Portrait of sleep in preschoolers involved with Child Protective Services and from the Community

Evelyne Touchette, PhD[1,2,3,4], Michel Rousseau, PhD[1,2], Valérie Simard, PhD[5,6,7], Annick St-Amand, PhD[1,2]

[1]Department of Psychoeducation and Social Work, Université du Québec à Trois-Rivières, Québec, Canada
[2]Centre de recherche universitaire sur les jeunes et les familles, Québec, Canada
[3]Research Unit on Children's Psychosocial Maladjustment, Québec, Canada
[4]Centre d'études avancées en médecine du sommeil, Montréal, Canada
[5]Department of Psychology, Université de Sherbrooke, Québec, Canada
[6]Research Center of the Sainte-Justine University Hospital, Québec, Canada
[7]Charles-Le Moyne Research Center, Québec, Canada

Address correspondence to:
Évelyne Touchette, PhD, Université du Québec à Trois-Rivières, Département de psychoéducation, campus de Québec, Université du Québec à Trois-Rivières; Phone : (418) 659-2170, extension 2837, 550, boul. Wilfrid-Hamel, Québec (Québec), G1M 3E5, Canada, email : Evelyne.Touchette@uqtr.ca

Short title: Child sleep in an adverse context.
Total number of words: 4250; **Number of references:** 45
Submission: *Sleep Medicine*

This work was supported by the Fonds de Recherche du Québec - Société et Culture [grant to Evelyne Touchette, 2019-NP-253118]. We acknowledge the considerable contribution of Sabrina Servot as a research assistant and the "Centre de recherche universitaire des jeunes et des familles" for data collection, and all families who participated in the study and members of the Child Protective Service from Capitale-Nationale. We are thankful to Hélène Paradis for her valuable statistical expertise.

Keywords: Sleep, child, adversity, maltreatment, Child Protective Services, actigraphy, Child Sleep Habits Questionnaire.

Abbreviations: CPS: Child Protective Services; CSHQ: Child Sleep Habits Questionnaire

Abstract

Objectives: The objectives of this exploratory study were: 1) to draw a portrait of sleep, using actigraphic sleep measures, sleep diaries and a validated sleep questionnaire in preschoolers (3- to 5-year-olds) involved with Child Protective Services (CPS) and to compare it with preschoolers from the community, not involved with CPS and 2) to verify whether the sleep differences between the two groups persisted after adjusting for covariates (sociodemographic and child characteristics).

Methods: A total of 92 preschoolers aged from 3 to 5 years (49,5 ± 7,0 months) participated in the study (n=22 preschoolers involved with CPS and n=70 preschoolers from the community). Actigraphic sleep parameters were recorded using the child's non-dominant wrist over 72 hours during weekdays and sleep diaries were filled out by parents (for nighttime) and childcare specialists (for daytime). Parents filled out the Child Sleep Habits Questionnaires (CSHQ) to measure their perception of their child's sleep. Chi-square tests, ANOVAs, and linear regressions were used to analyze the data and adjust for covariates (sociodemographic and child characteristics).

Results: Preschoolers involved with CPS took longer to fall asleep and signaled significantly fewer nighttime awakenings to their parents compared to the group of preschoolers from the community. These significant effects were still present after adjusting for covariates (sociodemographic and child characteristics).

Conclusions: Understanding the underpinnings of these sleep differences by exploring their possible links with daytime cortisol production, sleep ecology and parent-child attachment are interesting avenues for future research.

Introduction

Difficulties initiating and maintaining sleep are the most common sleep problems reported in preschoolers [1]. Sleep is influenced both by biological factors [2, 3] and environmental factors [4, 5]. The transactional child sleep model [4] evolved from the different levels of the bioecological system which postulates that sleep is influenced by the child's characteristics (e.g., health, maturity, temperament), parent-child interactions (e.g., behaviors surrounding sleep periods), parental characteristics (e.g., personality, mental health), cultural factors (e.g., sociocultural norms, media influences), environmental factors (e.g., socioeconomic factors, physical conditions) and family characteristics (e.g., family stress / support). In line with ecological vulnerability indicators [6], there is evidence to suggest that chronic adversity experiences in early infancy, such as maltreatment, primes the brain-mediated stress system which increases the risk of being in a chronically aroused state [7]. The last decade of evidence supports that maltreatment places children at elevated risk for developing social, cognitive, emotional, and health problems [8, 9]. In an early report about stress, trauma and sleep, clinicians outlined sleep problems as one of the most common non-specific consequences of childhood maltreatment [10]. To date, studies investigating actigraphic sleep measures, sleep diaries and a validated sleep questionnaire are scarce in maltreated preschoolers involved with Child Protective Services (CPS).

Studies assessing associations between child maltreatment and sleep among preschoolers were primarily based on subjective sleep data. A large cross-sectional study (n=17,023) found that all types of maltreatment in children (except sexual abuse) were associated with a higher likelihood of global sleep disturbances and short sleep duration (less than 9 hours) after controlling for covariates (child's age, child's sex, maternal education, SES, maternal psychological status, and children's emotional/behavioral problems) [11].

