ORIGINAL ARTICLE

Sleep among youths in foster care: Associations with potentially traumatic events, PTSD and mental health

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Abstract

Among maltreated youth in foster care, little is known about frequency of sleep problems and its association to potential traumatic events (PTEs) and mental health. Among youths in foster care, we examined: (1) sleep patterns, difficulties initiating and maintaining sleep (DIMS) and related functional impairment; (2) whether exposure to PTEs, symptoms of post-traumatic stress disorder (PTSD) and general mental health problems are associated with DIMS and related functional impairment, controlling for age, gender and time in foster care; and (3) whether PTSD and general mental health problems mediate the association between PTEs and DIMS. Foster youths in Norway (n = 299) completed a survey on sleep behaviour, the Child and Adolescent Trauma Screen, and the Strengths and Difficulties Questionnaire. Overall, 53.2% reported DIMS. For 82.1%, these sleep problems had lasted 3 months plus. Increased PTEs, PTSD and general mental health problems were all associated with increased DIMS score. Increased rate of PTEs was associated with decreased sleep duration. PTSD and general mental health problems partially mediated the association between PTEs and DIMS. Youth in foster care are at high risk of sleep problems, related to traumatic experiences and mental health problems. Treatment of PTSD may improve sleep problems among maltreated youth.

KEYWORDS
foster youth, mental health, potential traumatic events, PTSD, sleep

1 | BACKGROUND

Sleep problems are frequent among children and adolescents and are related to mental and physical health problems as well as impairment in cognitive function and school performance (Astill, Van der Heijden, Van IJzendoorn, & Van Someren, 2012; Hestetun, Svendsen, & Oellingrath, 2018). As many as three in four 11–15-year-olds have some degree of sleep problems (Ipsiroglu, Fatemi, Werner, Paditz, & Schwarz, 2002), and around 20% of 16–19-year-old adolescents fulfil the diagnostic criteria for an insomnia disorder (Hysing, Pallesen, Stormark, Lundervold, & Sivertsen, 2013). The rate of sleep problems

increases from early to late adolescence. In a population-based longitudinal study, the rate of difficulties initiating and maintaining sleep (DIMS) increased from 12.7% among 11–13-year-olds to 32.8% at the age of 16–18 years (Sivertsen, Harvey, Pallesen, & Hysing, 2017). Sleep duration decrease during the adolescent years, and in a meta-analysis, over half the studies reported sleep duration shorter than recommended (Gradisar, Gardner, & Dohnt, 2011). Sleep problems may be even more prevalent in high-risk groups such as children in foster care, given the high rate of risk factors for sleep problems including exposure to a spectrum of negative life events (Lehmann, Breivik, Monette, & Minnis, 2020) and high prevalence of a broad

range of mental disorders (Bronsard et al., 2016). Still, there is a dearth of studies about sleep among children in care, especially older children, and how sleep is associated with negative life events and mental health (Lawrence & Michelmore, 2019).

Sleep problems are frequent among young children in foster care (Dubois-Comtois, Cyr, Pennestri, & Godbout, 2016; Tininenko, Fisher, Bruce, & Pears, 2010). Among maltreated preadolescents in foster care, sleep problems were reported by more than 20% of their caregivers (Hambrick, Rubens, Brawner, & Taussig, 2018). Sleep problems were more frequent among young adults that had grown up in foster care than among low-income peers, with more night-time awakenings, longer sleep onset latency (SOL) and shorter sleep duration (Fusco, 2019). However, to our knowledge, no studies have investigated self-reported sleep-patterns and problems in more detail in older children and adolescents in foster care (Dubois-Comtois et al., 2016). This is an especially relevant age to investigate sleep, as sleep duration decreases and sleep problems increase in the general population during this time (Sivertsen et al., 2017).

The high rate of potentially traumatic events experienced by youth in foster care is one reason why sleep problems are expected to be higher in this group. Sleep is a fundamental biological process and an important self-regulatory mechanism when confronted with major life events and trauma. Traumatic events may trigger neurophysiological responses contributing to hyperarousal, that again may be an important physiological mechanism for the development and maintenance of sleep problems (Sinha, 2016). Presleep arousal, which may be experienced as both somatic and cognitive arousal, may impede sleep onset and increase insomnia symptoms (Scott, Alfano, Russell, & Weems, 2019). Acute sleep problems are a common reaction to potentially traumatic events (Glod, Teicher, Hartman, & Harakal, 1997). Retrospective studies of adults have found that both increased severity and increased numbers of adverse childhood experiences (ACEs) were associated with poor sleep quality (Bader, Schafer, Schenkel, Nissen, & Schwander, 2007). Later findings indicate a cumulative association between ACEs and self-reported sleep problems, that is, trouble falling or staying asleep, feeling tired after sleep (Chapman et al., 2011) and insomnia (Wang, Raffeld, Slopen, Hale, & Dunn, 2016). Sexual abuse was associated with sleep disturbances among teenagers living in residential care, whereas neglect, physical abuse and mental health problems did not increase sleep problems (Langevin et al., 2019). However, this study did not utilize validated self-report measures on mental health and did not screen for post-traumatic stress disorder (PTSD). Further, their sleep measure only consisted of three items and did not include a measure of sleep duration, and thus it is not certain if the association holds for sleep duration measures.

