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Adverse childhood experiences and sleep difficulties among young adult college students

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Summary

Although adverse childhood experiences (traumatic events such as maltreatment and household dysfunction) are associated with increased risk for sleep difficulties among adults, the association between adverse childhood experiences and poor sleep health among young adult college populations is understudied. This study examined the adverse childhood experience–sleep health (self-reported sleep difficulty and diagnosis of insomnia or "other" sleep disorder) association among college students. Data are from the 2018/2019 American College Health Association-National College Health Assessment II (ACHA-NCHA-II) survey administered at public universities in California ($n = 3606$) and Texas ($n = 407$). Logistic regression models investigated the relative effect of adverse childhood experiences (maltreatment only, household dysfunction only, and maltreatment + household dysfunction) on three sleep health indicators. Approximately 40% of the sample reported adverse childhood experiences: 11% maltreatment only, 14% household dysfunction only, and 17% both. Compared with students with no adverse childhood experience history, students who reported only household dysfunction or only maltreatment had higher odds of experiencing sleep difficulty in the past year [adjusted odds ratios: 1.52–2.40; 95% confidence intervals: 1.26–2.97]. Additionally, students who reported maltreatment only had 2.47 times the odds of receiving an insomnia diagnosis [95% confidence interval: 1.52, 4.01]. However, students who reported both had higher odds of all three sleep health indicators: past-year sleep difficulty, insomnia diagnosis, and "other" sleep disorder diagnosis [adjusted odds ratios: 2.53–3.10; 95% confidence intervals: 1.51–4.66]. Sleep is an important facet of health among the college student population, and plays a crucial role in overall well-being, psychosocial processes, attention and academic success. Results point toward a need for sleep health programmes and interventions on college campuses focused on healthy sleep behaviours in order to mitigate further negative health effects.

KEYWORDS
child maltreatment, college students, household dysfunction, sleep health, young adults

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1 | INTRODUCTION

Early traumatic stressors have a negative impact on health outcomes over the lifespan (Anda et al., 2010; Felitti et al., 1998; Hughes et al., 2017; Mersky et al., 2013). Since the seminal study conducted by Felitti et al. (1998) investigating the role of adverse childhood experiences (ACEs; childhood traumatic experiences, e.g. physical abuse, verbal abuse, sexual abuse, and household factors such as substance use, familial mental illness and incarceration) in health outcomes, numerous studies have documented a broad range of negative ACE-related effects that manifest as early as adolescence and persist throughout adulthood (Anda et al., 2010; Chapman et al., 2004; Felitti et al., 1998; Forster et al., 2018; Grigsby et al., 2020; Pakdaman et al., 2021; Windle et al., 2018). Sleep quality is an important area of research and a health indicator for college students, as poor sleep health can contribute to unhealthy diet, poor mental health and compromised academic performance (Gaultney, 2010; Ludy et al., 2018; Larson, Chapman, Spetz, & Brindis, 2017).

Thus far, ACE–sleep health studies have found that individual ACEs (e.g. physical abuse, sexual abuse or verbal abuse) are associated with poor sleep health (i.e. self-reported symptoms and disorders) and, when examined cumulatively, there is evidence of a graded relationship between ACEs and the likelihood of experiencing poor sleep health (Chapman et al., 2011; Sheehan et al., 2020; Windle et al., 2018). A recent systematic review noted several patterns of association between individual ACE and sleep health (Kajeepeta et al., 2015); compared with no abuse history, participants who experienced emotional/verbal, physical or sexual abuse specifically were at the highest risk for developing poor sleep health and having more sleep health issues, underscoring the link between ACEs and poor sleep health. However, only eight of the 30 studies examined in the aforementioned review contained young adult college student samples, none of which was from the USA (Kajeepeta et al., 2015). Furthermore, other recent work focused on the ACE–sleep health relationship among college students has examined specific mediators of this relationship, such as psychological distress (John-Henderson et al., 2018; Rojo-Wissar et al., 2019), but has not done so in diverse student populations. The current study will expand on this work by examining the association between types of ACEs (e.g. maltreatment and household dysfunction) and sleep health, and explore the potential role of race/ethnicity in this relationship among a diverse college student population.

