:211–223
5. Bax MCO (1980) Sleep disturbances in the young child. Br Med J 280:1177–1179
6. Bernal J (1973) Night waking in infants during the first 14 months. Dev Med Child Neurol 14:362–372
7. Blurton-Jones N, Mosetti-Ferreira MC, Farquar Brown M, MacDonald L (1978) The association between perinatal factors and later night waking. Dev Med Child Neurol 20:427–434
8. Brunet O, Lézine I (1971) Le développement psychologigue de la première enfance. Presses Universitaires de France, Paris
9. Czeisler CA, Weitzmann ED, Moore-Ede MC, Zimmermann JC, Knauer RS (1980) Human sleep, its duration and organization depend on its circadian phase. Science 210:1264–1267
10. Dittrichova J, Paul K, Woudracek J (1976) Individual differences in infants sleep. Dev Med Child Neurol 18:182–188
11. Eggers C (1982) Schlafstörungen im Kindes- und Jugendalter. Monatsschr Kinderheilkd 130:126–130
12. Erickson ML (1976) Assessment and management of developmental changes in children. Mosby, Saint Louis
13. Graziano AM, Mooney KC (1982) Behavioral treatment of "night-fears" in children: Maintenance of improvement at 2½- to 3-year follow-up. J Consult Clin Psychol 4:598–599
14. Grunwaldt E, Bates T, Guthrie D (1960) The onset of sleeping through the night in infancy. Pediatrics 26:667–668
15. Guilleminault C, Krobkin R, Winkle R (1981) A review of 50 children with obstructive sleep apnea syndrome. Lung 159:275–287
16. Illingworth RS (1975) The normal child. Churchill Livingstone, Edinburgh
17. Jacklin C, Snow M, Gahart J, Maccoby J (1980) Sleep pattern development from 6 through 33 months. Pediatr Psychol 5:295–303
18. Jenkins S, Bax M, Hart H (1980) Behaviour problems in preschool children. J Child Psychol Psychiatry 21:5–17
19. Jones DPH, Verduyn CM (1983) Behavioral management of sleep problems. Arch Dis Child 58:442–444
20. Kales A (1969) Sleep physiology and pathology. JB Lippincott, Philadelphia
21. Klackenberg G (1968) The sleep behaviour of children up to three years of age. Acta Paediatr Scand [Suppl] 187:105–122
22. Orem J, Barnes CD (eds) (1981) Physiology of sleep. Academic Press, New York
23. Ounsted MK, Hendrich AM (1977) The first born child: Patterns of development. Dev Med Child Neurol 19:446–453
24. Parmelee AH (1974) Ontogeny of sleep patterns and associated periodicities in infants. Mod Probl Paediatr 13:298–311
25. Prechtl HFR (1977) The neurological examination of the full term newborn infant. Clin Develop Med 63
26. Richman N (1981) A community survey of characteristics of one-to-two-year olds with sleep disruptions. J Am Acad Child Psychiatry 20:281–291
27. Richman N (1981) Sleep problems in young children. Arch Dis Child 56:491–493
28. Sanger S, Weir K, Churchill E (1981) Treatment of sleep problems: The use of behavioral modification techniques by health visitors. Health Visitor 54:421–424
29. Tobler A, Weber A (1980) Schlafstörungen in der kinderärztlichen Praxis. Eine empirische Untersuchung an 116 Kindern. Neurol Psychiatr 6:11–14
30. Weitzmann ED, Czeister CA, Zimmermann JC, Ronde JM, Kramer RS (1982) Chronobiological Disorders: Analytic and therapeutic techniques. In: Guilleminault C (ed) Sleeping and waking disorders. Addison-Wesley, London, pp 297–329
31. Weber R (1979) The circadian system of man. Springer, New York

Received November 1, 1983/Accepted February 23, 1984

KNOWLEDGE of the history of a disease
points the way toward reducing or eradicating it.

M. J. Allison
[in: Natural History *88*, 74–82 (1979)]

Eur J Pediatr (1984) 142: 174–178

European Journal of
Pediatrics
© Springer-Verlag 1984

Continuous ambulatory peritoneal dialysis in a program for children with end stage renal disease*

R. S. Fennell, III[1], J. K. Orak[1], T. Hudson[2], E. H. Garin[1], A. Iravani[1], G. A. Richard[1], S. L. Hislop[1], and M. I. Knight[1]

Departments of [1] Pediatrics and [2] Radiology, University of Florida College of Medicine, Gainesville, Florida

Abstract. Eighteen infants, children, and adolescents were trained in the techniques of continuous ambulatory peritoneal dialysis (CAPD) as a therapy for end stage renal disease (ESRD) at the University of Florida. Fourteen patients successfully continued CAPD 4–24 months, for a total of 193 patient-months.

