

# Childhood Abuse as a Risk Factor for Sleep Problems in Adulthood: Evidence from a U.S. National Study

Emily A. Greenfield, Ph.D. · Chioun Lee, M.A. ·  
Elliot L. Friedman, Ph.D. · Kristen W. Springer, Ph.D.

Published online: 8 June 2011  
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## Abstract

**Background** Accumulating evidence indicates that stress impairs sleep quality. Few studies, however, have examined the extent to which early life stress can jeopardize sleep in adulthood.

**Purpose** Guided by a life course epidemiological perspective on health, this study examined associations between childhood abuse and adult sleep problems.

**Methods** We used data from 835 respondents in the National Survey of Midlife Development in the United States (MIDUS). Self-report measures assessed the frequency of physical, emotional, and sexual abuse in childhood, as well as global and component indicators of sleep problems in adulthood.

**Results** Having experienced all three types of childhood abuse—even infrequently—was associated with global sleep pathology, as well as specific types of sleep problems. Reports of both frequent physical and frequent emotional abuse—even in the absence of sexual abuse—were also associated with poor sleep.

**Conclusions** Childhood abuse is a risk factor for individuals' long-term sleep problems.

**Keywords** Adverse childhood experiences · Sleep · Child abuse · Stress · Life course

**Electronic supplementary material** The online version of this article (doi:10.1007/s12160-011-9285-x) contains supplementary material, which is available to authorized users.

E. A. Greenfield  
School of Social Work,  
Rutgers, The State University of New Jersey,  
536 George St.,  
New Brunswick, NJ 08901, USA

E. A. Greenfield (✉) · C. Lee · K. W. Springer  
Institute for Health, Health Care Policy, and Aging Research,  
Rutgers, The State University of New Jersey,  
112 Paterson St.,  
New Brunswick, NJ 08901, USA  
e-mail: egreenf@ssw.rutgers.edu

C. Lee · K. W. Springer  
Department of Sociology,  
Rutgers, The State University of New Jersey,  
26 Nichol Ave.,  
New Brunswick, NJ 08901, USA

E. L. Friedman  
Institute on Aging, University of Wisconsin–Madison,  
1300 University Ave.,  
Madison, WI 53706, USA

## Introduction

Sleep complaints are common in adults, the most common being insomnia. An estimated 10–18% of the population of the USA suffers from chronic insomnia [1, 2], with up to 35% experiencing transient difficulty sleeping [1]. As a significant portion of sleeping problems go undiagnosed, these estimates are likely to be low [1]. Difficulty sleeping and the resulting fatigue and dysfunction in the daytime are linked to a wide range of problems, including reduced quality of life, depression, absenteeism from work, accidents, and increased health care utilization, which collectively represent substantial costs to society [3, 4].

Accumulating research evidence suggests that stress—defined as significant events, changes, or threats that demand physiological, behavioral, and psychological resources to maintain “psychophysiological equilibrium and well-being” [5] (p. 685)—is a risk factor for poor sleep. Little research, however, has addressed the extent to which stress experienced within one developmental period can jeopardize sleep within subsequent developmental periods [6]. Guided by a life course epidemiological perspective on health [7], this study aimed to

advance research in this area by examining abuse in childhood as a potential risk factor for sleep problems in adulthood.

Childhood abuse is an especially important type of early life stress to consider given its continued salience among children and adults worldwide. In the USA alone, child protective services agencies investigated alleged cases of maltreatment against 1.5 million children in 2008. Approximately 246,730 of those referrals resulted in confirmed cases of physical, emotional, and/or sexual abuse, and the vast majority of confirmed cases involved a child's biological parents as perpetrators [8]. Furthermore, US national survey data collected in 1995 indicated that approximately 15.8% of the sample recalled a parent hitting them or trying to hit them with a fist or object, and/or biting, beating, choking, kicking, or scalding them in childhood [9].

Recognizing the prevalence of abuse against children within US families, we used data from a national sample of adults to examine associations between experiences of childhood abuse and adult sleep quality. Drawing on the idea that both abuse and sleep are multidimensional phenomena, we explored whether long-term associations of risk are specific to particular experiences of abuse, as well as to particular domains of sleep problems.

### Theoretical Foundation

Scholars have concluded that stress is among the most powerful contributors to poor sleep [10]. Dating back to Seyle's [11] classic theorizing on the general adaptation syndrome, scholars have posited various ways in which stress affects individuals' sleepiness and arousal. For example, stress can trigger hypervigilance, a state which involves the activation of neuroendocrine systems that prevent an individual from sleeping soundly [12], as well as exhaustion, which occurs when an individual has depleted their energies in an effort to eliminate or manage stress [5].

A life course epidemiological perspective on health suggests that significant stress in childhood, such as abuse, might affect individuals' sleep not only in childhood but also in adulthood. A primary insight of this perspective is that an individual's early life experiences powerfully influence future health outcomes through lifelong and interconnected biological and social processes [7]. Previous research provides insights on multidimensional processes through which childhood abuse might jeopardize individuals' later sleep quality [6]. Regarding physiological processes, for example, chronic stress that is experienced early in life and during sensitive periods of development—such as child abuse—might fundamentally alter neuroendocrine systems

that regulate sleep/arousal and lead to chronic sleep problems [13, 14]. Regarding more behavioral processes, children in abusive families might have developed chronically poor sleep habits as active coping strategies to avoid further victimization, such as by purposely changing sleep locations or falling asleep only after the violent family member fell asleep or left the residence [15]. These poor sleep habits in childhood might persist beyond childhood and lead to sleep problems in adulthood. In summary, the life course perspective's general orientation to the interconnected nature of experiences across various domains of functioning, as well as over extended periods of time, motivates this study's attention to potential linkages between childhood abuse (as one domain of experience within a particular period of the life course) and sleep problems in adulthood (as another domain of experience at a subsequent period of the life course).