Conversely, a study among preschool-age children who had experienced sexual abuse [12] found that parents reported more sleep disturbances compared to non-sexually abused children. Sleep items in this longitudinal study were measured using a non-specific validated sleep questionnaire, the Child Behavior Checklist (i.e., difficulty falling asleep, nightmares, not wanting to sleep alone, not sleeping at night, sleeping less than most children during the day or night, talking or screaming in their sleep, and waking up often during the night) at 2 time points over the course of one year. Another study of 179 children aged from 3 to 6 years found that reported sleep problems were significantly associated with dissociative symptoms over and above all other covariates (e.g., parental distress, child's age, child's sex, presence of multiple interpersonal traumas and duration of child sexual abuse) [13]. To our knowledge, only one actigraphic study examined sleep in children in foster care using actigraphic measures. They investigated 25 preschoolers (3-7 years of age) who were in foster care and found that poor sleep was associated with past experiences of sexual abuse, neglect and parental stress, whereas no relationship was found between sleep characteristics and past experiences of physical abuse or type of foster family [14]. These findings suggest that different combinations of risk factors may lead to different sleep outcomes among families supervised by CPS.

In sum, prior research has focused on maltreatment as a predictor of sleep problems in childhood. However, it is important to recognize that maltreatment could also influence several factors that impact children's sleep including adverse or environmental stress conditions. In line with the transactional sleep model [4] and ecological vulnerability indicators [6], a myriad of adverse environmental factors may be associated with poor sleep in children from the general population who were not victims of maltreatment [15]. For example, low socioeconomic status is associated with poorer sleep [16]. It is well known that

parental divorce impacts the child's adjustment [17] and is associated with a higher incidence of sleep disorders in children [18]. Child externalizing problems are also associated with concomitant sleep problems [19]. A systematic review [20] showed a robust association between childhood maltreatment and behavioral sleep disturbances which varies with respect to maltreatment characteristics, type of behavioral sleep disturbance assessed, use of subjective versus objective measures, and study design. The prevalence of externalizing problems is greater among children victim of maltreatment compared to those in the general population [21]. Families supervised by CPS, which are burdened by multiple combinations of adverse familial conditions (e.g., poverty, single-parent status), were found at risk for poorer developmental outcomes and of developing sleep problems [22]. Taken together, these sociodemographic and child characteristics may differ between both groups and influence the quality of sleep. The current study aimed to investigate whether sleep differences between the two groups persist after adjusting for above mentioned covariates.

The current exploratory study aimed to draw a portrait of sleep in preschoolers who had experienced maltreatment but were still living with their parents under CPS supervision. This study is the first to compare a portrait of sleep, using actigraphic sleep measures, sleep diaries and a validated sleep questionnaire, in preschoolers involved with CPS compared to preschoolers recruited from the community. We hypothesized that sleep parameters would be poorer in the CPS preschooler group compared with the community group and would persist after adjusting for the targeted covariates, specifically sociodemographic and child characteristics (e.g. family type, household and child externalizing problems).

Methods

Participants

A total of 92 preschoolers aged from 3 to 5 years (49,5 ± 7,0 months) were separated into two groups: 1) preschoolers involved with CPS (n=22, 12 girls, 10 boys) and 2) preschoolers from the community who were not involved with CPS (n=70, 30 girls, 40 boys). The families under CPS supervision were recruited from the Center of integrated University Health and Social Services from the Capitale-Nationale region (Quebec City, Canada). Protective care agencies only referred families that expressed interest and met the eligibility criteria for participation in the study. Therefore, information about the number of families under CPS supervision who were approached and refused was not available. To recruit families from the community, posters about the project were placed in 8 kindergarten or childcare centers from the Quebec City region. Interested parents had to call the research assistant to participate in the project. Therefore, the total pool of potential parents was unavailable. Inclusion criteria were children aged between 3 and 5 years old, born at term (≥ 37 weeks of gestation) and parents were required to have an adequate understanding of French. Exclusion criteria were neurological problems or perinatal syndromes (n=4 children were excluded from the community group), and twin children (n=4 children were excluded from the community group), which differ by their psycho-environmental context compared with singletons. Before participating in the study, all families received detailed information by phone about the aims and procedures of the research program and signed a consent form. The ethics protocol was approved by the Center of integrated University Health and Social Services from the Capitale-Nationale and the Université du Québec à Trois-Rivières's research ethics.

Procedure

We scheduled a home visit with each family, during which a research assistant administered the Child Sleep Habits Questionnaire, sociodemographic questionnaire and BASC-2 to the volunteering parent, installed an actigraph on the child's non-dominant wrist, and provided instructions to the child and parent regarding the actigraph and sleep diaries. The actigraph (Actiwatch-L, Mini-Mitter/Respironics) was worn by the child for 72 consecutive hours during weekdays and could easily be removed during discomfort, swimming, or when bathing. In addition, a sleep diary was kept by the parent to note the times when the actigraph was removed, as well as the child's sleep periods. The volunteering parents were asked to give a daytime sleep diary with written instructions to childcare specialists, except for three children who did not go to daycare. Three days after the first visit, each family was met again to get the actigraph and the sleep diaries back and were offered $CAN40 and a children's book to compensate for their time.

