UCSF
UC San Francisco Previously Published Works

Title

Maternal Bonding Predicts Actigraphy-Measured Sleep Parameters in Depressed and Nondepressed Adults.

Permalink

https://escholarship.org/uc/item/1ps2r6kn

Journal

The Journal of nervous and mental disease, 208(1)

ISSN

0022-3018

Authors

Rojo-Wissar, Darlynn M
McQuaid, John R
Ancoli-Israel, Sonia
et al.

Publication Date

2020

DOI

10.1097/nmd.0000000000001071

Peer reviewed

Maternal bonding predicts actigraphy-measured sleep parameters in depressed and non-depressed adults

Darlynn M. Rojo-Wissar, MPH[1,2], **John R. McQuaid, PhD**[3,4], **Sonia Ancoli-Israel, PhD**[5], **Devan N. Gengler, BS**[2], **Patricia L. Haynes, PhD**[2]

[1]Department of Mental Health, Johns Hopkins Bloomberg School of Public Health, 624 North Broadway, Baltimore, Maryland, 21205, United States

[2]Department of Health Promotion Sciences, University of Arizona Mel and Enid Zuckerman College of Public Health, 1296 N. Martin Ave, Tucson, Arizona, 85724, United States

[3]VA San Francisco Health Care System, 4150 Clement St, San Francisco, California, 94121, United States

[4]Weill Institute of Neuroscience, University of California, San Francisco, 401 Parnassus Avenue, San Francisco, California, 94143, United States

[5]Department of Psychiatry, University of California San Diego School of Medicine, 9500 Gilman Drive 0737, La Jolla, California, 92093-0737, United States

Abstract

Associations between subjective maternal bonding recalled from the first 16 years of life and current sleep indices were investigated in a clinical sample of 34 adults with major depressive disorder and 36 normal controls (N = 70) using the self-report Parental Bonding Instrument and wrist actigraphy. Results of multiple linear regression analyses indicated that reports of maternal bonding indices were associated with several sleep indices in adulthood independent of depression status. Higher levels of maternal care were associated with greater time in bed (TIB) and total sleep time (TST). Higher levels of maternal overprotection were associated with fewer awakenings. Findings indicate that reported maternal bonding characteristics in childhood are related to objectively measured sleep characteristics in adulthood, independent of mood state.

Keywords

Parental Bonding Instrument; PBI; depression; sleep; actigraphy

INTRODUCTION

A multitude of studies have provided evidence for the importance of early life parental bonding in the prevention of major depressive disorder (Yap & Jorm, 2015; Yap, Pilkington, Ryan, & Jorm, 2014). The Parental Bonding Instrument (PBI) retrospectively assesses two

CORRESPONDING AUTHOR Darlynn M. Rojo-Wissar, MPH, Doctoral Student, Department of Mental Health, Johns Hopkins Bloomberg School of Public Health, 624 North Broadway, Hampton House, Baltimore, MD 21205, drojowi1@jhu.edu, Phone: 410-955-3910.

constructs of parental bonding as recalled by the individual in their first 16 years of life: care and overprotection. (Parker, Tupling, & Brown, 1979). The PBI was developed to quantify how parental bonding contributes to the prevalence of psychiatric disorders and other related health conditions (Parker et al., 1979). The care dimension of the PBI assesses perceived parental warmth and affection, while the overprotection dimension assesses perceived parental control and prevention of autonomy (Parker et al., 1979). Low perceived parental care and high overprotection have since been found to be independently associated with prevalent major depressive disorder in children (Stein et al., 2000), adolescents (Eun, Paksarian, He, & Merikangas, 2017), and adults (Plantes, Prusoff, Brennan, & Parker, 1988). Further, a 30-month prospective study examining the course of depression found that both lower levels of perceived care and higher levels of overprotection were associated with depression non-remission (Gotlib, Mount, Cordy, & Whiffen, 1988). Similarly, both lower levels of perceived care and higher levels of overprotection have been shown to be associated with depressive disorder recurrence (Singh, Khess, Bhattacharjee, & Singh, 2016).

