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Article Sub-Title		
Article CopyRight	Springer Science+Business Media, LLC (This will be the copyright line in the final PDF)	
Journal Name	Child Psychiatry & Human Development	
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Revised

Accepted

Abstract

In the current study, sleep actigraphy and parent-report measures were used to investigate differences in sleeping behavior among four groups of 3- to 7-year-olds ($N = 79$): children in regular foster care ($n = 15$); children receiving a therapeutic intervention in foster care ($n = 17$); low income community children ($n = 18$); and upper middle income community children ($n = 29$). The children in therapeutic foster care exhibited longer sleep latency and increased variability of sleep duration than the upper middle income community children. In addition, there was indication of a treatment effect: the therapeutic foster care children slept longer than the regular foster care and low income community children and had earlier bedtimes, fell asleep earlier, and spent more time in bed than the regular foster care children. The results are discussed in terms of the effectiveness of early intervention for enhancing sleep in foster children.

Keywords (separated by '-')

Sleep actigraphy - Foster care - Early intervention

Footnote Information

Journal: 10578
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Child Psychiatry Hum Dev
DOI 10.1007/s10578-010-0177-2

ORIGINAL ARTICLE

Sleep Disruption in Young Foster Children

Jennifer R. Tininenko · Philip A. Fisher · Jacqueline Bruce · Katherine C. Pears

Abstract In the current study, sleep actigraphy and parent-report measures were used to investigate differences in sleeping behavior among four groups of 3- to 7-year-olds ($N = 79$): children in regular foster care ($n = 15$); children receiving a therapeutic intervention in foster care ($n = 17$); low income community children ($n = 18$); and upper middle income community children ($n = 29$). The children in therapeutic foster care exhibited longer sleep latency and increased variability of sleep duration than the upper middle income community children. In addition, there was indication of a treatment effect: the therapeutic foster care children slept longer than the regular foster care and low income community children and had earlier bedtimes, fell asleep earlier, and spent more time in bed than the regular foster care children. The results are discussed in terms of the effectiveness of early intervention for enhancing sleep in foster children.

Keywords Sleep actigraphy · Foster care · Early intervention

Introduction

The ability to initiate and maintain sleep is closely related to aspects of stress regulation and vigilance (i.e., arousal). Individuals who regularly experience high levels of vigilance

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Article No. : 177 | LE | TYPESET
MS Code : CHUD-434 | CP | DISK

or who perceive their environment as unsafe are vulnerable to sleep disturbances [1]. Sleep and vigilance are competing, incompatible states that are greatly impacted by perceptions of safety and threat. For humans to engage in sleep, perceptions of safety are essential [1, 2]. Moreover, many of the neural systems central to sleep and vigilance overlap substantially with the neural systems central to stress regulation and vigilance. For example, the hypothalamic–pituitary–adrenal (HPA) axis and the sleep and vigilance processes are all impacted by stress responses and can bidirectionally influence each other [3, 4].

These issues are highly relevant to foster children, most of whom have experienced multiple stressors (e.g., parental substance abuse, parental imprisonment, and parental mental health problems) prior to entering out-of-home care [5]. In addition, apart from children placed in foster care at birth, many foster children have experienced some type of maltreatment. Finally, the caregiver transitions that occur among foster children may be additionally stressful. Prior researchers have suggested that exposure to such acute or chronic stressors cause marked impairment of sleep and interference with sleep architecture in children, thereby suggesting that sleep problems may be more likely in foster children [2, 6–9]

For young children, it is normative to perceive night as a fearful time and to request "curtain calls" after the lights are out to provide soothing gestures and to address fears [10]. Foster children may experience bedtime differently because they may not view foster caregivers as sources of regulation of normative fears due to compromised attachment relationships [11]. Furthermore, nighttime and darkness may be directly associated with experiences of abuse, thus further increasing anxiety around bedtime [2].

Despite strong evidence that stress inhibits a child's ability to obtain adequate sleep, there is evidence of resilience in children experiencing multiple stressors. Factors that have been related to increased quality, quantity, and regularity of sleep include a consistent sleep schedule, secure attachment with a primary caregiver, responsive and warm caregiving, and a contingent and consistent environment [9, 12, 13]. There is also evidence that placement in specialized treatment foster homes can reduce the occurrence of problem behavior and dysregulation [14].

Our primary purpose in this study was to examine sleep quality in foster children. In addition, given the prior reports of intervention effects for foster children, we investigated sleep differences between children placed in regular foster care or in a therapeutic intervention, Multidimensional Treatment Foster Care for Preschoolers (MTFC-P) [15]. In the MTFC-P intervention, the foster caregivers receive training to enhance consistent and warm caregiving, thereby increasing the likelihood that the children experience reinforcing, safe environments [15]. The foster caregivers are also provided with support to reduce parenting stress, which may be a risk factor for sleep disruption in caregivers and children. Although the MTFC-P intervention was not designed to specifically address sleep hygiene, it targets many areas of risk for disrupted sleep.