### Empirical Review

A relatively large body of research provides evidence for the adverse long-term mental and physical health consequences of childhood abuse [16, 17]. There has been very little research, however, on how childhood abuse influences adults' sleep, specifically. Most studies on abuse as a predictor of poor sleep quality have focused on childhood. Studies have found that childhood abuse is a risk factor for a range of observed sleep problems among children, including more nocturnal activity, longer sleep latency, and less sleep efficiency [18, 19]. Studies also have found that other types of childhood stressors—such as marital conflict [20] and community violence [21]—jeopardize children's sleep.

Very few studies have examined whether abuse that takes place in childhood impairs individuals' long-term sleep. Noll et al. [22] conducted a prospective study of 84 girls and found that adolescents who were sexually abused in childhood were more likely to report sleep problems 10 years after disclosure. Koskenvuo et al. [23] used data from a large sample of adults in Finland and found that the greater number of retrospectively reported childhood adversities was associated with poorer subjective sleep quality, with frequent fear of a family member showing the strongest association among all types of adversities examined. Similarly, Bader et al. [24] found that among adults with insomnia, those with more severe experiences of childhood neglect and abuse demonstrated poorer scores on polysomnographic and actigraphic measures of sleep quality. Studies also have found evidence for long-term linkages between experiences of other specific types of trauma that occurred earlier in the life course—such as combat and genocide—and impaired sleep decades later [25].

## The Current Study

This study aimed to advance research regarding childhood abuse as a risk factor for sleep problems in adulthood in several ways. First, whereas most studies on associations between childhood abuse and sleep quality have drawn upon small, regional, or clinical samples, this study used data from a large national and community-based sample. Population-based research on sleep is important because a substantial proportion of individuals with sleep problems do not seek specialized medical care; accordingly, the use of clinical samples is likely to overestimate associations between potential risk factors and sleep problems because respondents in clinical samples already are experiencing symptoms of poor sleep [26]. The use of population data also makes it possible to control for factors, such as gender and other childhood adversities, which might render associations between childhood abuse and adult sleep problems as spurious.

Furthermore, most previous studies on childhood abuse and adult sleep problems have utilized unidimensional measures of childhood abuse. Previous theoretical and empirical research indicates, however, that experiences of abuse vary across a variety of dimensions, including by type of abuse (e.g., emotional, physical, or sexual) and frequency of abuse (e.g., whether the abuse was a one-time episode or occurred more regularly throughout childhood) [27]. Scholars have posited that the effects of stress on sleep are likely to depend on the characteristics of the stressor itself, such as by the intensity and duration of the stressor [5]. Consistent with this theorizing, previous research has found that individuals with histories of chronic and/or multiple types of abuse are at greatest risk for adverse adult health outcomes [28, 29]. This study considered the heterogeneity of abuse histories by examining whether diverse experiences of childhood abuse in terms of type and frequency of abuse are differentially associated with sleep problems in adulthood.

Similar to recognizing abuse as a multidimensional phenomenon, researchers also have called for studies to examine related yet distinct domains of sleep quality [14]. Some previous studies have found different patterns of correlates for indicators of sleep quantity (such as number of awakenings at night, time to fall asleep, and total sleep duration) versus indicators of sleep quality (such as depth of sleep, how well rested one feels upon awakening, and overall satisfaction with sleep) [30]. Consistent with these findings, research on the effects of childhood abuse on children's sleep has indicated that abuse might influence some sleep components more so than others. For example, using actigraphic measures of children's sleep, Glod et al. [18] found that compared with non-abused children, abused children had longer sleep latency and reduced sleep

efficiency, but no differences were observed for sleep duration or number of nighttime awakenings. Sadeh et al. [19] found that abused children spent less time in quiet motionless sleep, but did not differ from non-abused children on length of longest sleep, sleep latency, or total sleep duration. The current study builds upon this previous research by examining whether long-term associations of risk between childhood abuse and adult sleep problems emerge across multiple sleep components.

Guided by previous theoretical and empirical research, this study aimed to address the following hypothesis (H) and research question (RQ). *H*: Diverse experiences of childhood abuse will be associated with a greater risk of global sleep pathology. *RQ*: Are associations between childhood abuse and poor sleep specific to particular components of sleep?

## Method

### Sample

This study used data from a subset of respondents who participated in the National Survey of Midlife Development in the United States (MIDUS). The MIDUS Study includes a primary national sample of adults ( $n=3,487$ ) and a national sample of adult twins ( $n=957$  pairs). Both samples were obtained through random digit dialing and included only English-speaking, non-institutionalized adults who were between the ages of 25 and 74 when first recruited into the study. Respondents were invited to participate in the study in 1995 (T1) and 2005 (T2) by completing a telephone interview and self-administered questionnaire at each wave of data collection.