Sleep problems are seen both as core symptoms or 'hallmarks of PTSD' and as an important risk indicator and a mechanism of pathophysiology of chronic PTSD (Germain, 2013). Research on sleep problems in children with PTSD is limited and restricted to reports of more sleep disturbances in trauma-exposed and paediatric PTSD populations than in nonexposed samples following war trauma, terrorist attacks or natural disasters (Kovachy et al., 2013). PTSD symptoms may also arise as a consequence of child abuse and neglect (Kearney, Wechsler, Kaur, & Lemos-miller, 2010). Among youth in foster care,

PTSD symptoms are prevalent, with as many as 53% scoring at or above the clinical cut-off on PTSD symptoms, and where PTSD symptom load is strongly associated with exposure to abuse and neglect (Lehmann et al., 2020).

Among maltreated adolescent girls with active cases in the child welfare services (CWS), there was a reciprocal association between symptoms of depression and PTSD, and sleep disturbances, where these symptoms predicted sleep disturbances and sleep disturbances predicted depressive and PTSD symptoms 4 years later (Schneiderman, Ji, Susman, & Negriff, 2018). This effect was not found for boys. McPhie, Weiss and Wekerle (2014) found that rather than through a direct association, maltreatment was only associated with sleep disturbance through psychological distress among adolescents receiving services from CWS. Among preadolescents in foster care, sleep problems is found to partially mediate the strong association between ACEs and delinquency (Hambrick et al., 2018). Sleep problems were, however, not associated with symptoms of PTSD in this study. To sum up, previous studies indicate both symptoms of PTSD and mental health problems as important for sleep in maltreated youth, but the nature of the association is still uncertain, with different models tested in the literature.

Sleep problems co-occur with both internalizing and externalizing mental health problems (Cox & Olatunji, 2016; Lycett, Sciberras, Mensah, & Hiscock, 2015), and a reciprocal relationship has been detected between sleep problems and oppositional defiant disorder, general anxiety disorder and depression among children and adolescents aged 9–16 years (Shanahan, Copeland, Angold, Bondy, & Costello, 2014). Further, among children diagnosed with ADHD, co-occurring internalizing and externalizing symptoms increased the risk of sleep problems (Lycett et al., 2015). Together, these findings suggest that a broad range of mental health problems are associated with sleep problems and that the total load of symptoms, regardless of subtype, might affect sleep in children and young people. Children in foster care may be particularly subjected to sleep problems due to their high prevalence of mental disorders with high comorbidity (Lehmann, Havik, Havik, & Heiervang, 2013).

1.1 | Aims

In this study, we aim to examine the following: (1) Sleep patterns and sleep problems in a sample of young people aged 11–17 years, living in foster care, more specifically, sleep problems (problems with falling asleep and early awakening), sleep duration, bed and rise time, time in bed (TIB), SOL, wake after sleep onset (WASO), sleep need and sleep deficiency; (2) Whether exposure to potential traumatic events (PTEs), load of PTSD symptom and other symptoms of mental health problems are associated with sleep problems (i.e., DIMS and sleep duration) and sleep-related functional impairment (amount of sleep during the day and frequency of oversleeping on schooldays), controlling for age, gender and time in foster care; (3) Whether the effect of potentially traumatic events on DIMS are mediated through (a) PTSD symptoms and (b) other mental health problems.

2 | METHODS

2.1 | Procedure and study sample

The study sample is part of the ongoing research project in Norway; Young in Foster Care (https://www.norceresearch.no/en/projects/ung-i-fosterhjem). Data collection was completed between 1 October 2016 and 31 March 2017. Eligible young people in foster care were born between 1999 and 2005, and their current foster placement had lasted at least 6 months, following legally mandated placement. Municipalities in the five counties encompassed by The Office for Children, Youth and Family Affairs—region south—were responsible for all placements. Participants were assessed for eligibility from regional records (N = 573) and from the municipal child protection services (CPS; N = 279) in the region. Background information for all eligible youths were given by the head of each office in the CPS; in total, 740 foster youth were identified as eligible.

We invited foster parents and youths to participate by postal mail comprising an information letter describing the study and how to complete the survey. In accordance with Norwegian legislation, we enclosed invitations to youths aged 11–15 years in the letter addressed to the carers, whereas youths aged 16 years and older received the information letter directly addressed to them. We sent reminders by post and subsequently contacted the families by telephone to prompt participation. Participants completed the questionnaire separately either online or via telephone interview. We compensated participating youths with a gift card of 33 USD. Foster parents did not receive compensation for participating.

2.2 | Measures

2.2.1 | Sleep

All sleep measures were self-reported. The participants indicated their usual bedtime and rise time in hours and minutes for weekdays and weekends separately. The participants also reported their usual SOL and WASO in hours and minutes by a scroll down menu. TIB was calculated as the difference between bedtime and rise time. Sleep duration was defined as TIB minus SOL and WASO.

