Changes in sleep quality and levels of psychological distress during the adaptation to university

John-Henderson, Neha; Williams, Sarah; Brindle, Ryan C.; Ginty, Annie T.

DOI:
10.1111/bjop.12314

Changes in sleep quality and levels of psychological distress during the adaptation to university: the role of childhood adversity

Neha A. John-Henderson[a*], Sarah E. Williams[b], Ryan C. Brindle[c], and Annie T. Ginty[d]

[a] Montana State University

[b] University of Birmingham

[c] University of Pittsburgh

[b] Baylor University

* Corresponding Author

Abstract

Stress-related sleep disturbances are common, and poor sleep quality can negatively affect health. Previous work indicates that early life adversity is associated with compromised sleep quality later in life, but it is unknown whether it predicts greater declines in sleep quality during stressful life transitions. We propose and test a conceptual model whereby individuals who reported experiencing greater levels of child maltreatment would experience greater psychological distress during a stressful life transition, which in turn would contribute to greater declines in sleep quality, relative to their quality of sleep before the stressful transition. Controlling for potential confounding variables (e.g., age, gender), structural equation modelling demonstrated that psychological distress experienced during a stressful transition (i.e. beginning life at university) mediated the relationship between childhood emotional neglect and changes in sleep quality. The hypothesized model demonstrated a good overall fit to the data, χ^2 (15) = 17.69, p = .279, CFI = .99, TLI = .97, SRMR = .04, RMSEA = .04 (90% CI < 0.001-0.09). Emotional neglect (β = .22) was positively associated with psychological distress which in turn was positively associated with poor sleep quality (β = .31) during a stressful transition. Future research should aim to understand the specific stressors in the university environment that are most challenging to individuals who faced early life emotional maltreatment. These findings will help inform interventions to facilitate adaptation to a new environment and improve sleep quality for these university students.

Keywords: childhood emotional maltreatment; sleep quality; psychological distress; university students

Changes in sleep quality and levels of psychological distress during the adaptation to university: the role of childhood adversity.

Accumulating evidence suggests that stress, including significant life events, is a risk factor for poor sleep (Chapman et al., 2011; Strine & Chapman, 2005). Further, adversity during one developmental period can affect sleep quality across the life-span. Child maltreatment, is defined broadly as acts of commission (abuse) or omission (neglect) perpetrated by a caregiver that results in harm or threat of harm to a child (Leeb, Pauloi, Melanson, Simon & Arias, 2008). Maltreatment in childhood associates with increased sleep disturbances and reduced quality of sleep in adolescence and adulthood (Baiden, Fallon, den Dunnen, Boateng, 2015; Kajeepeta, Gelaye, Jackson, Williams, 2015; Koskenvuo, Hublin, Partinen, Paunio & Koskenvuo, 2010; Mcphie, Weiss & Wekerle, 2014; Ramswah, Ancoli-Israel, Sullivan, Hitchcock, Stein, 2011; Wang, Raffeld, Slopen, Hale & Dunn, 2016).

Individuals who experience maltreatment during childhood are at an increased risk for psychological distress in adulthood (Edwards, Probst, Rodenhier-Stampfli, Gidycz & Tansill, 2014; Min, Farkas, Minnes, & Singer, 2007). Psychological distress refers to an emotional state experienced in response to stress that is characterized by symptoms of depression and anxiety (Barlow & Durand, 2005), and a perceived inability to cope (Ridner, 2004). Given that psychological distress is known to negatively impact sleep quality (Almojali, Almalki, Alothman, Masuadi & Alaqeel, 2017; Cunningham, Wheaton, & Giles, 2015; Seun-Fadipe & Mosaku, 2017), it is possible that higher levels of psychological distress may shape sleep quality in a negative way for individuals who experience child maltreatment. In line with this suggestion, previous research found that psychological distress is a mediator between childhood maltreatment and sleep quality in adolescence (McPhie, Weiss & Wekerle, 2014). However, it

remains unclear if childhood maltreatment is also associated with changes in sleep quality during stressful transitions or life events and specifically whether psychological distress experienced during this life event mediates this relationship.

One such life transition with the potential to elicit both psychological distress and changes in sleep quality is beginning life at a university. This is a time of tremendous change and adaptation (Bliming & Miltenberg, 1981; Raymore, Barber & Eccles, 2001). First year university students are faced with navigating a new environment, expectations, relationships and challenges (Arnett, 2000). This transition is likely to give rise to heightened psychological distress for most students (Saleh, Camart & Romo, 2017). Indeed, psychological distress among university students is a major health concern, with more than 50% of university students reporting depressive symptoms shortly after beginning university (Furr, Westefeld, McConnell. & Jenkins, 2001). Prior research indicates that sleep is particularly disturbed in this population, with students overwhelmingly attributing sleep disturbances to psychological distress (Lund, Reider, Whiting & Prichard, 2010). Given that individuals who experience emotional maltreatment in childhood tend to experience greater psychological distress (Braver et al., 1992; Briere & Runtz, 1988), it is possible that university students who experienced maltreatment during their childhood years will experience heightened levels of psychological distress at the start of university (Filipkowski, Heron & Smyth, 2016; Schilling, Aseltine & Gore, 2007). As a result, the quality of their sleep may suffer more compared to other university students.