Sleep disruption is also a significant risk factor for depression (Baglioni et al., 2011; Johnson, Roth, & Breslau, 2006; Perlis, Giles, Buysse, Tu, & Kupfer, 1997). Sleep behavior patterns, such as co-sleeping and bedtimes, begin in infancy and develop within a family context across the lifespan (Lee & Lemmon, 2017). Unfortunately, few studies have examined the relationship between parental bonding and sleep. To date, only one study of which we are aware has examined the relationship between retrospectively reported parental bonding during childhood (as measured by the PBI) and sleep disturbance in adulthood. In a community sample of Japanese adults, lower paternal care and higher paternal overprotection were associated with greater odds of subjectively-assessed disturbed sleep for men. For women, *maternal* overprotection was associated with greater odds of subjective disturbed sleep in adulthood (Shibata et al., 2016). After controlling for depression, these effects were attenuated but remained statistically significant. Parental bonding has been shown to be predictive of attachment styles (Wilhelm, Gillis, & Parker, 2016), which have been studied in relation to sleep. As noted by a clinical review, previous studies suggest a possible lifelong association between attachment and sleep, where secure attachment is associated with better sleep and less secure attachment is associated with worse sleep (Adams, Stoops, & Skomro, 2014). Together, these studies suggest that family processes may affect sleep both proximally and distally by establishing habitual patterns of behaviors that persist in regulating sleep into adulthood (Lee & Lemmon, 2017).

The current study seeks to add to the literature by examining the relationship between maternal parental bonding and objectively-measured sleep in a sample of depressed and non-depressed adults. This is the first study to our knowledge that has examined the relationship between parent-child bonding and sleep measured with actigraphy. Actigraphy is a valid and reliable measure of sleep/wake compared to the gold standard polysomnography in healthy adults, with the convenience of measurement in the natural environment via compact wrist-worn devices (Ancoli-Israel et al., 2003). Research on sleep and bonding is especially important because bonding/attachment is one of the primary reasons parents give for engaging in co-sleeping (Ward, 2014), a practice discouraged by the American Academy of Pediatrics based on concerns associated with infant safety and development (Moon & Task

Force on Sudden Infant Death Syndrome, 2016). Because of the strong association between depression, sleep disruption, and poor parental bonding, we hypothesized that depression may moderate the relationship between parent bonding and sleep, such that individuals with depression will have a stronger relationship between poor maternal bonding and sleep disruption as compared to individuals without depression. (See Figure 1).

METHODS

Data were collected as part of a larger study (Haynes, Mcquaid, Ancoli-Israel, & Martin, 2006), with the participants and procedure described previously.

Participants

Participants were recruited from the Veterans Affairs San Diego Healthcare System (VASDHS), San Diego State University (SDSU), and the general population via flyers, classified advertising, and email solicitations in the San Diego area between 2001–2002. Participants included 34 individuals with current, Major Depressive Disorder (MDD), without psychotic features (American Psychiatry Association, 1994) and 36 normal controls (NC) who did not meet DSM-IV criteria for any current psychiatric illness or past mood disorder. Depressed and control participants were matched by age (± 5 years) and gender.

Exclusion criteria included: participation in shift work, pregnant or less than 3–months postpartum, reported symptoms of a sleep disorder, and recent changes in medication regime (< 6 weeks). Depressed participants were excluded from study participation if they had ever been diagnosed with bipolar disorder, a psychotic disorder, or if they were currently diagnosed with a substance abuse/dependence disorder. Lastly, participants were excluded from analysis if they did not have complete data on all main variables of interest (n = 6)

Measures

Mood disorder measure—Depressed and normal control groups were diagnosed using Axis I diagnoses from the Structured Clinical Interview for the DSM-IV (SCID; Spitzer, Williams, Gibbon, & First, 1992). The SCID has adequate reliability and validity for most diagnoses and is considered the gold standard for diagnostic assessment (Shear et al., 2000; Zanarini et al., 2000). Interviewers completed a structured training program and established inter-rater reliabilities with a master's level clinician of a Kappa > .90.

Sleep-wake activity measures

<u>Screening for sleep disorders.:</u> All participants were administered the Pittsburgh Sleep Quality Index (PSQI; Buysse, Reynolds, Monk, Berman, & Kupfer, 1988) for the purpose of guiding an unstructured clinical interview; answers to individual items were used to screen for sleep apnea and restless legs syndrome. If this measure indicated the presence of a primary sleep disorder, an unstructured, clinical interview was conducted under the supervision of a Board-Certified Sleep Medicine specialist (SAI) for an assessment of suspicion of sleep disorder/exclusion criteria.