Subjective sleep need was reported in hours and minutes, based on a single question: 'How much sleep do you need to feel refreshed?' Sleep deficiency was calculated separately for weekends and weekdays, subtracting total sleep duration from subjective sleep need.

DIMS were rated on a three-point Likert-scale with response options 'not true,' 'somewhat true' and 'certainly true.' Given a positive response (somewhat true or certainly true, defined as a sleep problem), participants were then asked how many days per week they experienced problems either initiating or maintaining sleep. In addition, the duration of DIMS was rated in terms of duration (from 1 week to over a year) for 13–17-year-olds. A joint question on tiredness/sleepiness was rated on a three-point Likert-scale with response options not true, somewhat true and certainly true. If confirmed (somewhat true or certainly true), participants reported the number of days per week they experienced sleepiness/tiredness, for the 13–17-year-olds.

Informants aged 11–12 years (N = 42) completed a shorter version of the sleep measure, comprising the following items: bedtime weekday/weekend, rise time weekday/weekend (TIB weekday/weekend), difficulties falling asleep or frequent awakenings, drowsy/tired during the day, frequency of sleep during the day and oversleeping on schooldays.

2.2.2 | Mental health problems

The Strengths and Difficulties Questionnaire (SDQ) is a 25-item mental health questionnaire for 4–16-year-olds that can be completed by parents, teachers and as a self-report from age 11 years (Goodman, Meltzer, & Bailey, 1998). The SDQ consists of five subscales measuring prosocial behaviour, peer problems, emotional symptoms, conduct problems and hyperactivity-inattention symptoms. Each subscale comprises five items rated on a 3-point scale (0–1–2), with a total subscale score range of 0–10. A total difficulties score is computed by summing the three symptom subscales and the peer problem subscale, resulting in a score range of 0–40. The SDQ has shown good internal consistency and good to excellent discriminative validity in foster children (Lehmann, Bøe, & Breivik, 2017; Lehmann, Heiervang, Havik, & Havik, 2014). In this study, we used the self-reported SDQ total difficulties score as a measure of symptom-load across a broad spectre of general mental health problems.

2.2.3 | PTEs and symptoms of PTSD

In this study, we used the Norwegian version of the Child and Adolescent Trauma Screen (CATS; Sachser et al., 2017), translated by the Norwegian Centre for Violence and Traumatic Stress studies. The CATS is a questionnaire with two parts. Part 1 assess 15 different forms of PTEs young people may experience both outside of and within a family context. The questionnaire introduces the list of PTEs with the following instruction: 'Bellow is a list of events children and young people may experience. If it happened to you, and you felt scared, confused or helpless, then mark Yes. If there are any questions you do not want to answer, mark Pass.' Because the CATS does not cover emotional abuse and neglect, we added five custom-made items for this study (Lehmann et al., 2020). Two items assess parentification due to neglect: 'Often cared for your own parents because they were unable to take care of themselves' and 'Often cared for your siblings because your parents were unable to.' We also added three items based on Items 1, 4 and 5 in the ACE questionnaire (Felitti et al., 1998), covering emotional neglect: These five items replaced two original items 'Serious natural disaster like a flood, tornado, hurricane, earthquake or fire' and 'Ever experienced very scary events at the doctor, dentist or at hospital.' The PTE part is scored 0 (no) or 1 (yes). We used this coding in univariate correlation analyses where we combined PTE items into a scale. Respondents also had the option to answer pass. We

computed variables for all single PTE items, where pass responses were set as missing.

Part 2 of the CATS comprises 20 items covering symptoms of PTSD according to the criteria in DSM-5 (American Psychiatric Association, 2013). Items cover intrusions, avoidance, negative alterations in cognition and mood and hyper-arousal. The PTSD items are scored 0 (*never*), 1 (*once in a while*), 2 (*half of the time*) and 3 (*almost always*), yielding a sum score range from 0 to 60. Confirmatory factor analyses with all 20 items comprising one PTSD factor yielded good fit with our data (Lehmann et al., 2020). In further analyses, we use the one-factor solution as a measure of PTSD as a single construct. One item was removed (*trouble falling or staying asleep*) to control for overlapping method variance.

2.3 | Statistical analyses

We conducted descriptive analyses and multiple linear regression analyses in IBM SPSS Statistics version 25. We conducted a hierarchical linear regression with DIMS, sleep duration, sleep during the day and oversleep for school as dependent variables. Gender, age and time in current foster home was entered simultaneously as independent variables (IVs). These covariates were kept in the following regressions, adding one and one IV as separate blocks: Block 2 added sum of PTEs, Block 3 added PTSD symptom load and Block 4 added general mental health problems. Missing data were handled by listwise deletion. We used the PROCESS macro for SPSS (Hayes, 2017) to conduct mediation analyses with bootstrapping (INDIRECT) to examine whether the association between PTEs (X) and DIMS (Y) were mediated by PTSD symptoms and general mental health problems symptom load, respectively (Ms). Mediation analyses were based on test of Indirect effect (*ab*), which directly quantifies the difference between the effect of predictor (X) on outcome (Y) when the mediator (M) is controlled for versus when it is not. The inference is expressed in the form of a confidence interval conveying the uncertainty attached to the estimate. An interval estimate that does not include a zero is sufficient to support a claim of mediation of the effect of X on Y through M. As recommended by Hayes and Rockwood (2017), we used bootstrap confidence interval that makes no assumption about normality in the sampling distribution of *ab*. For this study, we used 10,000 bootstrap samples for percentile bootstrap confidence intervals. Level of confidence intervals were set to 95%. Gender and age were included as covariates in the mediation analyses.