Based on the existing literature documenting associations between childhood maltreatment and psychological distress, and psychological distress and sleep quality, we propose a conceptual model whereby individuals who report greater levels of child maltreatment will experience greater psychological distress during a stressful life transition. Further, we

propose that this experienced distress may contribute to greater declines in sleep quality compared to what they experienced before the stressful transition. In other words, we propose that during the stressful transition to university, greater psychological distress will mediate the negative impact that childhood maltreatment has on sleep quality. Using a longitudinal design, we tested our conceptual model by assessing childhood maltreatment (i.e., physical abuse, emotional abuse, physical neglect, emotional neglect), psychological distress experienced during a stressful life transition (i.e., the beginning of university), and sleep quality both before and during the stressful life transition. We then examined whether experiencing greater childhood maltreatment was associated with a greater change in sleep quality between final year of sixth form and first year of university[1] (i.e. greater declines in sleep quality), and whether this was mediated by greater reported psychological distress during the beginning of university. The hypothesized model is presented in Figure 1a. To determine whether our conceptual model proposed provided the best fit to the data, we further examined an alternate model (Figure 1b) which explored whether changes in sleep would serve as a better mediator in the associations between the different variables of interest.

As noted earlier a significant body of work documents cross-sectional associations between childhood maltreatment and later sleep quality (Baiden, Fallon, den Dunnen, Boateng, 2015; Counts, Grubin & John-Henderson, 2018; Kajeepeta, Gelaye, Jackson, Williams, 2015; Koskenvuo, Hublin, Partinen, Paunio & Koskenvuo, 2010; Mcphie, Weiss & Wekerle, 2014; Wang, Raffeld, Slopen, Hale & Dunn, 2016). In one prospective study, agency substantiated reports of childhood maltreatment was associated with worse sleep quality at a 21-year follow-up

[1] Final year of sixth form is the American equivalent of senior year of high school. First year of university is the American equivalent of first year of their undergraduate degree (first year of college).

(Abajobir, Kisley, Williams, Strathearn, Najman, 2017). The current investigation extends this body of work by using a longitudinal approach to investigate whether childhood maltreatment predicts *changes* in sleep quality during a stressful life transition – the start of university life.

Methods

Final year sixth form students ($N = 185$) were recruited from schools in close proximity to the University of Birmingham. Exclusion criteria included self-reported history of cardiovascular disease and not intending to enroll in university the next academic year. The cardiovascular exclusion criteria were implemented for the main aim of the project examining cardiovascular responses to acute laboratory stress (e.g., Brindle et al., 2016). The current manuscript are secondary analyses of the dataset. At the time of recruitment, participants were informed that the study consisted of a laboratory visit (phase 1) during their final year of sixth form and a follow-up online questionnaire assessment (phase 2) approximately 6 months into their first year of university. This time was selected since it was prior to their end of year exams. Participants were asked to sign up for the study only if they were willing to commit to participation in both phases. The study information and consent form included information about the follow-up portion of the study. All participants and legal guardians, if participants were under 18 years old, gave informed consent. Participants under 18 years old provided assent. Participants received £10 for study participation. The study was approved by the University of Birmingham Ethics committee.

Measures

In phase 1, participants completed questionnaires in a quiet room upon arriving at the laboratory.

Childhood trauma. The 28-item version of the Childhood Trauma Questionnaire (CTQ; Bernstein & Fink, 1998) was used to assess childhood trauma at Phase 2. The CTQ is a self-report measure that encompasses experiences from 0-17 years of age. Here we used 4 of the subscales measuring the following types of childhood maltreatment: emotional abuse (e.g., people in my family said hurtful or insulting things to me), physical abuse (e.g., people in my family hit me so hard that it left me with bruises or marks), emotional neglect (e.g., I felt loved; reverse scored), and physical neglect (e.g., I didn't have enough to eat). Each of the subscales has 5 items and a 5-point frequency of occurrence scale is used: (1) never true, (2) rarely true, (3) sometimes true, (4) often true, and (5) very often true. The possible range for each subscale is 5-25. The Cronbach's alpha for these subscales in this sample were all above 0.70. The CTQ is used widely as a retrospective measure of childhood trauma in college students (Demirci, Yildiz, Selvi, & Akpinar, 2016; Paivio & Cramer, 2004).

Sleep. The 19-item Pittsburgh Sleep Quality Index (PSQI) was administered (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). The PSQI assesses sleep quality disturbances during the previous month. The scale consists of 19 items which are used to derive a total of seven component scores: sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, sleep medication and daytime dysfunction. The seven component scores are summed to produce a global PSQI score. Global PSQI scores (possible range of 0-21; higher scores represent more severe sleep complaints) were computed for each participant. Participants completed the PSQI at Phase 1 and at Phase 2, providing a global measure of sleep quality before beginning university and during their first year as a university student. While this measure does not consistently associate with polysomnography measures of sleep (Buysse et al., 2008), a recent investigation found that the PSQI associates with some objective measures of sleep

quality including sleep efficiency (Kaplan et al., 2017). Cronbach' alpha for this measure was 0.70 (time 1 and time 2). This measure is commonly used as a measure of global sleep quality among college students (Kenney, Labrie, Hummer & Pham, 2012; Vargas, Flores, Robles, 2014).

Depression and anxiety. Depression and anxiety were measured at Phase 1 and Phase 2 using the Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983). These scales were included given that depressive symptoms and levels of anxiety are likely affected by the transition to university. The HADS includes 14 items, 7 measuring depression and 7 measuring anxiety. We calculated a total HADS score that reflects both depression and anxiety (range: 0-42, Cronbach's alpha for the anxiety and depression subscale were above 0.70 at time 1 and time 2. This measure has been used previously as a measure of depression and anxiety in college students (Choi, Wong & Fong, 2017; Matsudaira & Kitamura, 2006).

Perceived Stress Scale. The 10-item Perceived Stress Scale (PSS-10) was used to assess the degree to which situations in life are perceived as stressful (Cohen, Kamarck, & Mermelstein, 1983). This scale correlates with life-events scores, depressive and physical symptomatology, social anxiety and utilization of health services. Participants completed the PSS-10 at Phase 1 and at Phase 2, providing a measure of perceived stress during their final year of sixth form and six months into their first year as a university student (range: 0-40, Cronbach's alpha was .71 at time 1 and time 2. This scale has been used widely as a measure if perceived psychological stress in college samples (Choi, Wong & Fong, 2017; Pettit & Debarr, 2011; Stoliker & Lafreniere, 2015).