Outcome measures

Sleep characteristics

Actigraphic sleep parameters and sleep diaries

Children had to wear an actigraph (Actiwatch-L, Mini-Mitter; Philips), a small motor activity monitor, on their non-dominant wrist for 72 consecutive hours (3 days) during weekdays to record their motor activity. Actigraphic data were collected in 30-s epochs, meaning that children's activity was recorded every 30 seconds. Actigraphic data plots were examined visually to infer sleeping versus waking periods, with the help of sleep diaries with pre-determined 30 min intervals completed by parents and childcare specialists. Specifically, sleep onset and wake onset were marked manually at the time points of most drastic decrease and increase in motor activity around the sleep and wake onsets reported in the diaries.

Periods without movements that corresponded to removal of the actiwatch as marked on the sleep diary were excluded. Data were analysed with the automated manufacturer actigraphic algorithm. Actigraphic sleep measures are methodologically advantageous, and have been validated against polysomnography for sleep latency, sleep duration and sleep efficiency (r= >0.80) but a weak association with number of awakenings (< 0.40) [23]. As it was documented that this algorithm overestimates night awakenings among preschoolers [24], data were smoothed manually according to the recommendations of Sitnick et al. [25]. Then, 3-day means of sleep onset, wake time, nighttime awakenings duration, nighttime sleep duration, 24-hour sleep duration (total sleep duration including naps) and nighttime sleep efficiency (nighttime sleep duration / [nighttime sleep duration + nighttime wake duration] X 100) were computed. Finally, sleep latency 1 was computed as the difference between the actigraphy-derived sleep onset and the exact bedtime reported in the sleep diary (mean for 3 nights). Sleep latency 2 was computed as the difference between the actigraphy-derived sleep onset and the parental bedtime reported in the Child Sleep Habits Questionnaire which is presented below.

Sleep Questionnaire

The Child Sleep Habits Questionnaire (CSHQ) in toddlers and preschool children [26] is a validated sleep questionnaire. Four open-ended questions were used: (1) bedtime "What time does your child usually go to sleep at night?", (2) waketime "What time does your child usually get up in the morning?", (3) reported 24 h total sleep duration "How long your child sleeps each day (including nighttime sleep and naps", and (4) signaled nocturnal awakenings "Can you write how long on average a nocturnal awakening lasts in minutes?". Responses to these items were used to compute three continuous variables and the last variable (signaled nocturnal awakenings) was coded as less than 30 minutes vs. 30 minutes or more [27].

In all, 33 items were included in the CSHQ total score assessing the child's sleep habits during a typical recent week. Answers were provided on a 3-point frequency scale: frequently (3), sometimes (2) and rarely (1). The CSHQ includes eight subscales derived from 33 items related to sleep disorders in children: (1) bedtime resistance, (2) sleep onset delay, (3) sleep duration, (4) sleep-related anxiety, (5) nocturnal awakenings, (6) parasomnias, (7) sleep apnea as well as (8) daytime sleepiness. These eight dimensions shed light on the clinical manifestations of the most common sleep disorders in children, and on daytime sleepiness, which is a common consequence of many of these sleep-related problems. The CHSQ has good psychometric qualities [28], such as adequate internal consistency for both the clinical samples (alpha coefficients for subscales of the CSHQ ranged from 0.56 (Parasomnias) to 0.93 (Sleep-Disordered Breathing) and the community sample (alpha coefficients for subscales from 0.36 (Parasomnias) to 0.70 (Bedtime Resistance and an acceptable test-retest reliability (range 0.62 to 0.79). CSHQ subscales and total scores were able to consistently differentiate the sleep-disordered group from the community, demonstrating validity [28].

Covariates

Sociodemographic questionnaire

A sociodemographic questionnaire, administered to the volunteering parent by a research assistant, asked for the following characteristics: child's age (in months), child's sex (boy or girl), family type (intact or not), volunteering parent's sex and household income. Answers to the latter question were provided using the following scale in Canadian Dollars: 1) <10 000$, 2) 10 000$ to 19 999$, 3) 20 000$ to 29 999$, 4) 30 000$ to 39 999$, 5) 40 000$ to 49 999$ and 6) 50 000$ or more.

Child externalizing problems

To assess child externalizing problems, a research assistant administered the BASC-2 to parents (BASC-2-CDN-F, version for French Canadians; [29]), developed for children aged from 2 to 5 years (PRS-P version). The BASC-2 comprises 134 items rated on a four-point Likert scale, ranging from 0 (never) to 3 (always). It assesses four dimensions of behavioral and emotional functioning, including a global score of externalizing behavior problems (conduct problems (e.g., is easily frustrated, loses temper too easily, etc.) and hyperactivity (e.g., is easily distracted, has trouble concentrating, etc.). The BASC-2 has good psychometric qualities for preschoolers [29] and correlations among the four factors (externalizing problems, internalizing problems, adaptative skills and inattention) ranging from r=.36 to r=.59, indicating discriminant validity across the factors [30].

Data analysis

Data manipulation and analyses were performed using the SPSS statistical programming language (Version 27; SPSS windows). To test the sociodemographic and child differences between the groups, chi-squared tests were used for categorical variables (i.e., child's sex, volunteering parent's sex, and family status). ANOVAs or Welch tests (when homogeneity of variance was significant) were used to compare differences between both groups for continuous variables (i.e., child's age, income household and child externalizing problems).