3 | RESULTS

3.1 | Participants

Of a total sample of 302 youth completing the online survey (41% response rate), the sample in this study (*n* = 299) are foster youths who answered at least the introduction question on sleep (DIMS). The youth were between the age of 11 and 17 years (*M* = 14.82, *SD* 2.05),

and 53.2% (*n* = 159) were boys. They had lived in their current foster home for a mean duration of 6.72 years (*SD* 4.28), and 15.6% (*n* = 35) lived in kinship foster care. There was no difference between responders and nonresponders on sex (*t* = 1.09, *df* = 390, 61, *p* = 0.28), time in foster care (*t* = −.49, *df* = 383.46, *p* = .62) or placement form (kin vs. nonkin: *t* = .119, *df* = 223, *p* = .91). Responders were older (*M* = 15.01) than nonresponders (*M* = 14.29, *t* = −4.29, *df* = 371.98, *p* ≤ .001).

On average, each youth reported exposure to 3.45 of the 15 possible PTEs (*SD* 3.35, range 15). The mean score on the CATS Part 2 was 13.47 (*SD* 13.86, range 57), whereas mean total difficulties score was 11.93 (*SD* 6.65, range 32).

3.2 | Sleep patterns in young people in foster care

On weekdays, the youth aged 11–12 years went to bed on average at 20.57 (*SD* 0:27), whereas the older youth went to bed at 22:16 (*SD* 1:00). The average rise time of the youngest participants was at 7:02 (*SD* 0:18), whereas the older youth rose at 6:49 (*SD* 0:41). In sum, the youngest spent on average 10:06 (*SD* 0:32) hours in bed, whereas the older youth spent 8:31 (*SD* 1:14) hours in bed. For the older youth, we could calculate sleep duration, which was 7:10 (*SD* 2:03) hours on average on weekdays, whereas they reported their sleep need to be 8: 39 (*SD* 1:38) hours. A detailed description of sleep patterns is displayed in Table 1.

3.3 | DIMS and sleep-related functional impairment

DIMS and functional impairment are reported in Table 2. Overall, 53.2% of the youth reported difficulties falling asleep or frequent awakenings during the night. Among the older youth reporting DIMS, 82.1% reported that these difficulties had lasted for 3 months or more. Of the sample as a whole, 68.8% reported feeling drowsy or tired during the day, 33.1% reported sleeping during the day a couple of times per month or more and 31.8% reported oversleeping for school a couple of times a year or more.

3.4 | Association between PTEs, symptoms of PTSD and general mental health problems and sleep problems

Associations between DIMS and sleep duration on one hand and PTEs, symptoms of PTSD and general mental health problems on the other, are displayed in Table 3. In the fully adjusted model (Block 4), both increased numbers of PTEs, PTSD symptoms and general mental health problems were associated with increased DIMS. Regarding sleep duration, increased exposure to PTEs decreased length of sleep. The model accounted for 33% of the variance in DIMS (R^2 0.33, SE 0.59) and 34% of the variance in sleep duration (R^2 0.34, SE 1.38). Although gender differences were apparent in Block 1, where girls reported more DIMS,

TABLE 1 Sleep pattern among foster youth aged 11–17 years

	11–12 years n = 65			13–17 years n = 234			
	Range	M	SD	n	Range	M	SD
Bedtime weekday	20:00–22:00	20:57	0:27	223	20:30–03:00	22:16	1:00
Rise time weekday	6:30–7:45	7:02	0:18	225	05:00–11:00	6:49	0:41
Time in bed weekday	8:45–11:15	10:06	0:32	220	3:00–12:00	8:31	1:14
Bedtime weekend	21:00–24:00	22:15	0:43	199	21:15–05:00	24:01	1:27
Rise time weekend	7:00–12:00	9:16	1:05	213	06:00–18:00	10:28	1:38
Time in bed weekend	7:00–13:00	11:01	1:05	208	4:00–16:00	10:27	1:34
Sleep duration weekday				159	0:05–11:55	7:10	2:03
Sleep onset latency				208	0:00–9:00	1:04	1:13
Wake after sleep onset				170	0:00–6:00	0:19	0:46
Sleep need				186	3:00–15:00	8:39	1:38

TABLE 2 Difficulties initiating and maintaining sleep, and sleep-related functional impairment among foster youth aged 11–17 years