There are two broad categories of ACEs: child maltreatment and household dysfunction. Child maltreatment describes parent/caregiver behaviours that directly target a child (e.g. physical, verbal or sexual abuse; Anda et al., 2010; Felitti et al., 1998; Lenane, 2007; Norman et al., 2012; World Health Organization [WHO], 2020), while household dysfunctions are parent/caregiver behaviours or issues that do not directly target the child, but represent a home environment that causes disruptions in family functioning (e.g. mental health disorders, substances use or incarceration; Anda et al., 2010; Centers for Disease Control and Prevention [CDC], 2019) and can compromise the development and health of children (Gauffin et al., 2016). The use of maltreatment and household dysfunction categories has several benefits: it allows for inference about the relative effect of ACEs that describe actions directed toward a child (i.e. verbal abuse) by an adult in comparison to ACEs that describe adult behaviours not directed toward a child, and the joint effects of experiencing both in health outcomes. Prior research has identified maltreatment as an important predictor for poor sleep health (Chapman et al., 2011; John-Henderson et al., 2018; Kajeepeta et al., 2015; Rojo-Wissar et al., 2019; Windle et al., 2018); however, the present operationalization of ACEs is critical to gain a better understanding of whether the effects of household dysfunction, maltreatment or both are similar or different on sleep health of college students.

Based upon the literature reviewed, we hypothesized that students who reported any ACE would have: (a) higher odds of being diagnosed with a sleep disorder (insomnia or other) in the past 12 months; and (b) higher odds of experiencing sleep difficulty in the past 12 months compared with students who did not have a history of ACE. We also hypothesized that students who experienced both maltreatment + household dysfunction would have: (a) higher odds of being diagnosed with a sleep disorder (insomnia or other) in the past 12 months; and (b) higher odds of experiencing sleep difficulty in the past 12 months compared with students who experienced household dysfunction only or maltreatment only. Informed by work indicating sex and racial/ethnic differences across the ACE–health relationship (Forster et al., 2019a; Grigsby et al., 2020), we also explored potential sex and racial/ethnic differences across the primary relationships being tested in the present study.

2 | METHODS

Analyses were conducted on secondary data collected from the American College Health Association-National College Health Assessment II (ACHA-NCHA-II) survey, a national health assessment that was administered at public universities in California ($n = 3606$) and Texas ($n = 407$). Supplemental items on ACEs were added to the NCHA survey by the principal investigators. Sample demographics are similar to the college student profiles of each university in Spring 2018 and Fall 2019. Only students aged 18–27 years were included in the study as we were focused on the effect of ACEs in emerging adult health. Emerging adulthood (Arnett, 2007; Reifman et al., 2007) is defined as a developmental stage bridging adolescence and adulthood during which stressful transitions occur (Reifman et al., 2007). The survey was distributed to students via an electronic platform in California, and pencil and paper in Texas. Incentives of gift card raffles were used to encourage participation. All study procedures received Institutional Review Board approval at the participating sites.

3 | MEASURES

3.1 | Sleep health

Sleep health is a multidimensional facet of health that has been reliably measured in a variety of ways in the literature, including

self-reports (Buysse, 2014; Okun et al., 2009; Pilcher et al., 2010; Smith & Trinder, 2001). Survey questions were based upon questions and sleep quality indices from the Pittsburgh Sleep Quality Index, Jenkins Sleep Scale, and the Fatigue Severity Scale (Ağargün et al., 1996; Buysse et al., 1989; Gencay-Can & Can, 2012; Jenkins et al., 1988). Self-reported *sleep disorder diagnoses* were measured with two questions: "Have you been diagnosed with insomnia in the past 12 months?" and "Have you been diagnosed with some other sleep disorder in the past 12 months?" Response options were recoded as "Yes" (coded 1) and "No" (coded 0). Self-reported *sleep difficulty* was assessed with one question: "Has it been difficult to handle your sleep symptoms in the past 12 months?" Response options were recoded as "Yes" (coded 1) and "No" (coded 0).

3.2 | Adverse childhood experiences

Seven ACE items representing different categories of familial trauma asked respondents if they had experienced any of the following events prior to the age of 18 years: physical abuse, sexual abuse, verbal abuse, familial incarceration, household alcohol misuse, household drug misuse, and witnessing physical violence in the household. To assess the relative contribution of ACE types in sleep health, ACEs were operationalized as: *maltreatment* – physical abuse, verbal abuse and sexual abuse; and *household dysfunction* – familial incarceration, household alcohol misuse, household drug misuse and physical violence between adults in the household (Anda et al., 2010). A mutually exclusive categorical variable was coded as: 0 = No ACEs, 1 = Maltreatment only, 2 = Household dysfunction only, and 3 = Both maltreatment + household dysfunction (Anda et al., 2010).