Inclusion of Two Community Samples of Nonmaltreated Children

Most studies in the developmental sleep literature have been conducted with children living in upper middle income households, and it is unclear whether findings in this group can be generalized to higher risk samples [16]. Children in low income households may exhibit sleep disruption due to a higher incidence of stressors, including harsh parenting, increased marital conflict, and a greater vulnerability to negative psychosocial and physical health outcomes [17–19]. Past researchers have identified increased family turmoil and

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low-quality, crowded housing as stressors associated with children living in low income households [20], and other researchers have found these factors to be related to sleep disruption [21–23]. However, given the inconsistencies in the literature, this question deserves further exploration.

In this study, therefore, we not only examined sleep in the two groups of foster children (intervention and regular foster care), but also in two community groups: low income, nonmaltreated community children living with their biological parents and upper middle income, nonmaltreated community children living with their biological parents. Because so little sleep research has been conducted in this population, the current study was conducted to preliminarily investigate whether or not sleep is a problem for foster children and whether or not behavioral intervention is sufficient to impact sleep patterns in this group. Due to the preliminary nature of the study, our analyses were designed to answer these general questions with the intention of building a foundation for more comprehensive future studies.

Based on past research findings regarding the effects of early stress, we expected that the regular foster care group would show the most disrupted sleep and shortest sleep duration compared to the other groups. Secondly, we expected that the low income community group would show less sleep disruption and longer sleep duration than the regular foster care group but more sleep disruption and shorter sleep duration than the upper middle income community group. Because the intervention group did not receive direct sleep intervention, it was unclear whether this group would show similar sleep patterns to the regular foster care group or to the community groups. Sleep in the intervention group was compared with all other groups as an exploratory means of determining the extent of any treatment effect.

Method

Participants

Seventy-nine (41 females) 3- to 7-year-old ($M = 5.25$, SD $= 1.05$) children were recruited to participate in the study across four groups. The participants were demographically representative of Eugene, Oregon, and had the following ethnicity breakdown: European American (82.3%, $n = 65$), Latino (7.6%, $n = 6$), Native American (6.3%, $n = 5$), and African American (3.8%, $n = 3$). Fifty of the participants were enrolled in a larger randomized clinical trial to evaluate the MTFC-P intervention across three groups: regular foster care (RFC; $n = 15$), MTFC-P intervention (TFC; $n = 17$), and low income community sample (LIC; $n = 17$). The upper middle income community (UMC; $n = 29$) group was recruited via flyers posted in daycare settings, athletic facilities, and local businesses. Four children were excluded from the analyses owing to actigraphy equipment malfunctions (analytical $N = 75$).

The inclusion criteria for the LIC group were as follows: neither parent had a bachelor's degree or greater and the household annual gross income was $30,000 or less. Fifty-five percent of the LIC households received government aid. The inclusion criterion for the UMC group was household annual gross income at or above $60,000: $60,000–79,000 ($n = 12$), $80,000–99,000 ($n = 7$), and $100,000 or more ($n = 10$). There were no exclusion criteria for education in the UMC group. No UMC family received government aid. The LIC and UMC children were excluded from participation if they had any history

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of caregiver transitions or maltreatment (determined via Department of Human Services records).

Measures

Actigraphy

Actigraphy is a well-validated measure of sleep quality and quantity that can be collected at home. Actigraphs record movement-generated data, which is subsequently scored by computer-generated algorithms to differentiate sleep and wakefulness. Actigraphy has been validated against polysomnography, with reported correspondence of the measures up to 93% in adults and 89.9% in children [24].

The actigraph model used in the current study was the Basic Mini Motionlogger (Ambulatory Monitoring, Inc.). This wristwatch-sized actigraph was fastened around the child's nondominant wrist as is recommended by Sadeh and Acebo [25]. To make the device more child friendly, it was placed in a soft sleeve that was shaped like a sea creature.

Data were collected in 1-min epochs and at data amplification setting 18, the default acquisition setting for sleep/wake scoring. The actigraphic sleep data were then downloaded to a PC using ACT Millennium software and were subsequently scored on Action-W software (Ambulatory Monitoring, Inc.) using the Sadeh algorithm [24]. The sleep variables measured using actigraphy in the current study included measures of sleep quantity and quality.

Sleep onset, *wake onset*, *lights out time*, and *rise time* were manually indicated in the data file. Sleep onset was defined as the beginning of the first 15-min epoch of uninterrupted sleep, and wake onset was defined as the last 15-min epoch of uninterrupted sleep. Each caregiver was trained to indicate lights out time and rise time using an event marker on the actigraph. *Total time in bed* was scored as the difference between lights out time and rise time. *Sleep latency* was computed from the time between lights out time and sleep onset. *Number of night waking episodes* was scored as any 5 min of wake bounded by 15 min of uninterrupted sleep epochs.