	11–12 years n = 65	13-17 years n = 234		
	%	%	M	SD
Difficulties initiating and maintaining sleep	58.5	43.6		
Duration 3 months or more (n = 78)		82.1		
Nights per week, difficulties falling asleep (n = 58)			4.02	1.96
Nights per week, frequent awakenings (n = 58)			2.54	2.26
Drowsy/tired during the day	53.8	73.0		
Days per week drowsy (n = 157)			2.89	2.29
Days per week tired (n = 161)			3.85	1.90
How often do you sleep during the day				
Seldom (a couple of times per year)	24.6	22.2		
Sometimes (a couple of times per month)	1.5	22.6		
Often (several times a week)	0.0	13.7		
Always (every day)	1.5	5.1		
How often do you oversleep for school				
Seldom (a couple of times per year)	15.5	24.4		
Sometimes (a couple of times per month)	0.0	8.5		
Often (several times a week)	0.0	3.0		
Always (every day)	0.0	0.4		

and shorter sleep duration compared with boys, this difference disappeared when accounting for PTEs in the second block.

Older age decreased duration of sleep, also when accounting for PTEs, and symptoms of PTSD and general mental health problems.

3.5 | Association between PTEs, symptoms of PTSD and general mental health problems and sleep-related functional impairment

Associations between sleep related functional impairment (sleep during the day and oversleeping for school) and PTEs, symptoms of PTSD and general mental health problems are displayed in Table 4.

Controlling for age, gender and time in care, increased numbers of PTE were associated with both increased sleep during the day and oversleeping for school (Block 2). However, this association diminished when controlling for PTSD (Block 3) and general mental health problems. In the fully adjusted model (Block 4), an increase in symptoms of general mental health problems was associated with increased daytime sleep, but PTSD was no longer associated with sleep related functional impairment. Being a girl, and older age, was associated with increased frequency of sleep during the day. Older youth and those who had spent shorter time in current foster home overslept for school more often. Further, increased symptoms of general mental health problems were associated with more frequent oversleeping for school. The fully adjusted model accounted for 39%

TABLE 3 Associations with difficulties initiating and maintaining sleep and sleep duration, comparing four regression models

Block	Difficulties initiating and maintaining sleep					Sleep duration				
	R^2	ΔR^2	β	B	95% CI	R^2	ΔR^2	β	B	95% CI
1: Adjustment variables	.05					.19				
Sex[a]			**0.17**	**0.24**	**[0.07,0.40]**			−0.24	−3,478,48	[−5,574,32, −1,382,63]
Age (years)			0.06	0.02	[−0.02, 0.06]			−0.37	−1982,14	[−2774.49, −1189.79]
Time in current foster home			**0.15**	**−0.03**	**[−0.05, −0.01]**			−0.10	153,757	[−81.94, 389.45]
2: Added sum of potential traumatic experiences	.21	.16**				.32	.13**			
Sex[a]			0.08	0.12	[−0.04, 0.27]			−0.13	−1897,84	[−3904.07, 108.39]
Age (years)			−0.05	−0.02	[−0.06, 0.02]			−0.27	−1,445,26	[−2197.66, −692.86]
Time in current foster home			−0.05	−0.01	[−0.03, 0.01]			−0.00	−3,12	[−226.66, 220.43]
Sum of potential traumatic experiences			**0.44**	**0.10**	**[0.07, 0.12]**			−0.40	−842,91	[−1150.66, −535.17]
3: Added PTSD symptom load	.30	.09**				.33	.02			
Sex[a]			0.02	0.03	[−0.12, 0.17]			−0.10	−1,593,67	[−3609.514, 421.80]
Age (years)			−0.07	−0.02	[−0.06, 0.01]			−0.27	−1,418,30	[−2165.02, −671.57]
Time in current foster home			−0.05	−0.01	[−0.03, 0.01]			−0.01	−7,76	[−229.51, 213.99]
Sum of potential traumatic experiences			**0.17**	**0.04**	**[0.01, 0.07]**			−0.29	−307,20	[−1001.22, −213.16]
PTSD symptoms			**0.42**	**0.02**	**[0.02, 0.03]**			−0.17	−88,29	[−181,64, 5.06]
4: Added mental health symptom load	.33	.04**				.34	.01			
Sex[a]			−0.01	−0.01	[−0.16, 0.13]			−0.09	−1,277,78	[−3323.71, 768.16]
Age (years)			−0.04	−0.02	[−0.05, 0.02]			−0.27	−1,460,46	[−2205.62, −715.31]
Time in current foster home			−0.06	−0.01	[−0.03, 0.01]			0.01	18,79	[−204.49, 242.07]
Sum of potential traumatic experiences			**0.16**	**0.03**	**[0.01, 0.06]**			−0.30	−598,67	[−991.00,-206.34]
PTSD symptoms			**0.23**	**0.01**	**[0.00, 0.02]**			−0.07	−33,53	[−149.70, 82.63]
SDQ total difficulties scale			**0.28**	**0.03**	**[0.02–0.04]**			−0.15	−161,07	[−366.20, 44.05]

Note. Multiple regressions with youth reported sleep problems, sleep during day and oversleeping as dependent variable. Significant associations are marked in boldface.