Statistical Analyses

Analyses were conducted using SPSS version 22 (IBM Corp, USA) and AMOS 22 (IBM Corp, USA). A composite score of psychological distress was created for Time 2 comprised of the HADS total score and PSS score since these measures were highly correlated ($r = 0.73$) and based on previous research that describes psychological distress as a composite of stress, depressive symptoms and anxiety (DiPietro, Novak, Costigan, Atella, & Reusing, 2006). The HADS and PSS were independently standardized. The two standardized scores were then summed and labelled as "psychological distress." The HADS and PSS were independently standardized. The two standardized scores were then summed and labelled as "psychological distress."

The hypothesized model was then examined using path analyses. Goodness of fit was tested using the chi-squared likelihood statistic ratio (χ^2; Joreskog & Sorbom, 1993). Since a nonsignificant value is rarely obtained in practice, additional fit indices were also employed. Based on Hu and Bentler's (1999) recommendations, the Standardized Root Mean Square Residual (SRMR; Bentler, 1995) and Root Mean Square Error of Approximation (RMSEA) indicated absolute fit (values of $\leq .08$ and .06 respectively representing an adequate fit; Hu & Bentler, 1999). Additionally, the Tucker Lewis Index (TLI) and Comparative Fit Index (CFI) were employed to reflect incremental fit (values $> .90$ and $> .95$ indicating an adequate and excellent model fit, respectively; Hu & Bentler, 1999).

Controlling for age, gender, and sleep quality at time 1, we examined whether psychological distress at time 2, mediated the relationship between our four childhood maltreatment predictors (i.e., physical abuse, emotional abuse, physical neglect, and emotional neglect) and sleep quality at time 2. Mediation analyses was conducted following Hayes' (2013) recommendation of testing for indirect effects. Standardized regressions and 90% confidence

intervals, generated from bootstrapping of 2000 samples were reported for all significant indirect effects.

Next, the hypothesized model was compared to an alternate model. The alternative model (Figure 1b) examined whether sleep quality at time 2 mediated the relationship between childhood maltreatment and psychological distress. The same fit indices as those used when testing the hypothesized model were employed for the alternative model.

Results

Sample Characteristics

Participants were between 17 years and 19 years of age at phase 1 (M = 18.03, SD = 0.43), 81% female, and 52% Caucasian. One hundred and thirty-seven of the 185 participants completed the follow up (74.1%). Full data was available for 132 participants (84% female). There were no significant differences in sleep quality, anxiety, depression, or perceived stress at phase 1 between those who did and did not complete the follow-up (p's > .05).

Means and standard deviations of childhood emotional abuse, childhood physical abuse, childhood emotional neglect, childhood physical neglect, depression and anxiety, psychological distress, global sleep quality at phase 1, global sleep quality at phase 2, and change in global sleep quality are reported in Table 1 for participants who completed follow-up. According to the scoring for the Hospital Anxiety and Depression Scale, thirty percent of participants were above the clinical cutoff for anxiety at time 1 and 3.2% were above the clinical cutoff for depression. According to the PSQI cutoffs for poor sleep quality (a score of 5 or more), 51.1% of students had poor sleep quality at time 1 (a score of 5 or more), and 61.8% of students had poor sleep quality at time 2. Table 2 lists bivariate correlations between main variables of interest.

Hypothesized Model

The hypothesized model (Figure 1a) was tested by inserting regressions paths from physical abuse, emotional abuse, physical neglect, and emotional neglect to psychological distress, and from psychological distress to change in sleep quality. Direct regression paths were also included from physical abuse, emotional abuse, physical neglect, and emotional neglect to change in sleep quality to see whether any evident association was indirect through psychological distress. The model revealed a good fit to the data (see Table 3). However, regression paths to psychological distress from physical abuse (p = .689), emotional abuse (p = .466), and physical neglect (p = .817) were non-significant, as were regression paths to sleep quality from all predictors (physical abuse: p = .115; emotional abuse: p = .077; physical neglect: p = .885; emotional neglect: p = .100). As shown in Figure 1a, individuals who experienced greater emotional neglect experienced greater psychological distress which in turn was associated with a reduction in sleep quality. Although emotional neglect was not directly associated with change in sleep quality, there was an indirect pathway via psychological distress (β = .15, p = .027, CI = .017 – .153). This suggests the relationship between childhood emotional neglect and change in sleep quality during the transition to university life is mediated by psychological distress.

Alternate Model

An alternate model was tested to examine whether sleep at time 2 mediated the relationship between childhood maltreatment and psychological distress. As highlighted in Figure 1b, regression paths were included from the four measures of childhood maltreatment to psychological distress and sleep at time 2. A final regression path was included from sleep at time 2 to psychological distress. Results of the analysis provided the same fit to the data the same fit to the data (See Table 3 and Figure 1b). However, regression weights were all non-significant

except the paths from sleep quality at time 2 ($p < .001$) and emotional neglect ($p = .022$) to psychological distress, and from sleep quality at time 1 to sleep quality at time 2 ($p < .001$). Consequently, sleep at time 2 does not appear to mediate the relationship between childhood maltreatment and psychological distress.

Discussion

The transition to university is a time marked by high levels of psychological distress (Saleh, Camart & Romo, 2017). Students are often living independently from their parents or caregivers for the first time, are navigating new social relationships, and facing new academic challenges. Further, new university students encounter situations where they are required to make decisions about risky health behaviors (Rivers, Brackett, Salovey, Omori & Sickler, 2013; Decamps, Le Nair & Hagger, 2013). While the large majority of university students report sleep disturbances (Prichard & Cunningham, 2012; Lee, Wuertz, Rogers & Chen, 2013), previous work indicates that university students who have experienced trauma earlier in life struggle more with the adjustment to university compared to students with no history of trauma (Banyard & Cantor, 2004).