Actigraphy.: To measure sleep and wake, participants were instructed to wear a wrist-mounted actigraph on their nondominant wrist for one week. The actigraph recorded motor activity using a linear accelerometer and a miniaturized microprocessor (Ambulatory Monitoring, Inc., Ardsley, NY). Actigraphy has been shown to be a valid and reliable objective estimate of sleep and wake (Ancoli-Israel et al., 2003; Jean–Louis et al., 2000; Sadeh, 2011). Wrist activity data were recorded in one-minute epochs using default parameters. Sleep/wake variables were estimated from average activity counts using a validated, automated sleep-wake scoring algorithm with the ACTION4 software package (Ambulatory Monitoring, Inc., Ardsley, New York; Cole, Kripke, Gruen, Mullaney, & Gillin, 1992).

Self-reported total time in-bed (TIB) was determined using a daily log. Participants also logged times that the actigraph was removed (e.g., when showering, when engaged in water sports), and these data were edited from the actigraphic record. Sleep variables calculated for the participant-reported time spent in bed included: total sleep time (TST), nighttime sleep efficiency (SE; sleep time/total time in bed expressed as a percent), wake time after sleep onset (WASO), total number of nighttime awakenings, and the average duration of each awakening.

Parental bonding measure

Parental Bonding Instrument.: To measure perceived parenting styles, the 25-item self-report PBI was used, assessing maternal parenting styles recalled from the first 16 years of life (Parker et al., 1979). Each item was answered on a 4-point Likert scale and the following two subscales were computed: (1) care, reflecting perceived maternal warmth and affection, and (2) overprotection, reflecting perceived parental over-control and intrusion. In this study, both continuous factorially derived scales of care and overprotection were used, which have the following possible ranges: care: 0–36; overprotection: 0–39. For reference in interpreting mean scores, a the standard cut-off score for high versus low care is 27, and the cut-off score for high versus low overprotection is 13.5 (Gordon Parker et al., 1979). The PBI has been shown to have acceptable test-retest reliability across 20 years (Murphy, Wickramaratne, & Weissman, 2010; Wilhelm, Niven, Parker, & Hadzi-Pavlovic, 2005) corroboration with witnesses and independent observers (Parker, 1986; Parker, 1981a). Internal consistency in the current study was considered good ($\alpha = 0.89$) for the overprotection subscale and excellent ($\alpha = 0.94$) for the care subscale (Cicchetti, 1994).

Procedure

All procedures were reviewed and approved by the UCSD, SDSU, and VASDHS committees for the protection of human subjects. Participants attended a total of three visits. At the initial appointment, research staff informed participants about the study and received written informed consent. The SCID and PSQI were administered to all participants. Approximately one week later, participants attended the second appointment where they received instructions to wear an actigraph on their non-dominant wrist. They were asked to wear the actigraph for 7 consecutive days and nights. Participants returned the actigraph at the last interview, one week later. Actigraphy data were included in the main analyses if participants wore the device for at least 3 consecutive days and nights.

Statistical analysis

Statistical program IBM SPSS Statistics version 24 was used to conduct all analyses. Preliminary analyses were conducted to test for group differences in demographic characteristics and main variables of interest. Demographic variables were included as covariates if they were significantly different by group and correlated with any sleep indices. Chi-square tests were used to compare demographic variables between depressed and non-depressed participants, and independent samples t-tests were used to compare group differences in sleep and maternal bonding indices.

For the main analyses, individual hierarchical linear regression equations were used to test the effect of group (depressed/non-depressed) on the relationship between maternal bonding (care and overprotection), and mean sleep parameters (WASO, TIB, TST, SE, number of awakenings, and mean duration of each awakening). Since they represent different constructs, models for care and overprotection were conducted separately. In each analysis, age and group were entered into the first step, the maternal bonding subscale (care or overprotection) was entered into the second step, and the bonding x group interaction term was entered into the third step. Cook's distance was calculated for each individual model (Cook, 1977). Regression equations were analyzed with and without outliers using the $D_i >$ 4/n guideline for influential points (Bollen & Jackman, 1985).

RESULTS

Demographic characteristics of the total sample and by depression status are reported in Table 1. The majority of participants in the current study (n = 70) were men (n = 48, 69%) with a mean age of 43.38 years (SD = 12.42); participants ranged in age from 20 to 64 years old. Mean monthly income was $2,919.64 ($SD$ = $2,602.95). Of the participants with MDD (n = 34), 9 (26%) were taking more than one psychotropic medication. Most participants in both groups were Caucasian (n = 50, 71%), and 51% of the sample (n = 36) was composed of veterans. A significant proportion of participants had a mental disorder other than MDD (60%), and 64% had a medical disorder. Of the participants with MDD, 39% had a comorbid mental disorder and 37% had a comorbid medical disorder. Participants with MDD had an average history of 2.03 depressive episodes (SD = 6.10). Six participants had post-traumatic stress disorder (veterans = 5), and all were in the MDD group. Twenty-two participants had an alcohol abuse/dependence disorder, with no significant differences in prevalence by group (MDD = 12, NC = 10).