Abbreviations: B, beta values; CI, confidence interval; PTSD, post-traumatic stress disorder; R^2, R square; SDQ, Strengths and Difficulties Questionnaire; β, standardized beta values.

[a]Boys are the reference group.

**p ≤ 0.001.

of the variance in daytime sleeping (R^2 0.39, SE 0.95) and 15% of the variance in oversleeping for school (R^2 0.15, SE 0.69).

3.6 | Symptoms of PTSD and general mental health problems as mediators

PTSD symptom load and symptoms of general mental health problems, respectively, were treated as potential mediators of the association between PTEs and DIMS in two simple mediation models. The indirect effect of PTSD symptoms was significant (*ab* with 95% bootstrap confidence interval 0.08, 95% CI [0.05, 0.11]). The model accounted for 36% of the variance in DIMS (adjusted R^2 0.36, Mse 0.34). The indirect effect of symptoms of general mental health problems was also significant (*ab* with 95% bootstrap confidence interval 0.04, 95% CI [0.02, 0.05]) The model accounted for 32% of the variance in DIMS (adjusted R^2 0.32, Mse 0.35). In sum, both PTSD symptom load and symptoms of general mental health problems partly

TABLE 4 Associations with frequency of sleep during the day, and oversleeping for school, comparing four regression models

Block	Sleep during the day					Oversleep for school				
	R^2	ΔR^2	β	B	95% CI	R^2	ΔR^2	β	B	95% CI
1: Adjustment variables	.32					.10				
Sex[a]			**0.28**	**0.66**	**[0.43, 0.89]**			0.11	0.16	[−0−01, 0.32]
Age (years)			**0.48**	**0.29**	**[0.23, 0.35]**			0.26	**0.10**	**[0.05, 0.14]**
Time in current foster home			−0.08	−0.02	**[−0.05, 0.01]**			−0.19	−0.03	[−0.05, 0.01]
2: Added sum of potential traumatic experiences	.37	.05**				.12	.03*			
Sex[a]			**0.23**	**0.55**	**[0.32, 0.78]**			0.07	0.11	[−0.06, 0.27]
Age (years)			**0.41**	**0.25**	**[0.19, 0.31]**			**0.21**	**0.08**	**[0.04, 0.12]**
Time in current foster home			−0.02	−0.01	[−0.04, 0.02]			−0.15	−0.03	**[−0.05, −0.01]**
Sum of potential traumatic experiences			**0.24**	**0.09**	**[0.05, 0.12]**			**0.18**	**0.04**	**[0.01, 0.07]**
3: Added PTSD symptom load	.38	.02*				.13	.01*			
Sex[a]			**0.20**	**0.49**	**[0.25, 0.72]**			0.05	0.07	[−0.10, 0.24]
Age (years)			**0.41**	**0.25**	**[0.19, 0.31]**			**0.21**	**0.08**	**[0.03, 0.12]**
Time in current foster home			−0.02	−0.01	[−0.03, 0.02]			−0.15	−0.03	**[−0.05, −0.01]**
Sum of potential traumatic experiences			0.13	0.05	[−0.00, 0.10]			0.08	0.02	[−0.02, 0.05]
PTSD symptoms			**0.17**	**0.02**	**[0.04, 0.03]**			0.16	0.01	[−0.00, 0.02]
4: Added mental health symptom load	.39	.01*								
Sex[a]			**0.19**	**0.45**	**[0.22, 0.69]**	.15	.02*	0.03	0.04	[−0.13, 0.21]
Age (years)			**0.42**	**0.25**	**[0.20, 0.31]**			**0.23**	**0.08**	**[0.04, 0.13]**
Time in current foster home			−0.03	−0.01	[−0.04, 0.02]			−0.16	−0.03	**[−0.05, −0.01]**
Sum of potential traumatic experiences			0.12	0.05	[−0.00, 0.09]			0.07	0.02	[−0.02, 0.05]
PTSD symptoms			0.08	0.01	[−0.01, 0.02]			0.03	0.00	[−0.01, 0.01]
SDQ total difficulties scale			**0.14**	**0.03**	**[0.00, 0.05]**			**0.20**	**0.02**	**[0.01, 0.04]**

Note. Multiple regressions with sleep during day and oversleeping as dependent variable. Significant associations are marked in boldface.
Abbreviations: B, beta values; CI, confidence interval; PTSD, post-traumatic stress disorder; R^2, R square; SDQ, Strengths and Difficulties Questionnaire; β, standardized beta values.
[a]Boys are the reference group.
*$p < 0.05$.
**$p \leq 0.001$.

mediated the association between PTEs and DIMS. Figures 1 and 2 display the standardized coefficients for each pathway of the two models.

4 | DISCUSSION

To the best of our knowledge, this is the first study to examine sleep, and especially the mechanisms by which potentially traumatic events affect sleep, among adolescents living in foster care. Our results yield valuable insights into the mechanisms of how exposure and symptoms work together and separately as risk factors for sleep problems in high risk youths.