The data from the nights when the actigraph malfunctioned (one child from the community), instances where parents did not fill out Child Sleep Habits Questionnaire (one child part of CPS) and in the situation where a child took melatonin for treatment (one child

part of CPS), were excluded from the analyses. Sleep variables (in hours and minutes) were converted to numeric data in order to perform the statistical analyses but were reconverted in hours and minutes thereafter. Exploratory analyses, frequency (i.e. proportions of children who signaled or not their nocturnal sleep awakenings) and descriptive analyses were done using continuous sleep variables.

In order to test sleep differences between both groups, chi-squared tests were used for categorical variables (proportions of children who signaled or not their nocturnal sleep awakenings). Effect size was assessed using Cramer's V; small effect: <0.30, medium effect: 0.30 to 0.60 and large effect: > 0.60 [31]. ANOVAs or Welch tests (when homogeneity of variance was significant) were used for continuous sleep variables to compare both groups. The magnitude of group differences was reported with Eta-squared ($\eta 2$); small effect: 0.01 to 0.06, medium effect: 0.06 to 0.14 and large effect: > 0.14 [32].

In order to explore whether sleep differences between preschoolers involved with CPS and the community persisted after adjusting for other significant differences between the groups (see above, sociodemographic and child characteristics), linear regressions (if between-group difference was a continuous variable) and logistic regressions (if between-group difference was a categorical variable) were used. All statistical tests were two-tailed and the α-level was set at < 0.05.

Results

Sociodemographic and Child Characteristics

Table 1 presents the differences on sociodemographic and child characteristics between preschoolers involved with CPS (n=22) and from the community (n=70) groups. No

significant differences between the groups were found for the child's sex, age, or the volunteering parent's sex (mother vs. father). However, the group of preschoolers involved with CPS had a higher proportion of not intact families (χ^2=26.07, df=1, p <.001, Cramer's V=0.53), a lower household income (Welch test=10.48, df=1, η2=0.13 (0.03 - 0.26), p = 0.003), and more externalizing behavioral problems (F=5.70, df=1, η2=0.05 (0.06 (0.00 - 0.17), p = 0.02), compared with the group of preschoolers from the community.

[Insert Table 1]

Actigraphic sleep parameters and sleep diaries

Regarding sleep latency 1 (i.e., actigraphic sleep onset minus bedtime from the sleep diaries (mean of 3 nights)), preschoolers involved with CPS took longer to fall asleep (mean = 44 minutes, SD = 28 minutes) compared with preschoolers from the community (mean = 32 minutes, SD = 19 minutes) (F=4.46, df=1, η2=0.06 (0.00 – 0.18), p = 0.04). Regarding sleep latency 2 (i.e., actigraphic sleep onset minus reported parental bedtime obtained from the CSHQ), preschoolers involved with CPS took longer to fall asleep (mean = 1h13, SD = 25 minutes) compared with preschoolers from the community (mean = 50 minutes, SD = 26 minutes) (F=11.54, df=1, η2=0.12 (0.02 – 0.25), p = 0.001). No other significant difference was found on actigraphic sleep parameters between preschoolers involved with CPS and the group of preschoolers from the community (Table 2). The average bedtime was 21h00 (SD = 39 min) for preschoolers involved with CPS, and 20h50 (SD = 34 min) for those from the community sample, with no significant differences between the two groups. Average wake time was 6h38 (SD = 51 min) for preschoolers involved with CPS and 6h36 (SD = 39 min) for those from the community, with no significant between-group differences. Similarly, there were no significant statistical differences between groups on sleep duration (nocturnal or over a 24-hour period) and sleep efficiency. For example, not having a poor sleep efficiency (<

74%) [33] was found in both groups, with no between-group differences (mean = 95.3%, SD= 4.0 vs mean = 96.9%, SD=2.7, $p = 0.43$).

[Insert Table 2]

Sleep Characteristics Assessed by the CSHQ

Preschoolers involved with CPS signaled fewer nighttime awakenings to their parents compared to preschoolers from the community sample (χ^2=6.92, df=1, Cramer's V=.28, p = .009). Parent-reported bedtime (F=3,68, df=1, η2=04 (0.00 - 0.14), p = 0.06) and bedtime resistance scale (Welch test=3.80, df=1, η2=.06 (0.00 - 0.18), p = 0.06) marginally differed between the groups. The total and other subscale scores of the CSHQ were not significantly different between preschoolers involved with CPS and the group of preschoolers from the community sample (Table 3).

Did the sleep differences persist after adjusting on sociodemographic and child differences between the two groups?

Linear regression analyses revealed that preschoolers involved with CPS were more likely than the group of preschoolers from the community to experience a longer sleep latency (1 and 2) even after adjusting on significant sociodemographic differences between the two groups (e.g., family type, household income and child externalizing problems) (Table 4). The logistic regression about signaled nocturnal awakenings was not completed due to small cell sizes.