The current study used T2 data from 835 respondents across the primary national and twin samples. These respondents were selected because they had complete data available on the measures of sleep (see “Measures” below), which were available only in a special module of the MIDUS (T2) [31]. Furthermore, this analysis included only one randomly selected sibling from twin pairs when more than one sibling from the same family participated in the study to satisfy the assumption of independence of observations within ordinary least squares regression models (see “Data Analytic Strategy” below).

All respondents who participated at T2 were eligible for participation in the special module, which involved staying overnight at one of three regional General Clinical Research Centers. Although the special module was designed to collect detailed medical and physiological data on the respondents, the current study's research questions only necessitated the use of respondents' answers to the special module's self-administered medical history (which unique-

ly included this study's measures of childhood abuse) and sleep assessment. Love et al. [31] provide information regarding those who agreed to participate in the special module. They estimated response rates of 36.8% for T2 respondents from the primary national sample and 44.5% for T2 respondents from the twin sample. In general, participants in the special module had higher levels of education than other participants in the T2 sample; however, participants were similar to others in the recruitment pool on most other demographic and health characteristics, such as on self-rated health (with a mean score of 2.41 on a five-point scale with 1=excellent to 5=poor) and instrumental activities of daily living (with a mean score of 1.75 on a four-point scale with 1=not at all limited to 4=limited a lot).

## Measures

### Childhood Abuse

The self-administered questionnaire included items from the Childhood Trauma Questionnaire [32]. The Childhood Trauma Questionnaire is a well-validated measure that contains five-item subscales to assess each of three different types of abuse: sexual abuse (e.g., "Someone tried to make me do sexual things or watch sexual things"); physical abuse (e.g., "I got hit or beaten so badly that it was noticed by someone like a teacher, neighbor, or doctor"); and emotional abuse (e.g., "I thought that my parents wished I had never been born"). Respondents were asked to rate whether they felt that each item was never, rarely, sometimes, often, or very often true in their experiences. We conducted a latent class analysis (LCA) on responses to the items to categorize respondents into distinct classes of childhood abuse reflecting heterogeneity in types and frequency of abuse. LCA is a valuable analytic technique to distinguish those respondents with shared experiences of abuse based on their own reports as opposed to forcing responses into a priori researcher-defined categories for abuse versus non-abuse, which have been defined inconsistently across research studies [33]. The Childhood Trauma Questionnaire also included a three-item scale for minimization and denial to identify respondents likely to underreport negative events in childhood (e.g., "I had the perfect childhood") [32]. We used this three-item scale as a control variable in LCA models to adjust for underreporting of childhood abuse.

### Adult Sleep Problems

The self-administered questionnaire included the Pittsburgh Sleep Quality Inventory, which assesses seven components of sleep based on respondents' self-reports [34]. This

widely used instrument has been shown to reliably detect clinical levels of sleep disruption in adults across a wide range of ages [35, 36]. Global scores above 5 are considered indicative of poor sleep; early validation studies of the instrument showed that a cut point of 5 had a diagnostic sensitivity of 89.6% and specificity of 86.5% in distinguishing groups of "good" and "poor" sleepers previously categorized on the basis of subjective complaints, clinical interviews, and polysomnographic assessments [34].

The first sleep component, *subjective sleep quality*, was measured by a single item asking respondents to rate their sleep quality overall (1=very good to 4=very bad). The second sleep component, *sleep latency*, was assessed by two items, including how many minutes it typically took respondents to fall asleep and how often respondents were not able to fall asleep within 30 minutes over the past month. For the second item, respondents used a four-point response scale (1=not during the past month to 4=three or more times per week). This was the scale used for all other frequency items on the instrument. The third sleep component, *sleep duration*, was based on respondents' reports of the number of hours of sleep during a typical night. The fourth sleep component, *habitual sleep efficiency*, was assessed using respondents' reports of when they typically went to bed, when they typically woke up, and how many hours they typically slept. This information was used to calculate the proportion of sleep time relative to number of hours in bed. The fifth sleep component, *sleep disturbance*, was assessed using nine items, including frequency of waking during the night or having pain. The sixth component, *use of sleeping medications*, was measured based on respondents' reports of how often they took prescription or over-the-counter medication to help them sleep over the past month. The seventh and final sleep component, *daytime dysfunction*, was assessed using two items that asked respondents the frequency by which they were not able to "keep up enthusiasm to get things done" and having "trouble staying awake while driving, eating meals, or engaging in social activity."

Responses to items for each component were re-coded such that scores ranged from 0 to 3, with higher scores indicating poorer sleep on that component. Correlations (Spearman's rho) among the individual sleep components ranged from  $\rho=0.05$  (sleep duration and use of sleeping medications) to  $\rho=0.42$  (sleep duration and habitual sleep efficiency). All correlations—except the association between sleep duration and use of sleeping medications—were significant ( $p<0.001$ ). The mean correlation was  $\rho=0.25$  (see [Electronic Supplementary Material](#) for the correlation matrix.)

Scores across the seven individual sleep components were aggregated into a global score of sleep pathology with

a range from 0 to 21; 50% of the sample had cumulative scores of 2 through 5. As global scores above 5 are considered indicative of sleep pathology [34, 35], any participant with a global score above 5 was given a score of 1 on global sleep pathology, and all other respondents were coded 0. Table 1 displays descriptive statistics for this variable and all other analytic variables, with the exception of the measure of childhood abuse, which is displayed as part of the results of the LCA in Table 2.