Over half of the youth (53.2%) reported DIMS, a considerably higher rate than in a population-based sample from Norway using the same sleep assessment methods (Sivertsen et al., 2017). For most of the adolescents in foster care (82.1%), the sleep problems had lasted for

over 3 months, which underscores the severity. Thus, the current study suggests that sleep problems are prevalent among adolescents in foster care and is not restricted to sleep problems in younger children.

The adolescents reported to get less sleep than their subjective sleep need, with a discrepancy of 1:20 h. The adolescents' subjective sleep need is in line with the experts recommendations for this age group (Hirshkowitz et al., 2015), indicating a substantial sleep deficit. For the adolescent group, the long SOL is one of the drivers of the short sleep duration, with an average SOL of 1:10. Although adolescents often have a longer SOL than younger children, this is more than the 30 min that are one of the criteria for an insomnia disorder (American Psychiatric Association, 2013). This is also in line with results from studies investigating young children in foster care (Hambrick et al., 2018) and young people in transition out of foster care (Fusco, 2019). Thus, our results strengthen the evidence that sleep is an important issue for assessment and follow-up among young people in foster care.
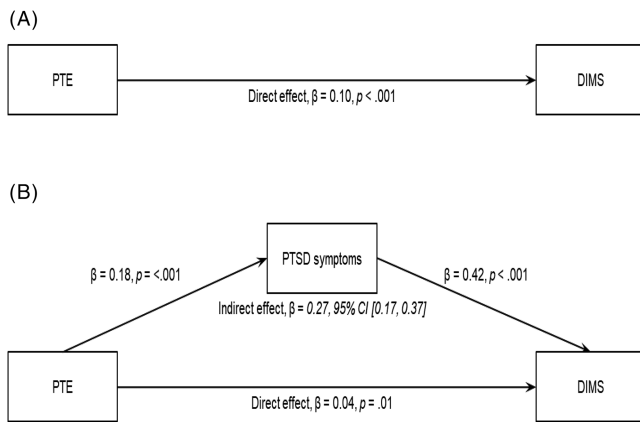
(A)

(B)

FIGURE 1 (a) Model of potential traumatic experiences as a predictor of sleep disturbances, (b) mediated by post-traumatic stress disorder (PTSD) symptoms

Our study demonstrated an association between increased exposure to PTEs and DIMS, and lower sleep duration. This contradicts the findings of Schneiderman et al. (2018), where maltreatment did not predict sleep disturbance, and moreover predicted longer, rather than shorter sleep duration for girls. A possible explanation for this is that the Schneiderman study utilized a dichotomous variable identifying active cases in the CWS, as a proxy for maltreatment, and did not measure maltreatment or a broader assessment of PTEs directly. The results are, therefore, not necessarily comparable. Further, although we found an association between PTSD symptoms and DIMS, controlling for gender and PTEs, Schneiderman et al. (2018) reported this connection only for girls. Because the U.S. study is longitudinal, this calls into question whether the association found in our study between PTSD and DIMS could also be interpreted as support for the notion that PTSD symptoms are accentuated by sleep difficulties (Germain, 2013) rather than causing it. These somewhat conflicting results indicate a need for more longitudinal studies examining the predictive value of PTSD on DIMS and vice versa. Our finding of an association between PTEs and DIMS are more in line with, and extend the findings of Langevin et al. (2019), demonstrating the predictive value of sexual abuse on sleep problems, controlling for mental health and gender.

It is worth noting, however, that even in a strict model with all predictors entered, both exposure to PTEs, PTSD symptoms and more general mental health problems contributed independently to the explained variation in DIMS. This indicates that both exposure to potentially traumatic events and a broad spectre of related but distinct mental health problems are related to sleep problems. Further, these results point to a cumulative effect of symptom load across subtypes of symptoms, in line with findings in the general (Shanahan et al., 2014) and clinical (Lycett et al., 2015) population. For foster children, this is an important finding because they often present with high comorbidity. Our full model accounted for 33% of the explained variation in DIMS, which indicate that total load covering symptom of PTSD and general mental health problems, together with aversive experiences, is a substantial driving force for sleep problems and sleep deficiency.

Although we did not find an independent impact of PTEs and PTSD symptoms on sleep-related functional impairment when general mental health problems were included, an increased load of general mental health problems was associated with daytime sleep and more frequent oversleeping from school. This is in line with findings among the Norwegian general youth population, where general mental health problems were associated with daytime sleepiness (Hestetun et al., 2018). The results indicate that in addition to contributing to DIMS and decreased sleep duration, symptom load of general mental health problems afflict sleep-related functional impairment and may contribute to an explanation of why some youth have trouble staying awake during the day and have increased risk of attrition from school. Oversleeping and related school absence are serious consequences of sleep problems underscoring the functional significance of mental health problems on sleep in this group. The influence of mental health problems on oversleeping is similar to a Norwegian population-based study that found that depression could account for some of the association between sleep problems and school absence (Hysing, Haugland, Stormark, Bøe, & Sivertsen, 2015).