Prior to conducting the analyses, each file was cleaned to ensure data integrity. This involved checking the actigraphy data against the parent-reported Sleep Diary (see below) to ensure that the caregivers accurately indicated lights out time and rise time with the actigraphic event marks and to determine whether the actigraph was ever removed in the night. The data from nights when the actigraph was removed ($n = 7$) and when there was noncompliance with the study protocol ($n = 7$) were excluded from the analyses. All children included in analyses had at least 4 nights of data.

Sleep Diary

The 15-item Sleep Diary was created by Sadeh [26]. The caregivers were asked to complete daily entries after the children went to bed and woke (e.g., lights out time, times and lengths of daytime naps, night waking episodes, and rise time). The caregivers also reported subjective impressions of how tired their children appeared before and after sleep, overall child health and daytime activity, and unusual nighttime occurrences that may have interfered with acquisition of data. The actigraphy data were checked against the Sleep Diary entries to ensure compliance with the protocol and to identify potential external sources of sleep anomalies.

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Procedure

A home visit was scheduled with each family so that the study could be explained fully to the caregivers and the children. For the foster children, caseworker consent was obtained prior to contacting the foster caregivers and introducing the study materials.

The sleep data were obtained on 5 consecutive nights to attain adequate reliability [27, 28]. Each caregiver was instructed to maintain a normal sleep routine and was not discouraged from allowing daytime naps or from engaging in bedtime routines. After the bedtime routine was completed, each caregiver was asked to secure the actigraph to the child's nondominant wrist prior to turning the lights out and to complete the applicable Sleep Diary entries. The caregivers recorded lights out time and rise time by pressing the event marker button on the actigraph. After rise time, each caregiver was asked to complete the applicable Sleep Diary entries. The children were rewarded with stickers after nights of successfully wearing the actigraph. At the end of the study, the children were given bath mitts that were larger versions of the actigraphy sleeves, and the caregivers were financially compensated.

TFC Group Procedure

The TFC group received the MTFC-P intervention program, which was developed specifically for preschool-aged foster children. This family-based preventive intervention addresses the developmental and social-emotional needs of this population and is delivered via a treatment team approach. In the intervention, services are provided foster children, their foster caregivers, and their permanent placement resources (birthparents or adoptive relatives/nonrelatives). Before a child is placed in their home, the foster caregivers complete 12 h of intensive training. After the placement, the foster caregivers receive support and supervision via daily telephone contacts, weekly parenting group meetings, and 24-hour staff availability. These services facilitate the maintenance of a warm, responsive, consistent environment in which positive behavior is encouraged and problem behavior is limited. The children receive individualized treatment with a child therapist to facilitate the acquisition of prosocial skills and improve functioning in preschool/daycare and home settings. They also participate in weekly therapeutic playgroup sessions that focus on facilitating school readiness and emphasizing social/emotional functioning and early literacy skills. When the children in the program transition to permanent placements, family therapists work to familiarize these families with the intervention's parenting techniques. This helps to facilitate consistency between settings. To ensure that treatment fidelity for all MTFC-P components is maintained, progress notes and checklists regarding services received are completed by the clinical staff and are monitored by the research team. Additional information about MTFC-P program and its theoretical underpinnings can be found elsewhere [14, 15]. The TFC children in the present study generally received the intervention for 6–9 months, although some children continued receiving the intervention until their behavior stabilized.

RFC Group Procedure

The RFC children received the routine foster care services administered in Lane County, Oregon, which typically involve monthly or more frequent contact with caseworkers to monitor progress in the foster home and identify issues in need of attention. Weekly individual psychotherapy to address trauma and/or behavioral issues is provided as needed.

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In cases of extreme behavioral and emotional problems (particularly AHDH symptoms), children may be prescribed medication by a primary care physician or child psychiatrist. In addition, some children receive developmental screening and, if delays are found, early childhood special education services.

Data Analysis

The sleep variables were aggregated over the 5 days of data collection. Sleep measure variability was computed as the within-subject standard deviation across the 5 days of data collection. The stability of the actigraphy measures across nights generally reached the suggested intraclass correlation coefficient level of .70 (range = .70–.89) [28], though some variables ranged from .60 to .69. Because there were no group differences in age, $F(3, 75) = .56$, $p > .05$, or in gender distribution, $\chi[2](3) = 1.10$, $p > .05$, these variables were excluded from further analysis.

A MANOVA was computed on the averaged sleep measures and sleep variability measures to examine group differences. The omnibus MANOVA using the Wilks' lambda criteria was significant, indicating group differences, $F(75, 141.37) = 1.57$, $p = .01$ (see Table 1).