*Covariates*

This study included measures of several covariates that could potentially confound the relationship between childhood abuse and adult sleep problems. These covariates measured

aspects of respondents’ socio-demographic characteristics and childhood family background that might render associations between childhood abuse and poorer adult sleep problems as spurious. Socio-demographic characteristics assessed during participation in the special module included age, marital status, and gender. Socio-demographic characteristics assessed at T2 included racial/ethnic status (1=White; 0=non-White); having a child under the age of 6 in one’s household (1=yes; 0=no); educational attainment (less than high school, high school, some college, and 4-year college degree or more); annual adjusted income; and current employment status (reported no work for pay, work only during the day, some work during the evening, and some work at night). Two additional covariates measured aspects of respondents’ childhood family background, which were

**Table 1** Descriptive statistics for measures of covariates

Study variable	Mean/percentage	Standard deviation	Range
<b>Adult sleep</b>			
Presence of sleep pathology	44.67		
Subjective sleep quality	0.97	0.67	0–3
Sleep latency	0.88	0.92	0–3
Sleep duration	0.78	0.72	0–3
Habitual sleep efficiency	0.56	0.97	0–3
Sleep disturbances	1.30	0.57	0–3
Use of sleep medications	0.57	1.07	0–3
Daytime disturbances	0.82	0.67	0–3
<b>Adult socio-demographic factors</b>			
Age	58.27	11.81	35–86
White	92.43		
Female	53.89		
Married	69		
Child under age 6 in household	7		
<b>Educational attainment</b>			
<12 years	4.20		
12 years	20.53		
13–15 years	28.57		
16+ years	46.70		
Adjusted annual income	56,033	42,383	0–212,132
<b>Employment status<sup>a</sup></b>			
Not employed	31.96		
Work days only	34.06		
Work some evenings	21.66		
Work some nights	12.31		
<b>Childhood family background covariates</b>			
Biological parents together until age 16	79.52		
Has a twin	27.31		
<b>Parents’ education</b>			
<12 years	21.35		
12 years	36.29		
12+ years	42.36		

Data are from 835 participants in a special module of the National Survey of Midlife Development in the United States (MIDUS)

<sup>a</sup> Percentages do not sum to 100.00 because of rounding error

**Table 2** Latent class probabilities to childhood trauma questionnaire items by five latent classes of childhood abuse

	Response category	No abuse (48.4% <i>n</i> =404)	Occasional physical and emotional without sexual (27.1%, <i>n</i> =226)	Occasional physical and emotional with sexual (11.6%, <i>n</i> =97)	Frequent physical and emotional without sexual (7.8%, <i>n</i> =65)	Frequent physical and emotional with sexual (5.2%, <i>n</i> =43)
<b>Emotional abuse</b>						
Called me stupid, lazy, ugly	Never	0.91	0.33	0.56	0.13	0.13
	Rarely or sometimes	0.09	0.61	0.44	0.47	0.46
	Often or very often	0.00	0.07	0.00	0.41	0.41
Parents wished never born	Never	0.99	0.78	0.81	0.40	0.25
	Rarely or sometimes	0.01	0.21	0.17	0.45	0.57
	Often or very often	0.00	0.01	0.02	0.15	0.18
Hurtful or insulting things	Never	0.86	0.09	0.40	0.03	0.00
	Rarely or sometimes	0.14	0.85	0.60	0.53	0.52
	Often or very often	0.00	0.06	0.00	0.44	0.48
Felt someone hated me	Never	0.98	0.67	0.74	0.24	0.11
	Rarely or sometimes	0.02	0.29	0.24	0.52	0.51
	Often or very often	0.01	0.04	0.02	0.25	0.38
Believe emotionally abused	Never	0.97	0.57	0.52	0.08	0.00
	Rarely or sometimes	0.02	0.35	0.38	0.61	0.40
	Often or very often	0.01	0.09	0.10	0.31	0.60
<b>Physical abuse</b>						
Hit so hard saw doctor	Never	1.00	0.99	0.99	0.70	0.72
	Rarely or sometimes	0.01	0.01	0.01	0.24	0.26
	Often or very often	0.00	0.00	0.00	0.06	0.02
Hit so hard left bruises	Never	0.98	0.83	0.84	0.08	0.15
	Rarely or sometimes	0.02	0.17	0.15	0.68	0.58
	Often or very often	0.00	0.00	0.01	0.25	0.27
Punished with hard object	Never	0.62	0.37	0.40	0.00	0.11
	Rarely or sometimes	0.34	0.56	0.55	0.54	0.39
	Often or very often	0.04	0.07	0.05	0.46	0.50
Hit so hard was noticed	Never	1.00	0.93	0.74	0.14	0.03
	Rarely or sometimes	0.00	0.07	0.25	0.68	0.36
	Often or very often	0.00	0.00	0.01	0.18	0.61
Believe physically abused	Never	1.00	0.98	0.99	0.64	0.62
	Rarely or sometimes	0.00	0.02	0.01	0.29	0.27
	Often or very often	0.00	0.00	0.00	0.08	0.11
<b>Sexual Abuse</b>						
Tried touch in sexual way	Never	0.97	0.94	0.04	0.87	0.00
	Rarely or sometimes	0.03	0.06	0.76	0.13	0.59
	Often or very often	0.00	0.00	0.20	0.00	0.41
Threatened unless did sexual	Never	1.00	1.00	0.73	1.00	0.29
	Rarely or sometimes	0.00	0.00	0.21	0.00	0.46
	Often or very often	0.00	0.00	0.06	0.00	0.25
Made do/watch sexual things	Never	0.99	0.95	0.26	0.96	0.05
	Rarely or sometimes	0.01	0.04	0.60	0.04	0.55
	Often or very often	0.00	0.00	0.14	0.00	0.41
Molested	Never	1.00	1.00	0.16	1.00	0.07
	Rarely or sometimes	0.00	0.00	0.63	0.00	0.45
	Often or very often	0.00	0.00	0.21	0.00	0.48
Believe sexually abused	Never	1.00	1.00	0.28	0.97	0.07
	Rarely or sometimes	0.00	0.00	0.44	0.03	0.40
	Often or very often	0.00	0.00	0.29	0.00	0.54