Controlling for mental health and exposure to potentially traumatic experiences, youth with shorter stay in current foster home overslept from school more often. This points to the pertinent role of foster parents in stabilizing and optimizing functioning in foster-youth, providing the right monitoring and support for everyday routines such as getting up from bed in time for school attendance.

Mediation analyses revealed that the association between PTEs and DIMS were partly mediated by both PTSD symptoms and general mental health problems when controlling for sex and age. This pattern confirms the importance of mental health problems on sleep in adolescence (Palmer, Oosterhoff, Bower, Kaplow, & Alfano, 2018; Zhang et al., 2017) and is also in line with the mediating effect of PTSD symptoms on sleep problems among youth who have experienced natural disasters such as earthquakes (Zhou, Wu, Chen, & Zhen, 2017) and the association between internalizing and ADHD problems and sleep disturbance among youth in care (Langevin
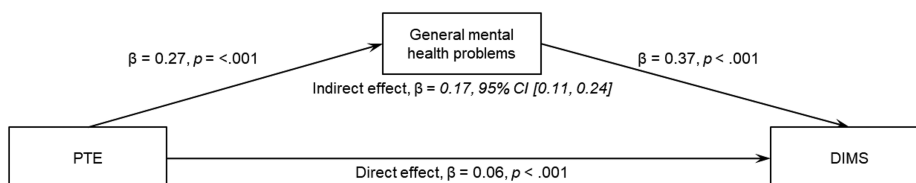

FIGURE 2 Model of potential traumatic experiences as a predictor of sleep disturbances, mediated by symptoms of general mental health problems

et al., 2019). For youth in foster care, the co-occurrence of sleep and mental health problems may indicate that a broad assessment might be conducted when adolescents present with these problems. Given the high rate of comorbid conditions, interventions that allow for a transdiagnostic perspective on sleep and mental health (Harvey, 2016) may be warranted. This warrant transdisciplinary competence comprising both specialized mental health personnel and child welfare workers integrated in the services responsible for the care, treatment and counselling of young people in foster care and their families.

4.1 | Strengths and limitations

A strength of the present study is the relatively large sample, and adequate response rate, considering previous studies of this hard-to-reach group of young people. The participants did not differ from non-responders regarding their sex, time in current foster care or placement form. The broad and structured assessment of a wide range of detailed measures of sleep and a standardized and validated measure of mental health problems is a strength of the study. The use of self-reported PTSD symptoms is a strength as these symptoms are difficult to detect by caregivers. The assessment of a wide range of PTEs, carefully addressing the necessity of assessing maltreatment experiences including emotional abuse and neglect, is a strength of the present study. However, there are limitations to this study. All data on sleep and mental health were obtained by self-report, and thus the lack of clinical interviews restricts information on clinical diagnosis of mental disorders and insomnia. For the sleep duration measures, the lack of objective measures should also be mentioned, although there has been shown good agreement between self-report and actigraphy on sleep duration (Kong et al., 2011). Future research using actigraphy would add substantially to the knowledgebase on sleep patterns among young people in foster care, although self-reports of sleep patterns including SOL and WASO have been shown to be comparable when compared with polysomnography (Zinkhan et al., 2014). We do not have data on timing, duration or details of severity of PTEs or relation to perpetrator. Self-reports may yield both overreporting and underreporting due to recall bias and may also give inflated associations between the included variables due to mono informant bias. Last, the cross-sectional nature of this study calls for cautious interpretation of the results of mediation analyses (Cole & Maxwell, 2003), as we can only assume temporal order of the three variables. However, in this debate, there are sound arguments that based on theoretical reasoning, mediation analyses on correlational data may give valuable insights to causal inference (Hayes & Rockwood, 2017). In a review of the literature, there was support for traumatic event exposure to precede the development of sleep problems and that PTSD is related to the development of sleep problems (Babson & Feldner, 2010), thus supporting the temporal order in the present study. Still, bidirectional associations may be present, in which sleep problems may also contribute to mental health problems over time. Future, longitudinal studies are needed to further investigate the temporal association between traumatic events, symptoms of post-traumatic stress and sleep problems.

4.2 | Conclusion and clinical implications

Increased symptom load of both general mental health problems and PTSD are associated with increased DIMS among maltreated youth in foster care. Further, increased exposure to multiple types of potentially traumatic experiences are related to sleep difficulties. However, both symptoms of PTSD and general mental health problems partly mediate this association. This is of high clinical significance, as it lends support to treatment approaches aiming to reduce PTSD and general mental health problems, to target DIMS, even in children exposed to aversive childhood experiences, which often lies in the past and are outside of control of the clinician and the young person herself. The cross-sectional nature of this study also opens up the possibility that targeted sleep treatment may decrease PTSD symptoms (Germain, 2013). Longitudinal research on high-risk groups of young people is still needed to disentangle these questions and improve the knowledgebase for advising clinicians working with maltreated youth struggling with the aftermath of multiple traumatic experiences, in the form of complex symptom patterns where sleep problems often co-occur.

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