[Insert Table 4]

Discussion

Using actigraphic sleep measures, sleep diaries, and a validated sleep questionnaire (CSHQ), the current exploratory study aimed to draw a portrait of sleep in preschoolers who experienced maltreatment and continued to live with their parents under CPS supervision, compared to a group of preschoolers from the community. It was not possible to conclude that there were any differences between the two groups of preschoolers with respect to nighttime sleep duration, 24-hour total sleep duration, nighttime sleep efficiency, CSHQ total score and any subscales of the CSHQ. However, preschoolers involved with CPS signaled significantly fewer nighttime awakenings to their parents compared to the group of preschoolers from the community. Finally, preschoolers who experienced maltreatment and continued to live with their parents under CPS supervision took significantly longer to fall asleep compared to the group of preschoolers from the community. The differences in sleep latency 1 and 2 persisted after adjusting for the targeted covariates, sociodemographic and child characteristics (e.g. family type, household and child externalizing problems).

First, we found that preschoolers involved with CPS signaled fewer nighttime awakenings than their peers from the community, whereas, based on actigraphic data, both groups spent the same amount of time awake during the night. According to Beaudoin et al. [34], preschool-aged victims of maltreatment are likely to develop insecure attachment styles, because of inconsistent parental responses to their emotional needs. Hence, preschoolers who experienced maltreatment may be less likely to signal their nocturnal awakenings because of experiences with caregivers who offered limited or inadequate responses to their needs. Noteworthy, according to subjective measures in general population studies, some children with insecure attachment (ambivalent/resistant) rather tend to amplify distress, therefore were more likely to signal their awakenings and have poorer sleep [35]. It may be that, in the

current study, only few children had high attachment ambivalence, and rather most of them had high attachment avoidance (child avoids the parent and manifests little visible distress when under stress) [36]. Such an assumption is coherent with a recent study that revealed more attachment avoidance indicators among children in foster care, compared to those in a community sample [37]. Future studies should investigate maltreatment, sleep and attachment in order to disentangle the influence of these factors.

Second, we found that preschoolers involved with CPS took longer to fall asleep compared with the group of preschoolers from the community. In line with ecological vulnerability indicators [6], it is well known that chronic adversity experiences in early life, such as maltreatment, could prime the brain-mediated stress system increasing the risk of being in a chronically aroused state [7]. This hypervigilance may often make it difficult for the child to fall asleep [38,39]. The hypothalamus-pituitary-adrenal (HPA) axis was found to be vulnerable to long-term effects of adversity in early childhood, especially when children experienced neglect from their caregivers [40]. It may affect the production of glucocorticoids (daytime cortisol pattern), normally characterized by a high waking value (peaking about 30 minutes after waking), followed by a rapid decline and then a slow drop-off across the day until reaching the lowest value at bedtime. A study [41] found that preschoolers involved with CPS who continued to live with their parents showed the most blunted (a flattened slope with a high value before bedtime) pattern of diurnal cortisol production compared with children in a low-risk sample. This result may suggest a potential biological dysregulation likely to affect sleep onset under adverse conditions. Future longitudinal studies are needed to examine sleep routine, actigraphic sleep parameters and cortisol production in preschoolers who experienced maltreatment in order to better understand the sequelae of childhood trauma on the risk of developing difficulties in initiating sleep and later externalizing problems [42, 43].

The above findings should be viewed in light of the present study's strengths and limitations. The use of actigraphic sleep measures and sleep diaries for three consecutive 24-hour periods (even during daycare) on weekdays contribute to increasing the study's internal validity. Another strength of the study was the use of a validated sleep questionnaire, the CSHQ. A major limitation of the study is the small and uneven sample size between the CPS group and the community group. Also, it is not possible to randomly assign children to conditions of abuse and/or neglect, and therefore a third variable (or variables) could account for the findings and heterogeneity between the groups that could not be controlled for. In addition, sleep is a multifaceted construct which implicates several sleep parameters [44]. Therefore, multiplicity of tests to compare both objective and subjective indicators of children's sleep quality could lead to a potential inflation of type I error rate as a result of the analysis of multiple outcomes [45]. Moreover, data about types of abuse or neglect (intensity, severity and length) and types of services offered to preschoolers who experienced maltreatment were unavailable and hence prevented us from exploring the effects of these potential covariates. Finally, the maternal reports provided in the CSHQ were potentially biased by social desirability, especially for parents under CPS supervision.

Despite these limitations, the current exploratory study sheds light on the portrait of sleep in preschoolers who experienced maltreatment and are supervised by CPS. According to other researchers [12,13], contextualizing the impact of poor sleeping habits is imperative in preschool-aged children who experienced maltreatment. Further longitudinal investigations incorporating actigraphic sleep measures, daytime cortisol production, and observational data about sleep ecology at home are needed to clarify the mechanisms linking child maltreatment and sleep. Finally, although more research is needed, the results of this study suggest that

418 professionals in youth protection agencies should investigate how sleep is initiated (e.g., sleep
419 hygiene and relaxing sleep methods may be taught in an effort to reduce sleep latency) in
420 families under CPS supervision. In addition, professionals in youth protection agencies should
421 also explore how parents answer nocturnal awakenings according to the child's needs in
422 different contexts in order to optimize attachment in preschoolers who have experienced
423 maltreatment. Future studies should test our results in a larger sample to establish whether a
424 sleep routine and education on sleep hygiene tailored for the child's specific sleep
425 environment could reduce the impact of familial instability in CPS families.
426

Table 1. Differences on sociodemographic variables between the preschoolers involved with Child Protective Services and those from the community.