3.3 | Demographic covariates

All analyses adjusted for biological sex, age, ethnicity, year in school, and state given their relevance in past research (Chapman et al., 2011; Forster et al., 2019a; Grigsby et al., 2020; John-Henderson et al., 2018; Kajeepeta et al., 2015; Rojo-Wissar et al., 2019; Windle et al., 2018). Biological sex was coded 0 = Male, 1 = Female. Age was a continuous variable ranging from 18 to 27 years. Race/ethnicity was coded 1 = White/Caucasian, 2 = Black/African American, 3 = Hispanic/Latino, 4 = Asian/Pacific Islander, 5 = American Indian/Alaska Native/Native Hawaiian/Other, and 6 = Biracial/Multiracial. State was coded 1 = California and 2 = Texas. Year in school was coded 1 = 1st year undergraduate, 2 = 2nd year undergraduate, 3 = 3rd year undergraduate, 4 = 4th year undergraduate, 5 = 5th year or more undergraduate, and 6 = Graduate or professional degree.

3.4 | Analysis

Univariate descriptive statistics and bivariate tests were conducted. A *t*-test was performed to determine if the average number of ACEs

significantly differed across the two samples (California and Texas). Three logistic regression models assessing the effects of ACE on each sleep health outcome tested the study hypotheses. Six additional models that included interaction terms (ACEs*race/ethnicity and ACEs*sex) were run to explore racial/ethnic and sex differences across the primary relationships of interest. Missing data were managed with listwise deletion. Chi-square and *t*-test analyses were used to compare the missing sample with the analytic sample, and those excluded due to missing did not differ on demographic or sleep health variables (*p* > 0.05).

4 | RESULTS

The final analytic sample was comprised of 4013 students from California and Texas. On average, respondents were approximately 22 years old (SD = 2.47) and the majority identified as female (70.8%). Approximately half (50%) of the student sample identified as Hispanic/Latino, followed by White/Caucasian (20%), Asian/Pacific Islander (14%), American Indian/Alaska Native/Native Hawaiian/Other (6%), Biracial or Multiracial (5%), and Black/African American (4%; Table 1). The racial/ethnic makeup of our sample is comparable to that of the 2017 US college student population (Dedman, 2019).

4.1 | Univariate analyses

Approximately 40% of students reported having experienced at least one ACE. Of those who reported ACEs, one in four students (26%) reported maltreatment only, 34% household dysfunction only, and 40% both maltreatment + household dysfunction. The average number of ACEs reported in Texas (M = 1.34; SD = 1.49) was significantly higher than in California (M = 0.84; SD = 1.36, *p* < 0.01). Among all respondents who reported at least one ACE, the mean was 2.17 (SD = 1.38). Household alcohol misuse and verbal abuse were the two most frequently reported ACEs, with 20% of the sample reporting these stressors. Physical abuse was acknowledged by 13% of the sample, followed by household drug misuse (11%), witnessing physical violence in the household (10%), familial incarceration (10%) and sexual abuse (6%), with approximately 60% of the sample reporting no history of ACEs, although this varied across states (Table 2). Approximately 4% (*n* = 147) of the sample had received a diagnosis of insomnia in the past 12 months, and 2% (*n* = 75) had received a diagnosis of some "other" sleep disorder in the past 12 months. About one-third (34%) of the sample reported that they had difficulty with their sleep in the past 12 months (Table 2).