assessed at T1. These variables included whether respondents reported living with both of their biological parents until the age of 16 (1=yes; 0=no) and their parents' highest level of education (less than high school, high school, or more than high school). A final covariate was included that indicated whether the respondent was part of the twin sample. As Table 1 indicates, the sample can be characterized as predominantly middle-aged, White, and with relatively high levels of income and education.

### Analytic Strategy

The analysis was conducted in two parts. The first part was the LCA to identify subgroups of respondents with similar histories of childhood abuse based on reported type(s) and frequency of abuse. The second part involved estimating logistic regression, which used results from the LCA to test this study's focal hypothesis and to explore its research question.

LCA is useful for identifying a set of heterogeneous subgroups based on the patterns of responses to observed categorical variables [36, 37]. Within this study's LCA, all 15 items of the Childhood Trauma Questionnaire (see "Measures" above) were treated as categorical variables. Some response categories of the individual abuse items were combined (specifically, "rarely" and "sometimes," as well as "often" and "very often") to achieve a manageable number of cells and to avoid unacceptable sparse distributions within cells in the latent analysis data matrix. In the LCA, we added scores on minimization/denial as a control variable to adjust for this response tendency among some respondents. There was significant model improvement after adding this variable.

We used the Bayesian information criterion (BIC), Akaike information criterion (AIC), Lo–Mendell–Rubin adjusted likelihood ratio test (LRT), the bootstrapped parameter likelihood ratio test, entropy, and interpretability to select the best model fit with the optimal number of latent classes in subsequent comparisons between  $k$  and  $k+1$  class solution. Better fitting models are indicated by smaller AIC and BIC values and entropy values closer to 1.0 [36]. A low  $p$  value of the LRT and the bootstrapped parameter LRT indicate that the model with one less class is rejected in favor of the estimated model [38]. The AIC and the BIC are well-established indicators for comparing competing models and are balanced tools between fit and parsimony [36]. The BIC is an especially credible indicator relative to other indicators to identify the optimum number of classes [39]. We estimated latent class probabilities and conditional probabilities with the LCA. While latent class probabilities describe the distribution of classes given the population, conditional probabilities indicate the item response probabilities of

individuals who belong to distinct classes that have particular characteristics [36].

We used results from the LCA within logistic regression models to examine associations between childhood abuse and adult sleep. Specifically, we used membership in a particular LCA childhood abuse class as the key independent variable. Binomial logistic models were estimated for the dichotomous measure indicating global sleep pathology, and ordered logistic models were estimated for each of the seven sleep components. Maximum likelihood estimation was used to regress each dependent variable on the latent classes of abuse, as well as the covariates. The latent classes were entered into the models as a series of dummy variables, with the reference group comprising respondents in the "no abuse" latent class (see "Results" below).

The percentage of missing data ranged from 2.2% (for annual adjusted income) to 9.7% (for parents' educational attainment). We applied multiple imputation generating ten imputed data sets. All variables except the dependent variables were included in the imputation procedure. In subsequent analyses, we confirmed that there were no significant differences in the effect of childhood abuse on outcomes before and after imputation. Also, previous studies have found some evidence for age and gender differences in responses to stress [40, 41]. Accordingly, in preliminary models, we estimated models that included 64 interaction terms between childhood abuse and gender and age, of which 63 were not statistically significant ( $p \geq 0.05$ ). Accordingly, we analyzed data from men and women, as well as from adults of all ages, in the same analytic sample. The analyses were carried out using Mplus 6.0 [42] and STATA 11.0 [43] software.

## Results

### Latent Classes of Childhood Abuse

According to BIC and AIC, we observed significant improvement in model fit for the five-class solution (BIC=11,531, AIC=10,784, entropy=0.91) in comparison to the four-class solution (BIC=11,613, AIC=11,017, entropy=0.91). Comparisons between the five- and six-class solutions demonstrated somewhat mixed results. Although AIC supported the six-class solution (AIC=10,631), there was no significant improvement in the BIC for the six-class solution (BIC=11,529). There was a negligible improvement of entropy for the six-class solution (entropy=0.92). The LRT and the bootstrapped parameter likelihood ratio test had  $p$  values of 0.74 and 0.50, respectively, for the six-class solution (versus  $<0.001$  and  $<0.001$  for the five-class solution), suggesting that the five-class solution was sufficient. In addition, the six-class model presented no

additional substantive classes, and two out of the six classes comprised <4% of the sample. This small sample size raised concerns regarding adequate statistical power when using the latent class memberships within multivariate models. Furthermore, we encountered problems in estimating standard errors within the six-class solution due to model identification problems. Accordingly, we retained the five-class solution.