Sociodemographic variables	Child Protective Services (n=22)	Community (n=70)	*P*
Categorical variables	n (%)	n (%)	
Child's sex, boys (%)	10 (45.5)	40 (57.1)	.34
Volunteering parent's, mother (%)	18 (81.8%)	63 (90.0)	.30
Family status, not intact (%)	13 (59.1)	6 (8.6)	**<.001**
Continuous variables	mean (SD)	mean (SD)	
Child age, in months	47.8 (6.1)	50.0 (7.3)	.19
Household income[1]§	4.1 (1.7)	5.4 (1.3)	**.003**
Child externalizing problems	109.5 (17.4)	100.7 (14.4)	**.02**

[1] The scale of household income is: 1=less than 10 000$, 2=10 000$ to 20 000$, 3=20 000$ to 30 000$, 4=30 000$ to 40 000$, 5=40 000$ to 50 000$ and 6=50 000$ or more.

§ Welch test was used because homogeneity of variance is significant.

Table 2. Differences on actigraphic sleep parameters between a group of preschoolers involved with Child Protective Services and a group of preschoolers from the community.

Actigraphic sleep parameters	Child Protective Services (n=21) Mean (SD)	Community (n=69) Mean (SD)	*P*
Sleep onset[1]	21:00 (0:39)	20:50 (0:34)	.28
Sleep latency 1 (actigraphic sleep onset minus bedtime from sleep diaries, mean on 3 nights), min	44 (28)	32 (19)	**.04**
Sleep latency 2 (actigraphic sleep onset minus bedtime from reported bedtime from CSHQ), min	1h13 (25)	50 (26)	**.001**
Wake time[1]	6:38 (0:51)	6:36 (0:39)	.88
Nighttime awakenings duration, min	28 (23)	24 (17)	.48
Number of nighttime awakenings	2.3 (1.5)	2.2 (1.3)	.82
Nighttime sleep duration	9h10 (0h44)	9h21 (0h37)	.25
24h total sleep duration, minutes (including naps)	10h30 (0h44)	10h34 (0h42)	.68
Nighttime sleep efficiency (%)	95.3 (4.0)	95.9 (2.7)	.43

[1] values reflect 24hr time.

One child part of CPS was excluded of the analyses because he was treated with melatonin and actigraphic measures did not work for one child from the community.

Table 3. Comparisons of the Child Sleep Habits Questionnaire (CSHQ) scores between the CPS and community groups.

Items from CSHQ	Child Protective Services (n=20) Mean (SD) or n (%) ‖	Community (n=70) Mean (SD) or n (%) ‖	*P*
Parental reports from CSHQ			
Bedtime[1]	19:46 (0:29)	20:01 (0:31)	.06
Waketime[1]	6:29 (0:35)	6:38 (0:43)	.43
24 h total sleep duration (including naps)	11h43 (0h56)	11h30 (1h05)	.43
Signaled nocturnal awakenings, yes‖, n (%)	6 (30.0)	43 (63.2)	**.009**
Subscales (CSHQ)			
Bedtime resistance§	8.9 (2.9)	7.4 (2.0)	.06
Sleep onset delay	2.0 (0.8)	2.0 (0.8)	.83
Sleep duration	3.8 (1.4)	3.9 (1.3)	.72
Sleep anxiety	6.3 (1.8)	5.7 (1.6)	.22
Night awakenings	4.0 (1.7)	4.3 (1.5)	.47
Parasomnias§	9.4 (1.4)	9.3 (1.9)	.70
Sleep disordered breathing	3.4 (0.5)	3.5 (1.1)	.54
Daytime sleepiness	11.9 (2.9)	12.2 (3.0)	.66
CSHQ total score	46.7 (5.3)	44.6 (6.7)	.51

[1] values reflect 24hr time.

‖ Signaled nocturnal awakenings is a categorical variable; yes = duration > 30 minutes.

§ Welch test was used because homogeneity of variance is significant.

Two children part of CPS was excluded of the analyses because one child was treated with melatonin and for the other child, his parent did not fill out the CSHQ.

Table 4. Models of significant sleep parameters associated with being supervised by CPS adjusting on targeted covariates (sociodemographic and child characteristics).

Models	Sleep latency 1		Sleep latency 2	
	Standardized Beta	*P*	Standardized Beta	*P*
Model 1				
Being supervised by CPS	.23	**.03**	.34	**.001**
Model 2				
Being supervised by CPS	.27	**<.05**	.39	**.003**
Non-intact family	.02	.91	-0.21	.15
Household income	.10	.48	-0.21	.13
Child externalizing problems	-.02	.84	-.04	.71

Sleep latency 1 means actigraphic sleep onset minus bedtime from sleep diaries, mean of 3 nights.
Sleep latency 2 means actigraphic sleep onset minus parental bedtime from CSHQ.
0 (reference) = not supervised by CPS; 1 = supervised by CPS.
0 (reference) = intact family; 1 = not intact family.
The scale of household income is an ordinal variable: 1=less than 10 000$, 2=10 000$ to 20 000$, 3=20 000$ to 30 000$, 4=30 000$ to 40 000$, 5=40 000$ to 50 000$ and 6=50 000$ or more.
Child externalizing problems is a continuous variable (raw scores).