4.2 | Multivariable analyses

Three separate logistic regression models were run to assess the relative effects of ACE classifications on each past-year sleep health outcome: insomnia diagnosis, "other" sleep disorder diagnosis, and sleep

TABLE 1 Demographic characteristics for the analytic sample by state ($n = 4013$)

	California ($n = 3606$) frequency (%) mean (SD)	Texas ($n = 407$) frequency (%) mean (SD)	Total sample ($n = 4013$) frequency (%) mean (SD)
Age			
Female	21.66 (2.5)	21.08 (1.9)	21.62 (2.5)
Ethnicity	2586 (71.8%)	250 (61.7%)	2836 (70.8%)
Hispanic/Latino	1802 (50.0%)	216 (54.3%)	2018 (50.3%)
White/Caucasian	722 (20.1%)	60 (15.1%)	782 (19.5%)
Asian/Pacific Islander	527 (14.6%)	34 (8.5%)	561 (14.0%)
Black/African American	118 (3.3%)	56 (14.1%)	174 (4.3%)
American Indian/Alaska Native/ Native Hawaiian/Other	234 (6.5%)	14 (3.5%)	248 (6.2%)
Biracial/Multiracial	196 (5.4%)	18 (4.5%)	214 (5.3%)
Year in School			
1st year undergraduate	622 (17.4%)	15 (3.8%)	637 (15.9%)
2nd year undergraduate	464 (13.0%)	67 (16.8%)	531 (13.2%)
3rd year undergraduate	1009 (28.2%)	142 (35.6%)	1151 (28.7%)
4th year undergraduate	716 (20.0%)	111 (27.8%)	827 (20.6%)
5th year or more undergraduate	451 (12.6%)	53 (13.3%)	504 (12.6%)
Graduate or professional degree	320 (8.9%)	11 (2.8%)	331 (8.2%)

TABLE 2 ACEs and sleep characteristics for the analytic sample ($n = 4013$)

Variable	Mean (SD) frequency (%)
Individual ACEs	
Verbal abuse by adult or parent	788 (19.6%)
Physical abuse by adult or parent	536 (13.4%)
Sexual abuse by adult or parent	233 (5.8%)
Familial incarceration	394 (9.8%)
Household alcohol misuse	787 (19.6%)
Household drug misuse	425 (10.6%)
Witness physical violence in household	417 (10.4%)
ACE classification	
None	2203 (61.1%)
Maltreatment only	386 (10.7%)
Household dysfunction only	470 (13.0%)
Both maltreatment and household dysfunction	547 (15.2%)
Sleep health indicators (past-12 months)	
Difficulty handling sleep symptoms	1371 (34.3%)
Diagnosed with insomnia	147 (3.7%)
Diagnosed with "other" sleep disorder	75 (1.9%)

Abbreviation: ACE, adverse childhood experience.

difficulty. All models adjusted for age, biological sex, race/ethnicity, year in school, and state.

Results of the logistic regression model assessing the effects of ACEs on insomnia indicated that students who reported only maltreatment had 2.47 times the odds of receiving an insomnia diagnosis in the past year compared with students who reported no ACEs [95% confidence interval (CI): 1.52, 4.01]. Students who reported maltreatment + household dysfunction had 3.10 times the odds of receiving an insomnia diagnosis in the past year compared with students who reported no ACEs [95% CI: 2.07, 4.66]. There was no significant association between household dysfunction only and insomnia (Figure 1; Table 3).

Results of the logistic regression model assessing the association between ACEs and the "other" sleep disorder diagnosis indicated that students who reported maltreatment + household dysfunction had 2.61 times the odds of receiving some "other" sleep disorder diagnosis in the past year compared with students who reported no ACEs [95% CI: 1.51, 4.51]. Maltreatment only and household dysfunction only were not associated with "other" sleep disorder diagnoses (Figure 1; Table 3).

Lastly, the results of the logistic regression model assessing the effects of ACEs on sleep difficulty indicated that students who reported only household dysfunction had 1.52 times the odds of experiencing sleep difficulty in the past year compared with students who reported no ACEs [95% CI: 1.26, 1.87]. Students who reported only maltreatment had 2.40 times the odds of experiencing sleep difficulty in the past year compared with students who reported no ACEs [95% CI: 1.93, 2.97]. Students who reported maltreatment + household dysfunction had 2.53 times the odds of experiencing sleep difficulty in the past year compared with students who reported no ACEs [95% CI: 2.10, 3.03] (Figure 1; Table 3). Students who reported maltreatment + household dysfunction had significantly higher odds of experiencing sleep difficulty than students who experienced household dysfunction only.