Table 2 displays results of the five-class solution, including the latent class probabilities, the size of each class, and the characteristics of each class as manifest through the conditional probabilities. We labeled the five classes as “no abuse” (48% of the sample), “occasional physical and emotional abuse without sexual abuse” (27% of the sample), “occasional physical and emotional abuse with sexual abuse” (12% of the sample), “frequent physical and emotional abuse without sexual abuse” (8% of the sample), and “frequent physical and emotional abuse with sexual abuse” (5% of sample).

#### Associations Between Childhood Abuse and Global Sleep Pathology in Adulthood

Model 1 of Table 3 displays results regarding this study’s focal hypotheses, which posited childhood abuse as a risk factor for global sleep pathology in adulthood. Three classes of abuse were robustly associated with a greater risk of global sleep pathology, including frequent physical and emotional with sexual abuse (OR=3.65, 95% CI=1.75–7.60,  $p<0.001$ ), frequent physical and emotional without sexual abuse (OR=3.27, 95% CI=1.83–5.86,  $p<$

0.001), and occasional physical and emotional abuse with sexual abuse (OR=1.68, 95% CI=1.06–2.70,  $p<0.05$ ). Respondents who reported occasional physical and emotional without sexual abuse were not at greater risk for global sleep pathology, in contrast to respondents who reported no abuse (OR=1.25, 95% CI=0.88–1.77, n.s.). To examine whether this pattern of findings varied by our coding of global sleep pathology, we estimated a regression model that regressed respondents’ continuous scores on global sleep pathology on the multi-categorical variable of childhood abuse and the covariates. Results did not differ. Overall, the results provide support for this study’s hypothesis by indicating associations between the three more extreme classes of childhood abuse and greater risk for global sleep pathology in adulthood.

#### Associations Between Childhood Abuse and Diverse Sleep Components in Adulthood

Models 2 through 8 in Table 3 display results regarding this study’s focal research question, which addressed associations between diverse experiences of childhood abuse and particular components of adult sleep. The most extreme class of abuse—frequent physical and emotional with sexual abuse—was associated with poorer self-reported sleep across many of the components, including poorer subjective sleep quality (OR=2.58, 95% CI=1.34–4.96,  $p<0.01$ ), greater sleep disturbances (OR=3.51, 95% CI=1.80–6.86,  $p<0.001$ ), greater use of sleep medication (OR=2.49, 95% CI=1.28–4.86,  $p<0.01$ ), and greater daytime dysfunction (OR=2.61, 95% CI=1.38–4.93,  $p<0.01$ ). Associations between this class of abuse and self-reported latency, as

**Table 3** Estimated odds ratios from binomial and ordered logit models regarding associations between five classes of childhood abuse and diverse domains of sleep quality in adulthood

	Model 1 Global sleep pathology	Model 2 Subjective quality	Model 3 Latency	Model 4 Duration	Model 5 Efficiency	Model 6 Disturbances	Model 7 Use of sleep medication	Model 8 Daytime dysfunction
No Abuse	–	–	–	–	–	–	–	–
Occasional physical and emotional abuse								
Without sexual abuse	1.25 (0.22)	1.07 (0.19)	1.24 (0.20)	0.88 (0.15)	0.94 (0.18)	1.55** (0.29)	1.28 (0.26)	1.38* (0.23)
With sexual abuse	1.68** (0.41)	1.54* (0.36)	1.82*** (0.41)	1.50* (0.34)	1.49* (0.35)	1.53* (0.37)	1.56* (0.41)	1.89*** (0.44)
Frequent physical and emotional abuse								
Without sexual abuse	3.27**** (0.97)	2.14*** (0.58)	2.65**** (0.67)	1.11 (0.30)	1.74** (0.49)	2.61**** (0.73)	2.38*** (0.68)	2.01*** (0.54)
With sexual abuse	3.65**** (1.36)	2.58*** (0.86)	1.75* (0.54)	1.18 (0.39)	1.79* (0.56)	3.51**** (1.20)	2.49*** (0.85)	2.61*** (0.85)
Pseudo $R^2$	0.07	0.03	0.03	0.04	0.03	0.06	0.03	0.04

Data are from 835 respondents who participated in a special module of the National Survey of Midlife Development in the United States (MIDUS). The dependent variables are coded such that higher scores indicate poorer sleep quality. Models include as covariates measures of respondents’ age, gender, marital status, residing with a child under the age of 6, educational attainment, annual adjusted income, employment status, living with both biological parents until the age of 16, parents’ educational attainment, and twin status. Standard errors are in parentheses. The pseudo  $R^2$  for the respective models that included only the covariates and not the multi-categorical measure of childhood abuse were 0.04 (model 1), 0.02 (model 2), 0.02 (model 3), 0.03 (model 4), 0.03 (model 5), 0.04 (model 6), 0.02 (model 7), and 0.03 (model 8)

\* $p<0.10$ ; \*\* $p<0.05$ ; \*\*\* $p<0.01$ ; \*\*\*\* $p<0.001$  (two-tailed)

well as efficiency, were smaller and achieved only a trend level of statistical significance (latency: OR=1.75, 95% CI=0.96–3.19,  $p<0.10$ ; efficiency: OR=1.79, 95% CI=0.92–3.29,  $p<0.10$ ). No association was observed between this class of abuse and sleep duration (OR=1.18, 95% CI=0.62–2.24, n.s.).