Here, utilizing a longitudinal design, we tested our conceptual model of whether unique forms of childhood maltreatment (emotional abuse, emotional neglect, physical abuse, and physical neglect) predict the degree to which sleep quality is affected by a time of transition marked by high levels of stress, specifically the transition from the final year of sixth form to the beginning of university. We also tested whether any observed associations were mediated by psychological distress experienced during the transition. Sleep quality data were collected while participants were still in sixth form, and once again approximately 6 months into their first year of university. Given the consistent relationship between psychological distress and sleep quality

(Caldwell & Redeker, 2009; Mystakidou, Parpa, Tsilika, Galanos & Vlahos, 2009; Scott, Paterson & Happel, 2014), particularly for university students (Lee et al., 2013; Prichard & Cunningham, 2012), we hypothesized that any observed relationships between childhood maltreatment and changes in global sleep quality would be mediated by levels of psychological distress experienced in the first year of university.

In line with our proposed conceptual model, we found that childhood maltreatment, in the form of self-report of emotional neglect, predicted greater declines in sleep quality from the final year in sixth form to the beginning of university. Childhood emotional neglect was also positively associated with psychological distress in the first year of university. Mediation analyses confirmed our hypothesis that any associations between childhood maltreatment and changes in sleep quality during a stressful transition would be mediated through experiencing greater levels of psychological distress during this transition. Consequently, individuals that experience emotional neglect in childhood tend to report feeling greater levels of distress during a stressful transition and it is this psychological distress that in turn is associated with poorer sleep quality compared to their quality of sleep before the start of university.

The results suggest that individuals with history of emotional neglect have a specific vulnerability to stressors that impact their levels of distress and quality of sleep. Our model suggest that psychological distress experienced at the start of university may explain the relationship between childhood emotional neglect and changes in sleep quality during the transition to university. Childhood emotional abuse, physical abuse and physical neglect were not associated with psychological distress or changes in sleep quality when accounting for the association between childhood emotional neglect and these outcomes. This is in line with previous research indicating that unique forms of childhood maltreatment differentially affect

health behaviors (Rodgers, Lang, Laffaye, Satz, Dresselhaus, Stein, 2004) and separate work highlighting the unique contribution of emotional neglect in childhood as a predictor of outcomes later in life (Lipschitz et al., 1999). Historically, focus has been placed on sexual abuse and physical abuse as predictors of problematic health behaviors later in life, while emotional neglect has received much less attention. However, emotional neglect represents over half of the maltreatment cases reported to child protective services in the United States (U.S. Dept of Health, 1988). Our findings support the notion that emotional neglect in childhood can have independent and important consequences on health-relevant outcomes across the lifespan.

Limitations

There are important limitations of this research. First, the Childhood Trauma Questionnaire (CTQ) was only measured at Phase 2, which may have inflated corresponding measures of distress and sleep due to common time measurement variance. However, previous research has demonstrated the CTQ has good test-retest reliability in undergraduate students (Paivio & Cramer, 2004; Raes & Hermans, 2008). Second, our measure of sleep is based on self-report, and as such could similarly be affected by current mood or affect. The PSQI was chosen due to the longitudinal nature of the study and the students attending universities throughout the United Kingdom and the world, making it difficult to gather meaningful follow-up objective sleep data. Although self-report measures of sleep have potential limitations, we were concerned with capturing measures of habitual sleep, of which polysomnography cannot capture. Also, as sleep-related epidemiological work is based, to a large extent, on self-reported sleep, using the PSQI allowed us to more readily interpret our results as a function of mental and physical health outcomes. The PSQI measure of global sleep quality used in this study has previously been associated with measures of psychological distress and disease outcomes. (Buysse et al., 2008;

Casement, Harrington, Miller & Resick, 2012; Jennings et al., 2007). Finally, while PSQI measure of sleep quality is not significantly associated with polysomnography, an objective measures of sleep architecture (Buysse et al., 2008), recent research indicates that the PSQI is significantly related to sleep efficiency, total sleep time, and sleep stage transitions (Kaplan et al., 2017). Third, it is unknown if students lived at home, with another relative, in independent off-campus housing, or in on-campus housing. Their primary living arrangements may have influenced the results of this study. However, a study examining psychological distress in over 7,000 undergraduates from 16 different universities demonstrated that living arrangements did not influence psychological distress levels among undergraduate students (Adlaf et al., 2001). Nevertheless, future research should measure if students are living on-campus or at home. Lastly, the study is correlational and cannot determine definite causality (Christenfeld, Sloan, Carroll, & Greenland, 2004). However, the use of structural equation modeling ensured that the conceptual model hypothesized could be directly compared to other potential models. The significant indirect effects of emotional maltreatment on changes in sleep quality through psychological distress, and the goodness of fit statistics confirmed that the hypothesized model provided an excellent fit to the data, whereas alternative models afforded a poorer fit.

The differential susceptibility to the environment theory (Belsky & Pluess, 2009) posits that some individuals are more susceptible to *both* the negative (risk-promoting) and positive (development-enhancing) features of the environment. In line with this theory, it is possible that while the sleep quality of university students who experience early life emotional neglect may be more affected by the transition to university, they may be similarly sensitive to positive qualities or experiences in the university environment such as enhanced social support or feeling more integrated into a social network. This possibility needs to be examined more closely. Future

studies should contribute to a clearer understanding of the stressors or experiences in the initial stages of university that are most challenging or rewarding to individuals who have experienced early life emotional neglect. This knowledge should then inform efforts to reduce psychological distress, promote positive affect, and improve sleep quality for these students in their new university environment.