FIGURE 1 Adjusted odds ratios (AORs) for past-year sleep health indicators by adverse childhood experience (ACE) classification
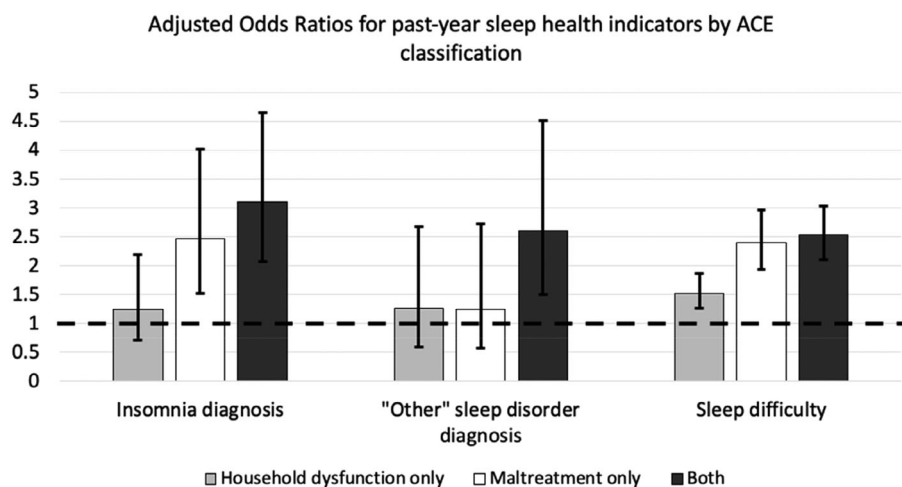

Adjusted Odds Ratios for past-year sleep health indicators by ACE classification

☐ Household dysfunction only   ☐ Maltreatment only   ■ Both

TABLE 3 Adjusted odds ratios (AORs) for three logistic regression models assessing ACE classification and past-year sleep health outcomes (n = 4013)

	Insomnia diagnosis AOR (95% CI)	"Other" sleep disorder diagnosis AOR (95% CI)	Sleep difficulties AOR (95% CI)
ACE classification			
Household dysfunction only	1.24 (0.71, 2.19)	1.27 (0.60, 2.67)	1.53 (1.26, 1.87)***
Maltreatment only	2.47 (1.52, 4.01)***	1.25 (0.57, 2.73)	2.40 (1.93, 2.97)***
Both	3.10 (2.07, 4.66)***	2.61 (1.51, 4.51)**	2.53 (2.10, 3.03)***
Age	1.07 (0.98, 1.17)	1.09 (0.97, 1.22)	1.00 (0.96, 1.04)
Sex	1.08 (0.74, 1.57)	0.82 (0.50, 1.36)	1.29 (1.11, 1.50)**
Ethnicity			
Hispanic/Latino	0.57 (0.37, 0.87)**	1.00 (0.51, 1.99)	1.15 (0.96, 1.39)
Asian/Pacific Islander	0.59 (0.33, 1.06)	1.59 (0.72, 3.54)	1.14 (0.90, 1.45)
Black/African American	0.63 (0.24, 1.65)	1.95 (0.61, 6.26)	1.00 (0.70, 1.45)
American Indian/Alaska Native/Native			
Hawaiian/Other	1.11 (0.60, 2.07)	3.17 (1.39, 7.21)**	1.58 (1.16, 2.14)**
Biracial/Multiracial	0.83 (0.41, 1.67)	1.35 (0.46, 3.94)	1.38 (1.00, 1.90)
Year in school			
2nd year undergraduate	1.49 (0.76, 2.92)	1.27 (0.51, 3.21)	1.09 (0.84, 1.41)
3rd year undergraduate	1.20 (0.63, 2.29)	1.07 (0.45, 2.56)	1.17 (0.92, 1.49)
4th year undergraduate	1.07 (0.53, 2.14)	0.97 (0.38, 2.48)	1.06 (0.81, 1.38)
5th year or more undergraduate	1.17 (0.54, 2.51)	0.73 (0.24, 2.19)	1.18 (0.87, 1.61)
Graduate or professional degree	1.03 (0.43, 2.48)	1.49 (0.49, 4.55)	0.84 (0.58, 1.22)
State			
Texas	0.34 (0.15, 0.79)*	0.11 (0.02, 0.80)*	0.76 (0.60, 0.97)*

Note: Reference groups: No ACE exposure, Male, White/Caucasian, 1st year Undergraduate, California.
*p < 0.05. **p < 0.01. ***p < 0.001.
Abbreviations: AOR, adjusted odds ratio; CI, confidence interval.