Descriptive statistics by group for maternal bonding and actigraphy-measured sleep variables are reported in Table 2. Normal controls, compared to participants with MDD, reported higher levels of maternal care and lower levels of maternal overprotection. The average MDD score for overprotection is in the high range, 2.85 points above cutoff, and for care is in the low range, 5.53 points below cutoff. The averaged NC score for overprotection is in the low range, 1.42 points below cutoff, and for care is in the high range, 1.33 points above cutoff.

Consistent with findings from the larger study (Haynes, McQuaid, Ancoli-Israel, & Martin, 2006), normal controls had less WASO, TIB, TST, and awakenings compared to individuals in the MDD group.

Main analyses

Maternal bonding and sleep indices—Results indicated no significant bonding x depression interactions. However, several main effects emerged for bonding indices. For individuals in both the NC and MDD groups, holding age constant, higher levels of maternal care were associated with greater TIB (R^2 = .09; B = 2.79, SE = 0.97, p = .006) and greater TST (R^2 = .05; B = 1.95, SE = 0.94, p = .042). The number of outliers in these models ranged from 2–8. When including outliers in the individual models, relationships between maternal care and sleep remained significant. Higher levels of maternal overprotection were associated with less awakenings (R^2 = 0.10; B = −0.18, SE = 0.06, p = .006). The number of outliers in these models ranged from 4–9. With the inclusion of outliers in the individual models, the relationship between maternal overprotection and number of awakenings as well as waketime were no longer significant.

Main effects emerged for group in both the care and overprotection models. In the care models depressed individuals had more awakenings (B = 4.20, SE = 0.92, p = .000), less SE (B = −3.27, SE = 1.25, p = .011), greater TIB (B = 59.82, SE = 16.06, p = .000), and greater WASO (B = 29.06, SE = 5.54, p = .000), with similar findings in the overprotection models. The findings in this subsample analysis are consistent with previous reports from the same dataset (Haynes et al., 2006).

DISCUSSION

The current study examined the relationship between perceived maternal bonding during childhood and sleep in adulthood. Higher levels of maternal care were associated with more TST and more TIB, independent of depression status. These findings suggest that regardless of mood, individuals who have higher levels of maternal care have a longer sleep duration in adulthood. This finding is consistent with a previous study that found a positive association between paternal attachment and longer sleep duration in girls (Keller & El-Sheikh, 2011). Findings from the current study, which used an objective measure of sleep, support and extend previous work that found an association between parental bonding and subjective sleep quality in adults (Shibata et al., 2016).

The relationship between maternal care and TST is largely consistent with developmental theory. Sleep physiology in human infants evolved under exposure to continuous parental contact during the early developmental stages (Worthman & Melby, 2002). Parental responsiveness to the needs of the infant is of critical importance to survival (McKenna et al., 1993). Moreover, parental warmth during early life has been described as a social reward system that promotes security (MacDonald, 1992). Mothers who were more caring toward their infant may have created a sense of safety and security in their infants that promoted sleep and developed into a lifelong pattern of sleep promotion as an adult. Findings from a nationally representative study of children supports this interpretation; parental warmth

predicted more hours of sleep during the week in younger children as measured by a time-diary (Adam, Snell, & Pendry, 2007).

Interestingly, the same study found that more hours of sleep were associated with stricter parental household rules in adolescents (Adam et al., 2007). Stricter rule-setting is likely to be more prevalent among overprotective parents. This explanation may partially explain our findings suggesting that maternal overprotection may be associated with fewer night awakenings in adulthood. Mothers who were more overprotective may have had more continuous night contact with their infants and more responsiveness to infant cues, which in turn reduced infant distress about potential threats during sleep and promoted sleep continuity. However, this explanation is largely speculative and our findings suggesting a link between overprotection and nocturnal awakenings were unstable with the removal of outliers. Therefore, further research is necessary to explicate this relationship.