Because of power limitations and to guard against Type I errors, specific contrasts (vs. all possible contrasts) were selected to test our hypotheses. Pairwise comparisons were used to determine group differences on sleep variables for which the between-subjects test reached or approached significance (see Table 1). Some follow-up contrasts were used to test whether the RFC group differed from the LIC group. Such differences were assumed to be attributable to placement in foster care. Other follow-up contrasts were used to test whether the LIC group differed from the UMC group. Such differences were assumed to be attributable to SES. There were no hypotheses for the TFC group because it was unknown how the intervention would affect sleep patterns. To more clearly understand how the intervention impacted sleep patterns, we examined pairwise comparisons of the TFC group with each of the other groups. Alpha inflation was controlled with Bonferroni corrections, and the values were compared against $p < .01$. Only the significant results are discussed below.

Results

Sleep Quantity

The TFC children slept significantly longer than the RFC children, $F(1, 71) = 8.50$, $p < .01$, and the LIC children, $F(1, 71) = 8.74$, $p < .01$ (see Fig. 1). Similarly, the TFC children showed a trend toward obtaining more true sleep than the LIC children, $F(1, 71) = 5.64$, $p = .02$ (see Fig. 2). The TFC children did not differ from the UMC children in either measure of sleep quantity.

Sleep Quality

Although the univariate test for nighttime activity was significant, none of the pairwise comparisons reached significance.

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Table 1 Summary statistics of sleep variables and results of univariate MANOVA tests in the RFC, TFC, LIC, and UMC Goups

Actigraphy-derived sleep measures	RFC ($n = 14$)[a]		TFC ($n = 17$)[a]		LIC ($n = 18$)[a]		UMC ($n = 26$)[a]		F
	M	SD	*M*	SD	*M*	SD	*M*	SD	
Sleep quantity									
Sleep duration	557.45	35.28	597.23	43.32	559.43	29.57	571.40	40.16	3.88(3, 71)**
True sleep time	471.70	54.17	514.66	53.08	472.77	52.13	491.43	50.53	2.48(3, 71)[‡]
Variability of sleep duration	52.11	20.48	62.17	34.67	44.57	21.82	39.35	17.24	3.42(3, 71)*
Variability of true sleep time	50.10	23.16	48.52	24.42	47.17	22.31	42.63	18.42	0.46(3, 71)
Sleep quality									
Sleep percentage (%)	84.56	6.77	86.41	5.62	84.53	7.32	85.97	5.34	0.43(3, 71)
Sleep activity	53.66	11.35	47.18	12.09	54.07	10.39	46.91	7.69	2.81(3, 71)*
Night waking episodes (#)	3.84	1.59	3.62	1.13	3.96	1.10	3.68	1.12	0.29(3, 71)
Wake minutes	85.76	38.18	82.56	34.52	86.67	40.19	79.97	29.40	0.16(3, 71)
Variability of sleep percentage (%)	4.92	2.48	5.21	2.78	5.51	4.73	5.23	3.00	0.08(3, 71)
Variability of sleep activity	6.11	2.40	6.84	2.59	6.13	3.20	6.28	3.31	0.22(3, 71)
Variability of night waking episodes (#)	1.54	0.93	1.41	0.54	1.43	0.41	1.25	0.41	0.88(3, 71)
Variability of wake minutes	28.90	16.94	36.35	22.81	32.26	27.65	31.02	18.11	0.34(3, 71)
Sleep schedule									
Time of sleep onset (time/min)	21:10	51.28	20:43	36.00	21:26	62.88	21:15	38.37	2.51(3, 71)[†]
Time of wake onset (time/min)	6:26	51.95	6:41	55.68	7:01	50.77	6:45	27.50	1.56(3, 71)
Lights out time (time/min)	20:21	46.68	20:00	33.92	21:11	47.60	20:48	38.77	9.60(3, 71)***
Rise time (time/min)	7:09	55.03	7:17	60.92	7:32	46.98	7:14	27.50	0.81(3, 71)
Total time in bed	647.76	31.07	676.99	58.40	625.86	33.62	625.98	35.31	6.57(3, 71)***
Sleep latency	51.63	16.85	43.31	19.28	30.41	18.58	26.76	10.59	9.19(3,71)***
Variability of time of sleep onset	35.70	17.90	41.00	19.70	61.67	135.73	25.08	15.65	1.04(3,71)
Variability of time of wake onset	37.58	23.03	40.68	24.22	38.52	27.57	34.88	17.03	0.24(3,71)
Variability of lights out time	31.02	16.15	38.05	22.77	35.82	21.08	26.02	15.85	1.70(3,71)
Variability of rise time	22.27	14.42	28.17	21.30	26.92	23.78	21.13	10.88	0.73(3,71)
Variability of total time in bed	39.57	12.54	44.79	40.34	43.6	34.37	28.52	14.85	1.64(3,71)

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Table 1 continued

Actigraphy-derived sleep measures	RFC ($n = 14$)[a]		TFC ($n = 17$)[a]		LIC ($n = 18$)[a]		UMC ($n = 26$)[a]		F
	M	SD	*M*	SD	*M*	SD	*M*	SD	
Variability of sleep latency	28.92	10.33	23.66	14.56	17.56	15.25	14.85	10.74	4.35(3,71)