Similarly, reports of frequent physical and emotional without sexual abuse were also associated with poorer sleep across many of the components, including poorer subjective sleep quality (OR=2.14, 95% CI=1.25–3.65,  $p<0.01$ ), longer latency (OR=2.65, 95% CI=1.62–4.35,  $p<0.001$ ), poorer efficiency (OR=1.74, 95% CI=1.00–3.00,  $p<0.05$ ), greater sleep disturbances (OR=2.61, 95% CI=1.51–4.52,  $p<0.001$ ), greater use of sleep medication (OR=2.38, 95% CI=1.36–4.12,  $p<0.01$ ), and greater daytime dysfunction (OR=2.01, 95% CI=1.18–3.41,  $p<0.01$ ). Similar to the results for the class of frequent physical and emotional abuse with sexual abuse, the only sleep component that this class of abuse was not associated with was duration (OR=1.11, 95% CI=.65–1.90, n.s.).

Although the class of occasional physical and emotional with sexual abuse was found to be associated with global sleep pathology, this class was only robustly associated with two individual sleep components: latency (OR=1.82, 95% CI=1.17–2.81,  $p<0.01$ ) and daytime dysfunction (OR=1.89, 95% CI=1.20–2.98,  $p<0.01$ ). This class of abuse was associated with the other individual sleep components at a trend level of statistical significance, including subjective sleep quality (OR=1.54, 95% CI=0.98–2.34,  $p<0.10$ ), duration (OR=1.50, 95% CI=0.96–2.34,  $p<0.10$ ), efficiency (OR=1.49, 95% CI=0.93–2.37,  $p<0.10$ ), disturbances (OR=1.53, 95% CI=0.95–2.46,  $p<0.10$ ), and use of sleep medication (OR=1.56, 95% CI=.92–2.62,  $p<0.10$ ). Also, occasional physical and emotional abuse without sexual abuse was associated with greater sleep disturbances (OR=1.55, 95% CI=1.08–2.23,  $p<0.05$ ).

In summary, the results indicated that frequent experiences of physical and emotional abuse in childhood were associated with poorer adult sleep across many individual sleep components. Reports of physical and emotional abuse at relatively lower levels of frequency were associated with fewer sleep components, in contrast to reports of more frequent childhood abuse.

## Discussion

Guided by a life course epidemiological perspective on health and conceptualizing childhood abuse as a prevalent type of early life stress, this study examined childhood abuse as a risk factor for sleep problems in adulthood. The results yielded evidence of elevated risk for poor sleep

among adults with histories of abuse. Adults who reported frequent experiences of physical and emotional abuse—regardless of sexual abuse—were found to be at especially high risk for global sleep pathology. Regardless of their experiences of sexual abuse, respondents who reported frequent experiences of physical and emotional abuse had odds for clinically relevant levels of sleep pathology over 200% higher than respondents who reported no abuse. These findings—which are based on a large, community-based sample of adults—extend prior research in this area that has used mostly small, regional, or clinical samples [21, 23].

The finding of elevated risk among respondents who reported frequent experiences of child abuse is consistent with previous theorizing on the especially deleterious effects of chronic stress. Scholars have posited that although humans' stress response system is well suited to handle acute stressors, chronic activation of the stress response system is especially likely to result in poor health outcomes [44]. Focusing specifically on frequent abuse, scholars have posited that abuse which occurs regularly over long periods of time is likely to profoundly damage healthy development by creating cumulative problems across various developmental stages [45].

In addition to respondents who reported frequent experiences of physical and emotional abuse, respondents who reported occasional physical and emotional abuse—in combination with sexual abuse—also were found to be at elevated risk for global sleep pathology. This class of abuse was also associated with several, but not all, individual sleep components, including latency and daytime dysfunction. These findings point to the long-term potency of sexual abuse on adult sleep quality in the context of less frequent experiences of other types of abuse. Perhaps because sexual abuse often occurs in bedrooms or at night, adults with histories of sexual abuse even with relatively rare experiences of other types of abuse might have developed long-lasting psychological associations between sleep and fear [46]. This might account for the heightened risk of global sleep pathology among adults who experienced physical and emotional abuse less frequently, but who also experienced sexual abuse.

This study also examined the extent to which childhood abuse was associated with any particular component of poor sleep in adulthood. The classes of abuse that were associated with greater risk of global sleep pathology in adulthood were associated with each individual sleep component, with one exception. None of the classes of childhood abuse were robustly associated with self-reported sleep duration. This finding is consistent with studies of sleep problems among abused children, which similarly have found that abuse is not associated with total sleep time [18, 19]. These findings suggest that life course stressors

such as childhood abuse might jeopardize individuals' sleep quality more than sleep quantity.