…

References

[1] Honaker, S. M., & Meltzer, L. J. (2016). Sleep in pediatric primary care: A review of the literature. *Sleep medicine reviews*, *25*, 31-39.

[2] Cajochen, C., Münch, M., Knoblauch, V., Blatter, K., & Wirz-Justice, A. (2006). Age-related changes in the circadian and homeostatic regulation of human sleep. *Chronobiology international*, *23*(1-2), 461-474.

[3] Jenni, O. G., Borbély, A. A., & Achermann, P. (2004). Development of the nocturnal sleep electroencephalogram in human infants. *American Journal of Physiology-Regulatory, Integrative and Comparative Physiology*, *286*(3), R528-R538.

[4] Sadeh, A., & Anders, T. F. (1993). Infant sleep problems: Origins, assessment, interventions. *Infant mental health Journal*, *14*(1), 17-34.

[5] El-Sheikh, M., & Sadeh, A. (2015). I. Sleep and development: introduction to the monograph. *Monographs of the Society for Research in Child Development*, *80*(1), 1-14.

[6] Beroya-Eitner, M. A. (2016). Ecological vulnerability indicators. *Ecological indicators*, *60*, 329-334.

[7] Perry, B. D., Pollard, R. A., Blakley, T. L., Baker, W. L., & Vigilante, D. (1995). Childhood trauma, the neurobiology of adaptation, and "use-dependent" development of the brain: How "states" become "traits". *Infant mental health journal*, *16*(4), 271-291.

[8] Shonkoff, J. P., Boyce, W. T., & McEwen, B. S. (2009). Neuroscience, molecular biology, and the childhood roots of health disparities: building a new framework for health promotion and disease prevention. *Jama*, *301*(21), 2252-2259.

[9] Boyce, C. A., & Maholmes, V. (2013). Attention to the neglected: Prospects for research on child neglect for the next decade. *Child maltreatment*, *18*(1), 65-68.

[10] Sadeh, A. (1996). Stress, trauma, and sleep in children. *Child and Adolescent Psychiatric Clinics of North America*, *5*, 685-700.

[11] Wang, Z., Li, W., Cui, N., Sun, X., Rong, T., Deng, Y., ... & Wang, G. (2022). The association between child maltreatment and sleep disturbances among preschoolers. *Child Abuse & Neglect*, *127*, 105525.

[12] Langevin, R., Hébert, M., Guidi, E., Bernard-Bonnin, A. C., & Allard-Dansereau, C. (2017). Sleep problems over a year in sexually abused preschoolers. *Paediatrics & child health*, *22*(5), 273-276.

[13] Hébert, M., Langevin, R., Guidi, E., Bernard-Bonnin, A. C., & Allard-Dansereau, C. (2017). Sleep problems and dissociation in preschool victims of sexual abuse. *Journal of Trauma & Dissociation*, *18*(4), 507-521.

[14] Dubois-Comtois, K., Cyr, C., Pennestri, M. H., & Godbout, R. (2016). Poor quality of sleep in foster children relates to maltreatment and placement conditions. *SAGE Open*, *6*(4), 2158244016669551.

[15] Touchette, É., Petit, D., Tremblay, R. E., & Montplaisir, J. Y. (2009). Risk factors and consequences of early childhood dyssomnias: New perspectives. *Sleep medicine reviews*, *13*(5), 355-361.

[16] El-Sheikh, M., Bagley, E. J., Keiley, M., Elmore-Staton, L., Chen, E., & Buckhalt, J. A. (2013). Economic adversity and children's sleep problems: Multiple indicators and moderation of effects. *Health Psychology*, *32*(8), 849.

[17] Davidson, R. D., O'Hara, K. L., & Beck, C. J. (2014). Psychological and biological processes in children associated with high conflict parental divorce. *Juvenile and Family Court Journal*, *65*(1), 29-44.

[18] Al Gharaibeh, F. M. (2015). The effects of divorce on children: Mothers' perspectives in UAE. *Journal of Divorce & Remarriage*, *56*(5), 347-368.

[19] Gregory, A. M., & Sadeh, A. (2012). Sleep, emotional and behavioral difficulties in children and adolescents. *Sleep medicine reviews*, *16*(2), 129-136.

[20] Brown, S. M., Rodriguez, K. E., Smith, A. D., Ricker, A., & Williamson, A. A. (2022). Associations between childhood maltreatment and behavioral sleep disturbances across the lifespan: A systematic review. *Sleep medicine reviews*, *64*, 101621.

[21] Center for Disease Control and prevention, 2020. *Data and statistics about children's mental health*. https://www.cdc.gov/childrensmentalhealth/data.html

[22] Vig, S., Chinitz, S., & Shulman, L. (2005). Young children in foster care: Multiple vulnerabilities and complex service needs. *Infants & Young Children*, *18*(2), 147-160.

[23] Bélanger, M. È., Bernier, A., Paquet, J., Simard, V., & Carrier, J. (2013). Validating actigraphy as a measure of sleep for preschool children. *Journal of Clinical Sleep Medicine*, *9*(7), 701-706.