4.3 | Sex and race/ethnic differences

To assess racial/ethnic and sex differences in these relationships, interaction terms (ACEs*sex, ACEs*race/ethnicity) were included in a separate set of models for each of the three outcomes (six total interaction models). In each of the models, there were no significant racial/ethnic or sex differences in the relationship between ACEs and sleep health (p > 0.05; Table 4).

TABLE 4 *p*-Values for six logistic regression interaction models including terms ACEs*race/ethnicity and ACEs*sex (*n* = 4013)

	Insomnia diagnosis *p*-value	"Other" sleep disorder diagnosis *p*-value	Sleep difficulties *p*-value
Interaction term			
ACEs*race/ethnicity	0.053	0.299	0.524
ACEs*sex	0.880	0.628	0.280

Abbreviation: ACE, adverse childhood experience.

5 | DISCUSSION

This study examined the role of early life course traumatic stressors in the sleep health of young adults. Examining the impact of ACEs on health among young adults, 50% of whom are enrolled in post-secondary educational programmes (National Center for Education Statistics, 2020), is essential to: (a) improve our understanding of the progression of negative health outcomes related to ACEs in early adulthood; and (b) inform prevention efforts that can disrupt the progression of trauma-related health consequences as youth transition to adulthood. We found partial support for the study hypothesis that: (a) students who reported any ACE would have higher odds of being diagnosed with a sleep disorder (insomnia or other) in the past 12 months and higher odds of experiencing sleep difficulty in the past 12 months than students who do not have a history of ACEs. We also found partial support for our hypothesis (b) that students who experienced maltreatment + household dysfunction would have higher odds of being diagnosed with a sleep disorder (insomnia or other) and higher odds of experiencing sleep difficulty in the past 12 months than students who experienced household dysfunction only or maltreatment only.

The statistically significant pattern of relationships between mutually exclusive ACE classifications and past-year (a) sleep disorder diagnoses and (b) sleep difficulty among respondents highlights that the negative impact of ACEs in young adult sleep health should be considered in health promotion efforts for college students. Although exposure to only household dysfunction increased the risk for poor sleep health, in comparison to maltreatment only or maltreatment + household dysfunction, this exposure was the least risky for poor sleep health. Experiencing maltreatment, but not household dysfunction, was associated with poorer sleep health than experiencing household dysfunction but not maltreatment; however, a history of both maltreatment and household dysfunction was associated with the highest risk for experiencing all poor sleep health indicators assessed in the study.

These findings are consistent with studies demonstrating a dose–response relationship between cumulative ACEs and other health issues (Chapman et al., 2004; Forster et al., 2019a; Grigsby et al., 2020; Mersky et al., 2013; Sheehan et al., 2020; Windle et al., 2018). Although some categories of ACEs may be more detrimental for certain health outcomes than others, individuals with high levels of adversity, often a combination of types, are especially vulnerable for poor outcomes including sleep health. Although extant literature has shown that individual experiences classified as maltreatment are more predictive of negative health outcomes compared with experiences classified as household dysfunction (Afifi et al., 2008; Chapman et al., 2011; Forster et al., 2019a; Merrick et al., 2017; Wang et al., 2016), few studies have examined the joint effects of these in sleep health among diverse samples of college students.

Sleep is an important facet of health among the college student population, and it plays a crucial role in overall well-being, psychosocial processes, attention and academic success (Eliasson et al., 2010; Kamdar et al., 2004; Levenson et al., 2016). Results of the current study highlight the importance of developing positive sleep habits in emerging adulthood, as poor sleep itself is a negative health outcome and can contribute to and further aggravate other negative health outcomes (Benham, 2010; Ming et al., 2011). Our results also point toward a potential link in the causal chain between elevated adversities, increased risk for anxiety, depression and substance use, ultimately leading to poor sleep health (Chapman et al., 2011; Forster et al., 2018, 2019a; Grigsby et al., 2020; Kajeepeta et al., 2015; Pakdaman et al., 2021; Windle et al., 2018); however, longitudinal research is needed to support these hypotheses.