The sleep component that appeared most sensitive to childhood abuse was sleep disturbances. This component is derived from responses to nine items, including pain during the night, feeling too cold or too hot, and having bad dreams. The largest association of risk was found between this sleep component and the most extreme class of abuse (i.e., frequent physical and emotional with sexual abuse). Also, the least extreme class of abuse—occasional physical and emotional without sexual abuse—was associated with sleep disturbances, but was not robustly associated with any of the other individual sleep components or even global sleep pathology. This might be because sleep disturbances include sleep problems that are closely related to long-term psychobiological consequences of childhood abuse, such as having bad dreams and experiencing pain. Further research on the extent to which stress, such as childhood abuse, jeopardizes particular components of sleep is important for advancing both theory and clinical interventions on sleep and stress. For example, the results of the current study suggest the importance of clinicians asking individuals with histories of childhood abuse about perceptions of sleep quality—such as their general satisfaction with sleep and experiences of sleep disturbances—as opposed to the number of hours that they sleep on average.

In summary, results of this study provide population-based evidence for childhood abuse as a risk factor for poor adult sleep quality. A critically important direction for subsequent research is to examine explicitly the pathways through which childhood abuse jeopardizes adult sleep quality. The cross-sectional nature of this study's data precluded our ability to test mediational hypotheses [47]. Regarding mental health as a potential explanatory pathway, for example, a growing body of research indicates that depression is both a cause and consequence of insomnia and that depression and insomnia might both result from some other shared condition [48]. Cross-sectional data do not allow for disentangling these time-ordered processes from each other. Accordingly, there is a need for studies that build from the associations documented in this study—specifically longitudinal research that draws on data collected at various time points throughout childhood and adulthood—to better disentangle the likely complex associations between childhood abuse, adult health problems, and sleep problems.

In addition to adult mental and physical health status, there are a variety of other pathways through which childhood abuse might impair adult sleep. For example, regarding a direct physiological pathway, chronic stress that is experienced early in life and during sensitive periods of development—such as child abuse—might fundamentally alter sleep/arousal systems and lead to chronic sleep

problems [12, 13]. Moreover, adults with histories of childhood abuse might experience poor sleep quality on account of an accumulation of subsequent stressors in adulthood, such as revictimization [49]. One adult health problem that is especially important for research on pathways from childhood abuse to poor sleep quality to consider is posttraumatic stress disorder (PTSD). As this mental health problem specifically involves self-reported problems with sleeping following exposure to severe stress [50], PTSD might constitute a predominant pathway through which childhood abuse—especially severe experiences of abuse—leads to poor sleep quality in adulthood (our study is unable to examine rates of PTSD among respondents because the data set does not include a relevant measure.)

Despite this study's strengths, features of the data limit our ability to advance understanding of childhood abuse as a risk factor for poor adult sleep in several ways. First, this study used self-report measures of both adult sleep and childhood abuse. Although the Pittsburgh Sleep Quality Inventory was originally developed for the detection of sleep problems in clinical populations [1], it since has been widely used in diverse non-clinical samples to assess subjective sleep problems [36, 51, 52]. Nevertheless, scores on the instrument are often unrelated to objective measures of sleep, such as polysomnography, and to other subjective sleep measures, such as the Epworth Sleepiness Scale [35, 51]. Thus, while the Pittsburgh Sleep Quality Inventory is not useful for detecting abnormalities in sleep architecture (e.g., slow-wave or rapid eye movement sleep), it is reliable for the detection of insomnia [35] and the assessment of links between psychological factors (e.g., stress and depression) and sleep problems [52]. Regarding the study's measure of childhood abuse, previous research on measurement of abuse suggests that while some respondents might overestimate childhood abuse (e.g., respondents with a negative mood at the time of data collection are likely to over-report experiences of abuse), many respondents are also likely to underestimate abuse (e.g., because of infant amnesia, respondents are unable to remember and report abuse that took place very early in childhood) [53]. To fully understand the relationship between childhood abuse and sleep problems in adulthood, it will be important to expand this line of work to other types of measures, including objective assessments of sleep and agency reports of childhood abuse.

Other limitations include that this study's measure of abuse did not assess approximately when in childhood the abuse took place. Drawing on a developmental psychopathology perspective, scholars have posited that the effects of childhood abuse might depend on the developmental stage(s) over which it was experienced [54]. This study also did not address the potentially long-term

sleep consequences among individuals with histories of neglect—a related yet distinct domain of child maltreatment that previous studies have identified as having deleterious health effects in adulthood (e.g., [55]). Also, other factors that this study did not control for might account, in part, for both childhood abuse and poorer adult sleep quality, such as exposure to marital conflict in childhood [20]. Furthermore, potentially systematic patterns of non-participation in the special module, as well as in the subsequent sleep study, raise concerns about biased estimates of population parameters [56].

Despite these limitations, this study contributes to empirical evidence regarding childhood abuse as a life course risk factor for poor sleep quality in adulthood. Previous research has found that healthcare providers are unlikely to ask respondents about experiences of abuse [57] or about current sleep problems [58]. These findings—in conjunction with the results of the current study—suggest that sleep problems among adults with histories of abuse might be especially likely to be under-detected and undertreated. Results of the current study support the importance of educating healthcare professionals on childhood abuse as a life course risk factor for poor sleep quality, as well as the importance of testing the effectiveness of sleep interventions specifically among adults with histories of abuse (e.g., [59]).

**Acknowledgments** This study was supported by grants from the National Institute on Aging (AG206983; AG20166).

**Conflict of Interest Statement** The authors have no conflict of interest to disclose.

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