In conclusion, individuals who experienced higher levels of emotional neglect displayed greater declines in sleep quality during the transition from their year in sixth form to their first six months of university. Specifically, this association operated through greater levels of psychological distress experienced during their first six months of university. The current study adds to a growing literature trying to understand the antecedents of poor sleep or declining sleep quality and highlights the importance of psychological distress as a pathway through which childhood maltreatment may negatively affect sleep quality during periods of stress. Compromised sleep quality could have negative implications for physical and mental health (e.g., Strine & Chapman, 2005), social relationships (Friedman et al., 2005) and academic performance in university (Gilbert & Weaver, 2010). Future research should examine these relationships in the context of other stressful life transitions (e.g., leaving university, having children). Finally, it will be important to determine whether similar relationships exist between childhood emotional neglect and objective measures of changes in sleep quality during stressful transitions.

References

Abajobir A. A., Kisley, S., Williams, G., Strathearn L., Najman, J. M. (2017). Childhood maltreatment and adulthood poor sleep quality: a longitudinal study. *Internal Medicine Journal, 47,* 879-888.

Adlaf, E.M., Gliksman, L., Demers, A., & Newtown-Taylor, B. (2001). The prevalence of elevated psychological distress among Canadian undergraduates: findings from the 1998 Canadian Campus Survey. *Journal of American College Health, 2,* 67-72.

Almojali ,A. I., Almalki, S. A., Alothman, A. S., Masuadi, E. M., Alaqeel, M. K. (2017). The prevalence and association of stress with sleep quality among medical students. *Journal of Epidemiology and Global Health,* 7, *169-174.* https://doi.org/ 10.1016/j.jegh.2017.04.005

Arnett, J. J. (2000). Emerging adulthood. A theory of development from the late teens through the twenties. *American Psychologist, 55,* 469-480.

Baiden, P., Fallon, B., den Dunnen, W., Boateng, G. O. (2015). The enduring effects of early-childhood adversities and troubled sleep among Canadian Adults: a population-based study. *Sleep Medicine, 16,* 760-767.

Banyard, V. L., & Cantor, E. N. (2004). Adjustment to university among trauma survivors: An exploratory study of resilience. *Journal of University Student Development, 45,* 207-221.

Barlow, D. H., & Durand, V. M. (2005). Abnormal Psychology: An integrative approach. (4th Edition). Belmont, CA: Wadsworth Press.

Bassett, S. M., Lupis, S.B., Gianferante, D., Rohleder, N., & Wolf, J.M. (2015). Sleep quality but not sleep quantity effects on cortisol responses to acute psychosocial stress. *Stress,* 18: 638-644. https://doi.org/10.3109/10253890.2015.1087503

Belsky J., & Pluess, M. (2009). Beyond Diathesis stress: Differential susceptibility to environmental influence. *Psychlogical Bulletin, 135,* 885-908. https://doi.org/10.1037/a0017376

Bentler, P.M. (1995). *EQS structural equations program manual.* . Encino, CA: Multivariate Software Inc.

Bernstein, D. P., & Fink L. (1998). Childhood Trauma Questionnaire: A retrospective self-report manual. San Antonio TX: The Psychological Corporation

Bliming, G. S., & Miltenberg, L.J. (1981). The resident assistant: Working with university students in residence halls. Dubque, IA. Kendall/Hunt.

Brindle, R. C., Ginty, A. T., Phillips, A. C., Fisher, J. P., McIntyre, D., & Carroll D. (2016). Heart rate complexity: A novel approach to assessing cardiac stress reactivity. *Psychophysiology, 53,* 465-472. https://doi.org/10.1111/psyp.12576

Buysse, D.J., Hall, M.L., Strollo, P.J., Kamarck, T.W., Owens, J., Lee, Laisze, Reis, S.E., & Matthews, K.A. (2008). Relationship between the Pittsburgh Sleep Quality Index (PSQI), Epworth Sleepiness Scale (ESS), and clinical/polysomnographic measures in a community sample. *Journal of Clinical Sleep Medicine, 4,* 563-571.

Buysse, D. J., Reynolds, C. F, Monk, T. H., Berman, S. R, & Kupfer, D. J. (1989). The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. *Psychiatry Research, 28,* 193-213.

Caldwell, B. A., & Redeker, N. S. (2009). Sleep patterns and psychological distress in women living in an inner city. *Research in Nursing and Health, 32,* 177-190. https://doi.org/10.1002/nur.20308

Casement, M. D., Harrington, K. M., Miller, M.W., & Resick, P.A. (2012). Associations between Pittsburgh sleep quality Index factors and health outcomes in women with posttraumatic stress disorder. *Sleep Medicine, 13,* 752-758. https://doi.org/10.1016/j.sleep.2012.02.014

Chapman, D. P., Wheaton, A. G., Anda, R. F., Croft, J. B., Edwards, V. J., Liu, Y., . . . Perry, G. S. (2011). Adverse childhood experiences and sleep disturbances in adults, *Sleep Medicine. 12,* 773-779. https://doi.org/10.1016/j.sleep.2011.03.013

Choi, E. P. H., Wong, J. Y. H., & Fong, D. Y. T. (2017). Mental health and health-related quality of life of Chinese college students who were the victims of dating violence. *Quality of Life Research, 26,* 945-957. https://doi.org/10.1007/s11136-016-1413-4

Christenfeld, N. J., Sloan, R. P., Carroll, D., & Greenland, S. (2004). Risk factors, confounding, and the illusion of statistical control. *Psychosomatic Medicine, 66,* 868-875.

Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2003). Applied multiple regression/correlation analysis for the behavioral sciences (3rd ed.). Mahwah, NJ: Lawrence.

Cohen, S., Kamarck, T. W, & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior, 24,* 385-396.

Counts, C.J., Grubin, F.C., & John-Henderson, N.A. (In press). Childhood socioeconomic status and risk in early family environments: predictors of global sleep quality in college students. *Sleep Health.* doi.org/10.1016/j.sleh.2018.02.003

Cunningham, T. J., Wheaton, A. G., & Giles, W. H. (2015). The association between psychological distress and self-reported sleep duration in a population-based sample of women and men. *Sleep Disorders,* Article ID 172064. https://doi.org/10.1155/2015/172064

Decamps, G., Le Nair, C., & Hagger, M. S. (2013). Stress, coping and addictive drug use among university students. *Psychological Health, 28,* 85-85.

Delle Femina, D., Yeager, C. A., & Lewis, D.O. (1990). Child abuse: Adolescent records vs. adult recall. *Child Abuse and Neglect, 14,* 227-231.

DiPietro, J. A., Novak, M. F. Costigan, K. A., Atella, L. D., Reusing, S. P. (2006). Maternal psychological distress during pregnancy in relation to child development at age two. *Child Development, 77,* 573-587.

Edwards, V. J., Anda, R. F., Nordenberg, D. F., Felitti, V. J., Williamson, D. F., & Wright, J. A. (2001). Bias assessment of child abuse survey: Factors affecting probability of response to a survey about childhood abuse. *Child Abuse and Neglect, 25,* 307-312.

Edwards, K. M., Probst, D. R., Rodenhier-Stampfli, K. A., Gidycz, C. A., & Tansill, E. C. (2014). Multiplicity of child maltreatment and biopsychosocial outcomes in young adulthood: The moderating role of resiliency characteristics among female survivors. *Child Maltreatment, 19,* 188-198.

Eich, E., Rachman, S., & Lopatka, C. (1990). Affect, pain and autobiographical memory. *Journal of Abnormal Psychology, 99,* 174.

Filipkowski, K. B., Heron, K. E., & Smyth, J. M. (2016). Early adverse experiences and health: The transition to university. *American Journal of Health Behavior, 40,* 717-728.

Furr, S. R., Westefeld, J. S., McConnell, G. N., & Jenkins, J. M. (2001). Suicide and depression among college students: A decade later. *Professional Psychology, Research and Practice, 32,* 97-100.

Francis, L. J., Brown, L. B., & Philipchalk, R. (1992). The development of an abbreviated form of the revised Eysenck Personality Questionnaire (EPQR-A): Its use among students in

England, Canada the U.S.A. and Australia. *Personality and Individual Differences, 13,* 443-449.

Friedman, E.M., Hayney, M.S., Love, G.D., Urry, H.L., Rosenkranz, M.A., Davidson, R.J., Singer, B.H., & Ryff, C.D. (2005). Social relationships, sleep quality, and interleukin-6 in aging women. *Proceedings of the National Academy of Sciences of the United States of America, 51,* 18757-18762.

Gilbert, S.P. & Weaver, C.C. (2010). University students: A wake-up call for university psychologists. *Journal of University Student Psychotherapy, 24,* 295-306.

Hayes, A.F. (2013). *Introduction to mediation, moderation and conditional process analysis.* New York: The Guilford Press.Hu, L.T., & Bentler, P.M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modelling, 6,* 1-55.

Jennings, J.R., Muldoon, M.F., Hall, M., Buysse, D.J., & Manuck, S.B. (2007). Self-reported sleep quality is associated with metabolic syndrome. *Sleep, 30,* 219-223.

Joreskog, K., & Sorbom, D. (1993). *LISREL 8: Structural Equation Modeling with the SIMPLIS Command Language.* . Chicago, IL: Scientific Software International Inc.

Kajeepeta, S., Gelaye, B., Jackson, C. L., & Williams, M. A. (2015). Adverse childhood experiences are associated with adult sleep disorders: a systematic review. *Sleep Medicine, 16:* 320-330. https://doi.org/10.1016/j.sleep.2014.12.013

Kaplan, K. A., Hirsman, J., Hernandez, B., Stefanick, M. L., Hoffman, A. R., Redline, S., … Zeitzer, J. M. (2017). When a golden standard isn't so golden: Lack of prediction of subjective sleep quality from sleep polysomnography. *Biological Psychology, 123,* 37-46. https://doi.org/10.1016/j.biopsycho.2016.11.010

Kenney, S. R., Labrie, J. W., Hummer, J. F., Pham, A. T. (2012). Global sleep quality as a moderator of alcohol consumption and consequences in college students. *Addictive Behaviors, 37(4), 507-512.* https://doi.org/10.1016/j.addbeh.2012.01.006

Koskenvuo, K., Hublin, C., Partinen, M., Paunio, T., Koskenvuo, M. (2010). Childhood adversities and quality of sleep in adulthood: a population-based study of 26,000 Finns. *Sleep Medicine, 11,* 17–22. https://doi.org/10.1016/j.sleep.2009.03.010

Lee, S., Wuertz, C., Rogers, R., & Chen, Y. (2013). Stress and sleep disturbances in female university students. *American Journal of Health and Behavior,* 37, 851-858. https://doi.org/10.5993/AJHB.37.6.14

Leeb, R. T., Paulozzi L., Melanson, C., Simon, T., & Arias, I. (2008). Child maltreatment surveillance: Uniform definitions for public health and recommended data elements, version 1.0 Atlanta (GA): Centers for Disease Control and Prevention, National Center for Injury Prevention and Control.

Lipschitz, D. S., Winegar, R. K., Nicolaou, A. L., Hartnick, E., Wolfson, M., Southwick, S. M. (1999). Perceived abuse nad neglect as risk factors for suicidal behavior in adolescent inpatients. *Journal of Nervous and Mental Disease, 187,* 132-139.