Note: *RFC* regular foster care; *TFC* treatment foster care; *LIC* low income community; *UMC* upper middle income community

[a] Values are shown in minutes except where noted

† $p < .07$; ‡ $p = .06$; * $p < .05$; ** $p < .01$; *** $p < .001$

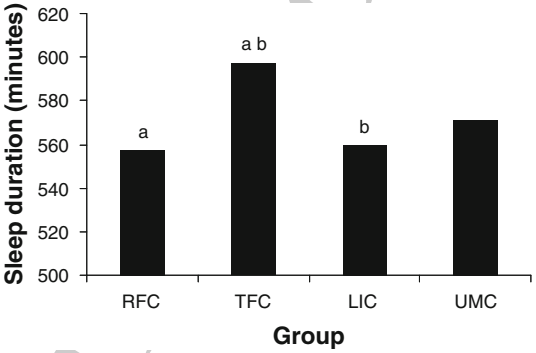

Fig. 1 Differences in mean sleep duration between groups. [a] $p < .01$; [b] $p < .01$. *Note: RFC* regular foster care; *TFC* treatment foster care; *LIC* low income community; *UMC* upper middle income community

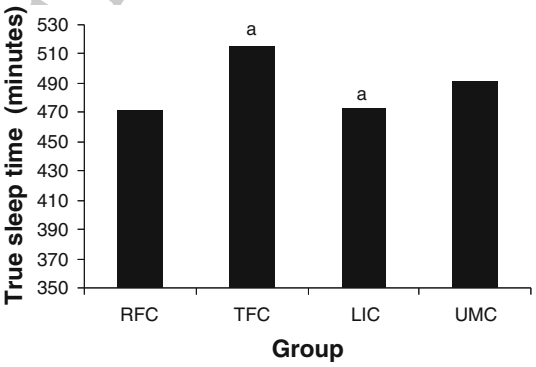

Fig. 2 Differences in mean true sleep time between groups. [a] $p < .02$. *Note: RFC* regular foster care; *TFC* treatment foster care; *LIC* low income community; *UMC* upper middle income community

Sleep Schedule

There were unexpected group differences in sleep schedule. The RFC children went to bed earlier than the LIC children, $F(1, 71) = 11.23$, $p < .001$. The TFC children went to bed significantly earlier than the LIC children, $F(1, 71) = 24.96$, $p < .001$, and the UMC children, $F(1, 71) = 13.40$, $p < .001$ (see Fig. 3). The TFC and RFC groups did not differ in the average lights out time.

The TFC children also spent more time in bed on average than the LIC children, $F(1, 71) = 13.81$, $p < .001$, and the UMC children, $F(1, 71) = 16.16$, $p < .001$ (see Fig. 4).

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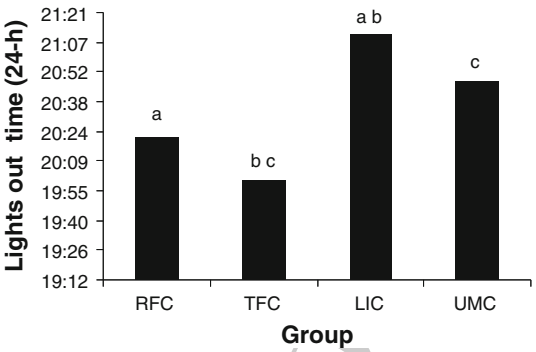

Fig. 3 Differences in mean lights out time between groups. [a] $p < .001$; [b] $p < .001$; [c] $p < .001$. *Note: RFC* regular foster care; *TFC* treatment foster care; *LIC* low income community; *UMC* upper middle income community

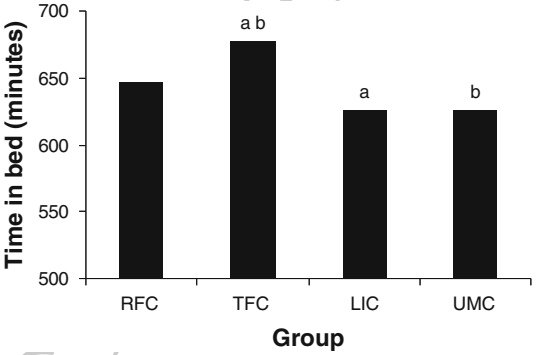

Fig. 4 Differences in mean time in bed between groups. [a] $p < .001$; [b] $p < .001$. *Note: RFC* regular foster care; *TFC* treatment foster care; *LIC* low income community; *UMC* upper middle income community

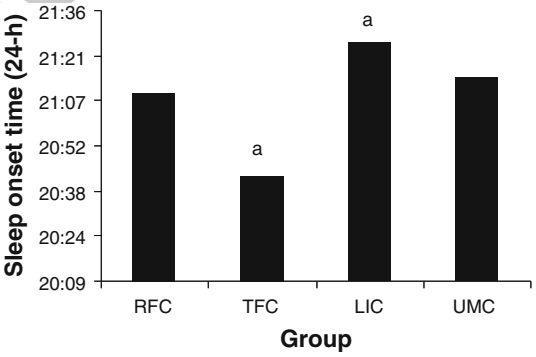

Fig. 5 Differences in mean sleep onset time between groups. [a] $p < .01$. *Note: RFC* regular foster care; *TFC* treatment foster care; *LIC* low income community; *UMC* upper middle income community

Correspondingly, the TFC children initiated sleep significantly earlier than the LIC children, $F(1, 71) = 6.91$, $p < .01$ (see Fig. 5).