5.1 | Limitations

The results of this study should be interpreted in the context of the following limitations. Due to the sensitive nature of some questions, students may not have disclosed information or remembered specific events; therefore, recall and/or response bias may have led to underestimating associations between ACEs and sleep health. However, most ACE studies have used retrospective measures of ACEs (Chapman et al., 2011; Forster et al., 2019a; Grigsby et al., 2020; John-Henderson et al., 2018; Kajeepeta et al., 2015; Rojo-Wissar et al., 2019; Windle et al., 2018). Second, the cross-sectional nature of this survey cannot address temporal ambiguity; however, all questions referred to events prior to age 18 years, and sleep items assessed sleep health indicators within the past year. Third, although the ACE items used in the current study are typically utilized in ACE literature (Anda et al., 2010; Chapman et al., 2004, 2011; Felitti et al., 1998; Forster et al., 2019a; Grigsby et al., 2020), we did not provide an exhaustive list; as a result, our results may be underestimating the effect of ACE on sleep health. Fourth, the frequency or severity of ACEs were not measured in the original data collection instrument and should be examined in future studies. Fifth, due to the limitations of the sleep health questions in the ACHA-NCHA-II survey, we could not assess the frequency or severity of these self-reported sleep

health indicators including those indicating "other" sleep disorders that were not defined, and we recommend these be examined in future studies. Sixth, the current sample of ACE-exposed college students may differ from all ACE-exposed young adults, therefore our results may not be generalizable to the US college population or ACE-exposed young adults that did not attend college. Finally, all sleep health variables included in the study were self-reported, including diagnosed sleep disorders; however, self-reported measures have been utilized in many sleep studies (Chapman et al., 2011; John-Henderson et al., 2018; Kajeepeta et al., 2015; Rojo-Wissar et al., 2019; Windle et al., 2018).

Despite these limitations, the results of the current study contribute unique findings to the ACE-health literature, advance our understanding of the relative effects of ACE classifications in health among college students, and demonstrate that ACEs can have serious health consequences even among the most resilient young adults.

5.2 | Conclusion and implications

The current study provides further evidence that ACE exposure is associated with negative health outcomes, specifically sleep health. Moreover, our results suggest that much more work is needed to determine whether sociocultural factors, such as perceived discrimination and ethnic identity, play a role in stress-related health outcomes among diverse young adult, college student populations. Evidence from this study can be used to inform future research, and prevention and intervention initiatives tailored to college students with a history of childhood adversity in order to prevent or limit symptoms such as depression and anxiety, substance misuse, poor academic performance, and poor sleep health (Pakdaman et al., 2021; Chapman et al., 2011; Forster et al., 2018, 2019a; Grigsby et al., 2020; Kajeepeta et al., 2015; Windle et al., 2018). For example, a pilot study implemented on a university campus in Pennsylvania evaluated the feasibility and efficacy of a sleep health promotion programme for college students (Levenson et al., 2016). Intervention components included email feedback on sleep diary entries and group presentations (Levenson et al., 2016). Overall, the results of this study indicated that this programme was feasible to implement on campus, and favourably altered sleep behaviours and knowledge (Levenson et al., 2016). Future interventions should continue this work on college campuses to promote healthy sleeping behaviours in the context of ACEs to potentially reduce the negative effects of ACEs on overall health and well-being.

Researchers and practitioners have called for early detection of ACEs, early intervention, and the development of programmes tailored to ACE-exposed individuals. As trauma-informed clinical practice evolves, practitioners and researchers have struggled to identify best practices in screening methods. Doing so will require the use of appropriate tools that currently need further validation. Future work should also attempt to find the most effective methods for intervening early in order to mitigate the negative effect of trauma on health and to stop the progression of negative health outcomes by identifying the individual, social and cultural assets that can be leveraged to promote resilience.

CONFLICT OF INTEREST

AUTHOR CONTRIBUTIONS

Larisa Albers conceived of the present study idea, developed the foundational theory and performed computations. Timothy J. Grigsby participated in original data collection, provided study data and verified analytical methods. Stephanie M. Benjamin supported the development of the theoretical framework and verified analytical methods. Christopher J. Rogers contributed to the analytic plan for the manuscript and supported computational activities. Jennifer B. Unger contributed to overall revisions of the manuscript and implications of findings. Myriam Forster participated in original data collection, provided study data, verified analytical methods and supervised the findings of this work. All authors discussed the results and significantly contributed to the final manuscript.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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