Lund, H. G., Reider, B.D., Whiting, A. B., & Prichard, J. R. (2010). Sleep patterns and predictors of disturbed sleep in a large population of university students. *Journal of Adolescent Health, 46,* 124-32. https://doi.org/10.1016/j.jadohealth.2009.06.016

Matsudaira, T., & Kitamura, T. (2006). Personality traits as risk factors of depression and anxiety among Japanese students. *Journal of Clinical Psychology, 62,* 97-109.

Mcphie, M., Weiss, J.A., & Wekerle, C. (2014). Psychological distress as a mediator of the relationship between childhood maltreatment and sleep quality in adolescence: Results

from the maltreatment and adolescent pathways (MAP) longitudinal study. *Child abuse and neglect*, 38, 2044-2052. https://doi.org/10.1016/j.chiabu.2014.07.009

Mystakidou, K., Parpa, E., Tsilika, E., Galanos, A., & Vlahos, L. (2009). Does quality of sleep mediate the effect of depression on hopelessness? *International Journal of Psychology, 44*, 282-289. https://doi.org/10.1080/00207590802194226

Paivio, S.C. & Cramer, K.M. (2004). Factor structure and reliability of the childhood trauma questionnaire in a Canadian undergraduate sample. *Child Abuse & Neglect, 28*, 889-904.

Pettit, M. L., & Debarr, K. A. (2011). Perceived stress, energy drink consumption and academic performance among college students. *Journal of American College Health, 59*, 335-341.

Preacher, K. J., & Hayes, A. F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavioral Research Methods, Instruments & Computers, 36*, 717-731.

Prichard, J. R., & Cunningham, J. (2012). Academic stress, social trauma and disturbed sleep in a large population of university students: interconnections and health implications. *Journal of Adolescent Health, 50*, 32-32.

Raes, F. & Hermans, D. (2008). On the mediating role of subtypes of rumination in the relationship between childhood emotional abuse and depressed mood: brooding versus reflection. Depression & Anxiety, 25, 1067-1070. https://doi.org/10.1002/da.20447

Ramswah, H. J., Ancoli-Israel, S., Sullivan, S. G., & Hitchcock, C. A. (2011). Neuroticism mediates the relationship between childhood adversity and sleep quality. *Behavioral Sleep Medicine, 9*, 130-143.

Ridner, S. H. (2004). Psychological distress: A concept analysis. *Journal of Advanced Nursing, 45*, 536-545.

Rivers, S., Bertoli, M. C., Brackett, M. A., Salovey, P., Omori, M., & Sickler, C. (2013). Emotion skills as a protective factor for risky behaviors among university students. *Journal of University Student Development, 54*, 172-183.

Rodgers, C. S., Lang, A. J., Laffaye, C., Satz, L. E., Dresselhaus, T. R., Stein, M. B. (2004). The impact of individual forms of childhood maltreatment on health behavior. *Child Abuse and Neglect, 28*, 575-586.

Saleh, D., Camart, N., Romo, L. (2017). Predictors of stress in college students. *Frontiers in Psychology, 8:* 19

Schilling, E. A., Aseltine, R. H., & Gore, S. (2007). Adverse childhood experiences and mental health in young adults: a longitudinal survey. *BMC Public Health, 7*, 30.

Scott D., Paterson, J.L., & Happel, B. (2014). Poor sleep quality in Australian adults with comorbid psychological distress and physical illness. *Behavioral Sleep Medicine, 12*, 1-11. https://doi.org/10.1080/15402002.2013.819469

Seun-Fadipe, C. T., & Mosaku K, S. (2017). Sleep quality and psychological distress among undergraduate students of a Nigerian University. *Sleep Health, 3*, 190-194. https://doi.org/10.1016/j.sleh.2017.02.004

Stoliker, B. E., & Lafreniere, K. D. (2015). The influence of perceived stress, loneliness and learning burnout on university students' educational experience. *College Student Journal, 49, 146.*

Strine, T. W., & Chapman, D. P. (2005). Associations of frequent sleep insufficiency with health-related quality of life and health behaviors. *Sleep Medicine, 6,* 23-7.

U.S. Department of Health, 1988.

Vargas, P. A., Flores, M., Robles, E. (2014). Sleep quality and body mass index in college

students: The role of sleep disturbances. *Journal of American College Health, 62,* 534-541.

Williams, L.M. (1995). Recovered memories of abuse in women with document child sexual victimization histories. *Journal of Trauma and Stress, 8,* 649-673.

Zigmond, A. S., & Snaith, R. P. (1983). The hospital anxiety and depression scale. *Acta Psychiatrica Scandinavia, 67,* 361-370.

Table 1
Descriptive Statistics

	Range	Mean	SD
Age in years (Phase 1)	17.02-19.47	18.00	0.42
Childhood Physical Abuse	5-25	6.17	2.91
Childhood Emotional abuse	5-25	8.59	3.73
Childhood Physical Neglect	5-25	8.25	2.37
Childhood Emotional Neglect	5-25	9.02	4.01
Depression and Anxiety (Phase 1)	0-35	13.70	6.03
Depression and Anxiety (Phase 2)	0-35	12.75	7.40
Perceived Stress (Phase 1)	3-38	20.49	6.34
Perceived Stress (Phase 2)	3-38	18.71	6.79
Global Sleep Quality (Phase 1)	0-14	6.05	2.85
Global Sleep Quality (Phase 2)	0-14	6.39	3.05

Note. Change in Sleep Quality (Time 2 – Time 1)
Note. All means represent scores on respective questionnaires, not standardized scores.