There were also significant group differences in sleep latency in the expected direction. The RFC children spent more time in bed prior to falling asleep than the LIC children, $F(1, 71) = 13.75$, $p < .001$. The TFC children took longer to fall asleep once in bed than the UMC children, $F(1, 71) = 10.92$, $p < .001$, and the LIC children, $F(1, 71) = 5.65$, $p < .02$ (see Fig. 6). The RFC and TFC groups did not significantly differ in sleep latency.

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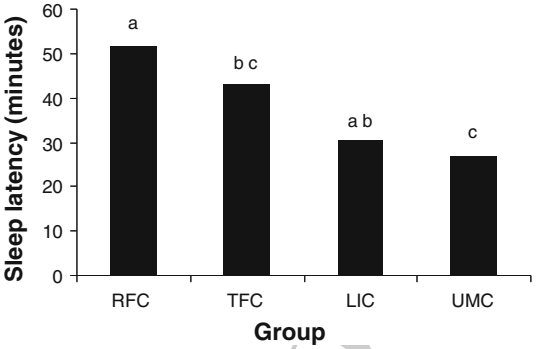

Fig. 6 Differences in mean sleep latency between groups. [a] $p < .001$; [b] $p < .02$; [c] $p < .001$. *Note: RFC* regular foster care; *TFC* treatment foster care; *LIC* low income community; *UMC* upper middle income community

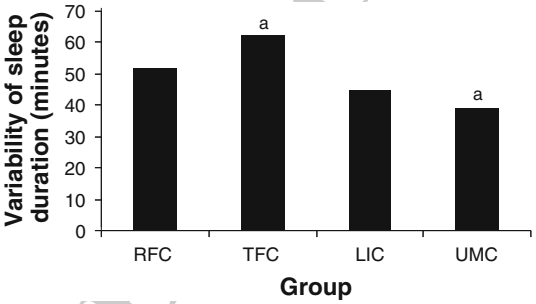

Fig. 7 Differences in variability of sleep duration between groups. [a] $p < .01$. *Note: RFC* regular foster care; *TFC* treatment foster care; *LIC* low income community; *UMC* upper middle income community

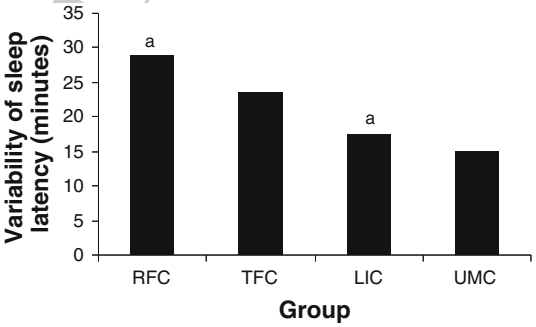

Fig. 8 Differences in variability of sleep latency between groups. [a] $p = .015$. *Note: RFC* regular foster care; *TFC* treatment foster care; *LIC* low income community; *UMC* upper middle income community

Sleep Variability

Although the TFC children slept significantly longer than the RFC and LIC children, sleep duration was less consistent in the TFC group compared to the UMC group, $F(1, 71) = 9.45$, $p < .01$ (see Fig. 7). In addition, sleep latency was marginally more variable in the RFC group compared to the LIC group, $F(1, 71) = 6.21$, $p = .015$ (see Fig. 8).

Discussion

A number of noteworthy results emerged from our analyses. The community groups were hypothesized to show less sleep disruption than the foster care groups. Overall, the results confirmed that the differences between the foster and community children were more

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pronounced than the differences between the LIC and UMC children. However, across many of the sleep measures, specifically in measures of sleep quality, no group differences emerged. Among the hypothesized effects, the foster children displayed greater difficulty initiating sleep relative to the community children. Specifically, the TFC children had longer sleep latency than the LIC or UMC children, and the RFC children had longer sleep latency than the LIC children. For foster children, the transition from daytime activity to sleep may be especially problematic owing to increased vigilance at bedtime and poorly developed regulatory abilities to manage bedtime stressors.