Uremic symptoms were well controlled with blood urea nitrogen concentration (BUN) decreased to between 60 and 80 mg/dl. Parathyroid hormone levels increased but roentgenographic evidence of osteodystrophy improved in most patients. The rate of peritonitis was one episode in 7.7 patient-months. Blood transfusion requirements decreased for patients transferred from in-center hemodialysis to CAPD with no significant decrease in average hematocrits. Caloric intake was adequate and anorexia was usually not a major problem. Children who were evaluated for growth were under 15 years of age, with bone ages less than 12 years, and were using CAPD for longer than 6 months. Their mean growth velocity was 74.7 ± 20.4% (SD) of the predicted velocity.

Key words: CAPD – Renal failure – Children

Introduction

Continuous ambulatory peritoneal dialysis (CAPD) has become accepted therapy for adult patients with end stage renal disease (ESRD) [15–18]. CAPD is rapidly becoming a mode of therapy for the short-term maintenance of children with ESRD as well [1–7, 9, 11, 14, 19, 21, 22]. However, since the long-term suitability of CAPD for children has not yet been clearly determined, we have reviewed our first 2 years' experience.

Materials and methods

Indications for entering the CAPD program were (i) the likelihood of requiring dialysis for at least 6 months before transplantation; (ii) family interest; (iii) patient too small for hemodialysis; and (iv) patient having problems with vascular access for hemodialysis. Training techniques for patients and families are outlined elsewhere.

Adult Tenckhoff catheters were used in children weighing over 15 kg. Neonatal and pediatric catheters were used in infants and small children. Four to five exchanges were performed daily using commercial dialysate delivered in volumes of 500, 1000, and 2000 cc. The volume of dialysate in each exchange was 35–50 cc per kg body weight depending on the tolerance of the patient. The chemical composition of the dialysate was 132 mEq/l Na, 3.5 mEq/l Ca, 1.5 mEq/l Mg, 102 mEq/l Cl, 35 mEq/l lactate and 1.5, 2.5, or 4.25 g/dl glucose. The various glucose concentrations were chosen to achieve the desired ultrafiltration.

If peritonitis was suspected, the dialysate specimen was retained for cell count, gram stain, and culture. Antibiotic therapy, consisting of the intraperitoneal administration of cephalosporin and gentamicin, was begun immediately. One hundred milliliters of the cloudy dialysate was either centrifuged or filtered through a bacterial filter and the pellet or the filter cultured. The criteria for peritonitis were abdominal pain, a positive culture of the peritoneal fluid, and greater than 50 white cells/ml dialysate. Two out of the three criteria had to be present for peritonitis to be diagnosed. Patients with evidence of peritonitis continued to receive the appropriate antibiotic therapy for 14 days and were evaluated in clinic within 48 h of the onset of symptoms. Patients were usually not hospitalized.

Diets were designed to provide 2–3 g/kg per day protein and 100% of recommended caloric requirements. The infants were encouraged to consume between 110 and 140 calories/kg per day and allowed 3–6 g protein/kg per day. Fluids were not restricted. Multivitamins, 1,25-dihydroxycholecalciferol, calcium carbonate and phosphate binding gels were routinely administered.

The protocol for clinic evaluations is outlined in a previous publication [11]. Peritoneal clearances were performed periodically in clinic and protein losses determined from 24 h specimens of peritoneal dialysate transported to the clinic [8, 12, 20].

Roentgenograms of the knees, hip, and wrists were obtained periodically to evaluate osteodystrophy. All roentgenograms were reviewed independently for evidence of renal osteodystrophy (hyperparathyroidism and renal rickets) by an orthopedic radiologist (TH). The roentgenographic changes present were rated on a scale from zero to 4+ as follows: Zero, normal; 1+, equivocal subperiosteal resorption; 2+, definite

* This study was supported in part by The Comprehensive Children's Kidney Failure Center Grant from the Children's Medical Services, a program of the State of Florida Department of Health and Rehabilitative Services

Offprint requests to: Robert S. Fennell, III, M.D., Department of Pediatrics, College of Medicine, University of Florida, Gainesville, Florida 32610, U.S.A.