Table 2
Bivariate Correlations Between Main Variables in the Proposed Model

	1	2	3	4	5	6
1. Emotional neglect						
2. Physical neglect	.38***					
3. Emotional abuse	.51***	.37***				
4. Physical abuse	.16	.33***	.68***			
5. Psychological distress	.28**	.15	.24**	.14		
6. Sleep quality (time 1)	.08	.06	.02	.05	.22**	
7. Sleep quality (time 2)	.35***	.14	.25**	.07	.45***	.44**

Note. *p <.05, **p<.01, ***p<.001.

Table 3
Model Fit Indices for the Hypothesized Model and Alternative Model

	χ^2	*df*	*p*	CFI	TLI	SRMR	RMSEA (90% CI)
Hypothesized model	17.69	15	.279	.99	.97	.04	.04 (<.001 – .094)
Alternate model	17.69	15	.279	.99	.97	.04	.04 (<.001 – .094)

Figure 1.

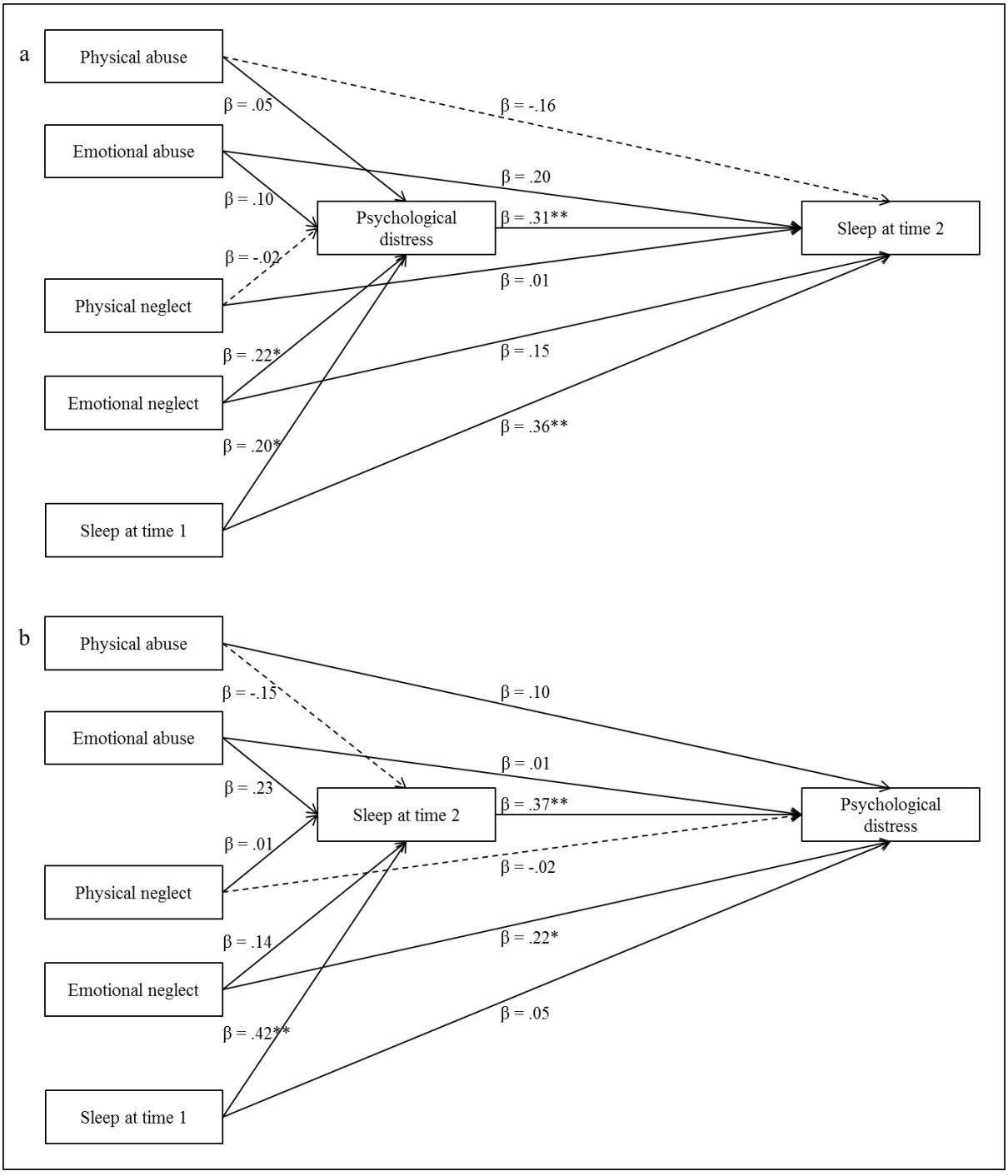
a
Physical abuse
Emotional abuse
Physical neglect
Emotional neglect
Sleep at time 1
Psychological distress
Sleep at time 2
β = .05
β = .10
β = -.02
β = .22*
β = .20*
β = -.16
β = .20
β = .31**
β = .01
β = .15
β = .36**
b
Physical abuse
Emotional abuse
Physical neglect
Emotional neglect
Sleep at time 1
Sleep at time 2
Psychological distress
β = -.15
β = .23
β = .01
β = .14
β = .42**
β = .10
β = .01
β = .37**
β = -.02
β = .22*
β = .05

Figure 1. (a) Results for the hypothesized model of psychological distress mediating the relationship between physical and emotional abuse or neglect and sleep quality at time 2. (b) Results for the alternate model of sleep quality at time 2 mediating the relationship between physical and emotional abuse or neglect and psychological distress. Note: All coefficients are standardized. *p <.05, **p<.001. For visual simplicity, controlling variables age, gender and covariates between maltreatment variables are not presented but were included in all analyses. Full lines represent positive relationships and dashed lines represent negative relationships.