Other group differences indicated potential treatment effects in the TFC group. In particular, the TFC children slept longer than the RFC and LIC children (sleep duration and true sleep time). Furthermore, the TFC children went to bed earlier, spent more time in bed on average, and fell asleep earlier than the LIC and UMC children. This is an especially relevant finding for the MTFC-P intervention; prior researchers have consistently suggested that sleep duration is highly important for the acquisition of restorative sleep, which decreases the probability of impaired cognitive function, emotion regulation, and behavioral regulation [29–32] This may be particularly important for foster children owing to the high occurrence of cognitive, behavioral, and emotional problems that have been observed in this population [33–36] These complex problems are challenging for foster caregivers, and targeting these problems directly can be very challenging and resource intensive. In contrast, addressing these problems at least in part via improved sleep may be an efficient intervention approach. Along these lines, researchers have suggested that increased sleep duration provides an opportunity for reducing the intensity or frequency of such difficult behavior [30, 37].

Although sleep is not specifically targeted in the MTFC-P intervention, the intervention directly addresses many areas that are central to adequate sleep hygiene. MTFC-P foster caregivers are trained to provide highly consistent care, which includes establishing predictable daily routines. Furthermore, the intervention emphasizes high rates of reinforcement in concert with brief, but effective, corrective feedback to facilitate a warm, instructional environment. In prior research on MTFC-P outcomes, researchers have found that the multilayered treatment approach is associated with changes that are central to adequate sleep. For example, Fisher and Kim found that the regular foster care children displayed increasingly insecure attachment-related behavior over time, whereas the intervention foster care children displayed increasingly secure attachment-related behavior [38]. Although the intervention does not specifically target attachment relationships, the intervention foster care children in the Fisher and Kim study began to utilize their caregivers for help or protection more frequently than the regular foster care children. In regard to improving quality sleeping behavior, such children may feel safer in their homes and find their foster caregivers to be safe and reliable resources.

The likelihood of sufficient sleep duration in the TFC group was increased by an earlier lights out time: over 60 min earlier than in the LIC group, 45 min earlier than in the UMC group, and over 20 min earlier than in the RFC group. This allowed the TFC children to take an average of 43 min to initiate sleep and still obtain the most sleep of any group. The RFC children also went to bed earlier than the LIC children but obtained the least sleep of any group due to longer sleep latency, later sleep onset, and more time spent awake in bed.

Although the TFC children slept longer on average than the LIC and RFC children, their night-to-night fluctuations exceeded 60 min; this inconsistency was comparable to the RFC children. As was predicted, the UMC children had the most stable sleep, with night-to-night fluctuations of approximately 40 min. The RFC children were more inconsistent in sleep duration and sleep latency than any of the other groups. The finding that the TFC

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children slept longer (although inconsistently so) may indicate that new sleep patterns were developing and could stabilize over time, perhaps owing to the consistent environment provided in the MTFC-P intervention. In prior MTFC-P studies investigating regulatory functions such as cortisol, the stress hormone end-product of the HPA axis, researchers have observed similar processes as a result of the intervention; for example, cortisol levels have been shown to stabilize and decrease in variability over time in intervention children but to become increasingly dysregulated and variable in regular foster care children [39].

We expected the RFC and TFC children to exhibit difficulties with initiating sleep. This frequently reported sleep problem in young children [10] might be exacerbated for children with histories of maltreatment. Researchers have found associations between maltreatment and prolonged sleep latency [40], which is supported by our results. Sleep latency might be a precursor to more problematic sleeping problems in later years. However, the earlier lights out time in the TFC group seemed to ameliorate the potential negative effects of reduced sleep duration.

Contrary to the findings from past research [21, 41], there were surprisingly few sleep differences between the LIC and UMC children. Perhaps the methods used in the current study parsed maltreatment from SES when looking at sleep outcomes. Maltreatment is more common among low income children than among upper middle income children, which may have inflated the SES differences found in prior studies. Additionally, the income level of the LIC group was set above the poverty line to be comparable to the foster children's families of origin, but children living in poverty may experience greater sleep disruption than other low income children.

Another unexpected outcome of the study was the absence of group differences in sleep quality, which has been widely recognized as important for the initiation and adequate duration of deep sleep stages [42, 43]. Although interesting group differences in sleep schedule and duration emerged, the overall results suggest that, to a certain extent, sleep is protected in all preschool-aged children regardless of risk exposure. Dahl proposed that sleep is a regulatory process that is difficult to disrupt throughout early childhood but that early disruptions might significantly impact functioning in later developmental periods (e.g., adolescence), when sleeping patterns are no longer protected [1]. The lack of group differences in sleep quality in our study supports the notion of a protective mechanism for sleep in young children and might indicate a viable prevention window for establishing regular and adequate sleep routines to improve outcomes in later development; to this end, the improved sleep behavior found among the TFC children are promising. In sum, the results from this investigation of actigraphy-derived sleeping behavior in foster and community children suggest promising treatment effects that are encouraging for future prevention efforts.