[24] Bélanger, M. È., Bernier, A., Paquet, J., Simard, V., & Carrier, J. (2013). Validating actigraphy as a measure of sleep for preschool children. *Journal of Clinical Sleep Medicine*, *9*(7), 701-706.

[25] Sitnick, S. L., Goodlin-Jones, B. L., & Anders, T. F. (2008). The use of actigraphy to study sleep disorders in preschoolers: some concerns about detection of nighttime awakenings. *Sleep*, *31*(3), 395.

[26] Goodlin-Jones, B. L., Sitnick, S. L., Tang, K., Liu, J., & Anders, T. F. (2008). The Children's Sleep Habits Questionnaire in toddlers and preschool children. *Journal of Developmental & Behavioral Pediatrics*, *29*(2), 82-88.

[27] Gaylor, E. E., Goodlin-Jones, B. L., & Anders, T. F. (2001). Classification of young children's sleep problems: a pilot study. *Journal of the American Academy of Child & Adolescent Psychiatry*, *40*(1), 61-67.

[28] Owens, J. A., Spirito, A., & McGuinn, M. (2000). The Children's Sleep Habits Questionnaire (CSHQ): psychometric properties of a survey instrument for school-aged children. *Sleep-New York-*, *23*(8), 1043-1052.

[29] Kamphaus, R. W. (2014). Behavior Assessment System for Children, (BASC-2). *The encyclopedia of clinical psychology*, 1-6.

[30] Dowdy, E., Chin, J. K., Twyford, J. M., & Dever, B. V. (2011). A factor analytic investigation of the BASC-2 Behavioral and Emotional Screening System Parent Form: Psychometric properties, practical implications, and future directions. *Journal of School Psychology*, *49*(3), 265-280.

[31] Acock, A. C., & Stavig, G. R. (1979). A measure of association for nonparametric statistics. *Social Forces*, *57*(4), 1381-1386.

[32] Maxwell, S. E., Camp, C. J., & Arvey, R. D. (1981). Measures of strength of association: A comparative examination. *Journal of Applied Psychology*, *66*(5), 525.

[33] Ohayon, M., Wickwire, E. M., Hirshkowitz, M., Albert, S. M., Avidan, A., Daly, F. J., ... & Vitiello, M. V. (2017). National Sleep Foundation's sleep quality recommendations: first report. *Sleep health*, *3*(1), 6-19.

[34] Beaudoin, G., Hébert, M., & Bernier, A. (2013). Contribution of attachment security to the prediction of internalizing and externalizing behavior problems in preschoolers victims of sexual abuse. *European Review of Applied Psychology*, *63*(3), 147-157.

[35] Simard, V., Chevalier, V., & Bédard, M. M. (2017). Sleep and attachment in early childhood: a series of meta-analyses. *Attachment & human development*, *19*(3), 298-321.

[36] Solomon, J., & George, C. (2008). The measurement of attachment security and related constructs in infancy and early childhood.

[37] Carrera, P., Román, M., & Jiménez-Morago, J. M. (2021). Foster children's attachment representations: the role of type of maltreatment and the relationship with birth family. *Attachment & Human Development*, *23*(6), 969-986.

[38] Dahl, R. E. (1996). The regulation of sleep and arousal: Development and psychopathology. *Development and psychopathology*, *8*(1), 3-27.

[39] Keller, P., & El-Sheikh, M. (2011). Children's emotional security and sleep: Longitudinal relations and directions of effects. *Journal of Child Psychology and Psychiatry*, *52*(1), 64-71.

[40] Ladd, C. O., Huot, R. L., Thrivikraman, K. V., Nemeroff, C. B., & Plotsky, P. M. (2004). Long-term adaptations in glucocorticoid receptor and mineralocorticoid receptor mRNA and

negative feedback on the hypothalamo-pituitary-adrenal axis following neonatal maternal separation. *Biological psychiatry*, *55*(4), 367-375.

[41] Bernard, K., Butzin-Dozier, Z., Rittenhouse, J., & Dozier, M. (2010). Cortisol production patterns in young children living with birth parents vs children placed in foster care following involvement of Child Protective Services. *Archives of pediatrics & adolescent medicine*, *164*(5), 438-443.

[42] Shoal, G. D., Giancola, P. R., & Kirillova, G. P. (2003). Salivary cortisol, personality, and aggressive behavior in adolescent boys: a 5-year longitudinal study. *Journal of the American Academy of Child & Adolescent Psychiatry*, *42*(9), 1101-1107.

[43] Van Goozen, S. H., Fairchild, G., Snoek, H., & Harold, G. T. (2007). The evidence for a neurobiological model of childhood antisocial behavior. *Psychological bulletin*, *133*(1), 149.

[44] Sadeh, A. (2015). III. Sleep assessment methods. *Monographs of the Society for Research in Child Development*, *80*(1), 33-48.

[45] Li, G., Taljaard, M., Van den Heuvel, E. R., Levine, M. A., Cook, D. J., Wells, G. A., ... & Thabane, L. (2017). An introduction to multiplicity issues in clinical trials: the what, why, when and how. *International journal of epidemiology*, *46*(2), 746-755.