Clinical Significance and Policy Implications

Although not all of the hypothesized differences between foster and community groups were supported, the results of the current study suggest that foster children have greater difficulty with sleep regulation. This is an important clinical consideration; foster children frequently exhibit difficulties across behavioral, cognitive, and emotional domains. The results from this study suggests that it is important for clinicians to thoroughly assess and treat sleep problems in young children. Given the strong interconnection between sleep and daytime problems, if sleep is adequately addressed, some daytime difficulties may also be alleviated for these children.

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The results from this study also suggest that foster children present unique problems for their foster caregivers at nighttime. Foster caregivers are likely not provided with information about such sleep difficulties given the lack of research on the topic in this population. Foster caregivers would likely benefit from information and instruction regarding sleep difficulties common to foster children, the management of such sleep difficulties, and the importance of sleep, bedtime routines, and consistent caregiving.

Limitations

Although we found a number of interesting results, there were limitations in this study. The first of these involved the relatively small group sizes. Follow-up studies with larger sample sizes would allow for increased power to detect group differences. Given that group differences were detected in our study, the effects may increase in magnitude with a larger sample. This point is supported by the results of post-hoc power analyses that suggested that most of the comparisons that were statistically significant reached (or approached) adequate power (i.e., .80). Comparisons that were not statistically significant had wide ranging power values, some of which suggested that the tests were significantly underpowered. Because this was a preliminary study, larger studies are needed for a more comprehensive investigation of sleep problems in foster children.

The small sample size also precluded the investigation of potential heterogeneity between the RFC and TFC children and the investigation of potentially interesting individual differences factors (e.g., gender and age). Bruce et al. [44] found that foster children who had more than four placement transitions, were placed in the foster care system in infancy, and experienced severe neglect were at the greatest risk for regulatory problems. Other researchers have suggested that the frequency and type of prior maltreatment impacts outcomes in foster children [36]. Thus, in future research, it will be important to investigate specific placement history variables and maltreatment frequency and type as possible moderators of sleep differences.

The second limitation of our study was the lack of pre–post measures in the treatment outcome study. This limitation was warranted given the exploratory nature of the study and the lack of research in this area with foster children, but it poses challenges to interpreting the results.

The third limitation of our study involved the homogeneity of ethnicity and relatively low-risk nature of our sample, which was recruited from a primarily Caucasian college town. Our findings did not support prior findings of sleep differences (except for differences in nighttime activity) among SES groups. The results from many prior studies indicating impaired sleep related to SES have been found in predominantly urban communities. As such, environmental factors such as neighborhood violence, noise, and home crowding have been implicated in sleep disruption, but these factors may be less prevalent in rural neighborhoods. Additionally, researchers have found ethnicity differences beyond the effects of SES [45], which could not be examined in our predominantly Caucasian sample. In future, larger scale studies, it will be important to explore differences related to ethnicity and setting (rural vs. urban).

Future Directions

The results from our study (and from prior MTFC-P research) have potential treatment implications that warrant further exploration. For example, future researchers should assess the caregiver–child relationship to better understand the relationship between attachment-

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related behavior and sleeping behavior over time. Specifically, it will be important to understand the mechanisms by which sleep might be improved. For example, future studies could compare sleep differences between children with secure or insecure attachment relationships with their caregivers. Furthermore, future researchers should investigate longitudinal changes in sleep as a function of involvement in the MTFC-P program. A longitudinal study would allow for a better understanding of the intervention's impact on sleep, whether sleep stabilizes over time, and whether early prevention efforts impact sleep after pubertal onset: for example, a treatment design in which foster children are randomized into MTFC-P or regular foster care after collecting baseline information about their sleep, with follow-up data collected over the subsequent year. Such work could illuminate the extent to which prior stressful experiences are be attributable to sleep disruption, the extent to which foster care variables maintain or enhance sleep disruption, and the potential mechanisms by which the MTFC-P program reduces sleep problems in foster children.

Summary

In this study, we investigated differences in sleep among 3- to 7-year-old foster children and non-maltreated community children and investigated whether sleep in foster children can be improved via the MTFC-P intervention. The results suggest that participating in the MTFC-P intervention is associated with sleep improvements. Specifically, the TFC children slept longer than RFC and LIC children and spent more time in bed than the LIC and UMC children. Additionally, the TFC group went to bed earlier to than the LIC and UMC children. (The RFC group also went to bed earlier than the LIC children.) The foster children in both groups appeared to have greater problems initiating sleep than the community children. The TFC group had longer sleep latency than both community groups, and the RFC group had more difficulties than the LIC group. Overall, the results from the current study suggest that foster children have more difficulty initiating sleep at bedtime. Thus, it may especially important to address these sleep problems through environmental intervention.

Acknowledgments Support for this research was provided by the following grants: R01 MH059780, NIMH, U.S. PHS; R01 HD045894, NICHD, U.S. PHS; and R01 DA021424 and P30 DA023920, NIDA, U.S. PHS. The authors thank the staff and families of the Multidimensional Treatment Foster Care for Preschoolers program, Kristen Greenley for project management, and Matthew Rabel for editorial assistance.

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