This study has notable strengths, particularly in the use of actigraphy. To our knowledge, this is the first study to examine parent-child bonding and objectively measured sleep in adults. Compared to studies using polysomnography, actigraphy offers a naturalistic measurement of sleep/wake. Another strength of the present research is the inclusion of both depressed and nondepressed individuals. By including both groups, we were able to test for moderating effects of depression on the relationship between parental bonding and sleep. This is important given the strong association between both parental bonding and depression and sleep and depression (Yap & Jorm, 2015; Yap, Pilkington, Ryan, & Jorm, 2014; Baglioni et al., 2011; Johnson, Roth, & Breslau, 2006; Perlis, Giles, Buysse, Tu, & Kupfer, 1997).

These results support and extend previous findings demonstrating a link between maternal warmth and sleep duration in adults. Given the significant reduction in sleep duration of U.S. Americans within the last decade, these results provide preliminary data to suggest that prevention programs promoting maternal warmth may have an additive benefit of sleep promotion that could last into adulthood. Further, although this study does not assess co-sleeping explicitly, it provides proof-of-concept support that future studies should be conducted on co-sleeping, bonding and sleep health. Given that bonding/attachment is one of the most common reasons reported by parents for engaging in co-sleeping (Ward, 2014), it will be important for future studies to examine whether co-sleepers have more optimal levels of parent-child bonding compared to independent sleepers, and how that relates to sleep health across the lifespan.

Limitations and Future Directions

The cross-sectional study design prevents the ability to infer causality or test bidirectional relationships. For instance, sleep duration and nocturnal awakenings during childhood may influence parental warmth and overprotection. Prospective studies are needed to elucidate directionality of these relationships over time. Longitudinal studies will also help us understand how the relationship between parental bonding and sleep changes across the life course, and whether improvements in non-optimal parent bonding are associated with improvements in child sleep. In future studies with larger sample sizes, it will be beneficial to examine the interaction between the care and overprotection scales in the PBI in relation to sleep.

The generalizability of these findings is limited. The sample primarily consisted of Caucasian males, and over half were veterans. In addition, participants were recruited more than a decade ago, and findings may not generalize to a similar sample of adults in the United States today. The current study specifically examined maternal bonding and sleep. Future studies should examine differences in predictability of parental bonding with both mothers and fathers. Finally, it will be of value to study whether these relationships hold in other clinical populations, including adults with stress-related or anxiety disorders and children with attention deficit hyperactivity disorder.

CONCLUSION

This study provides early evidence that maternal parental bonding during childhood may be associated with objective sleep parameters in adulthood. Results also suggest that this association may exist in both depressed and non-depressed adults, though depressed adults reported less optimal maternal bonding and more disturbed sleep. The importance of both parental bonding and sleep for health and well-being points to the clinical benefits of exploring these relationships over time.

ACKNOWLEDGMENTS

REFERENCES

Adam E, Snell E, & Pendry P. (2007). Sleep Timing and Quantity in Ecological and Family Context: A Nationally Representative Time-Diary Study. J Fam Psychol, 21(1), 4–19. 10.1037/0893-3200.21.1.4 [PubMed: 17371105]

Adams GC, Stoops MA, & Skomro RP (2014). Sleep tight: Exploring the relationship between sleep and attachment style across the life span. Sleep Medicine Reviews, 18(6), 495–507. 10.1016/j.smrv.2014.03.002 [PubMed: 24721278]

Ancoli-Israel S, Cole R, Alessi C, Chambers M, Moorcroft W, & Pollak CP (2003). The role of actigraphy in the study of sleep and circadian rhythms. Sleep 10.1093/sleep/26.3.342

Baglioni C, Battagliese G, Feige B, Spiegelhalder K, Nissen C, Voderholzer U, … Riemann D. (2011). Insomnia as a predictor of depression: A meta-analytic evaluation of longitudinal epidemiological studies. Journal of Affective Disorders, 135(1–3), 10–19. 10.1016/j.jad.2011.01.011 [PubMed: 21300408]

Bollen KA, & Jackman RW (1985). Regression diagnostics: An expository treatment of outliers and influential cases. Sociological Methods & Research, 13(4), 510–542. 10.1177/0049124185013004004

Buysse DJ, Reynolds CF 3Rd, Monk TH, Berman SR, & Kupfer DJ (1988). The Pittsburgh Sleep Quality Index: A New Instrument for Psychiatric Practice and Research. Psychiatry Res. 10.1016/0165-1781(89)90047-4

Cicchetti DV (1994). Guidelines, Criteria, and Rules of Thumb for Evaluating Normed and Standardized Assessment Instruments in Psychology. Psychological Assessment, 6(4), 284–290. 10.1037/1040-3590.6.4.284

Cole RJ, Kripke DF, Gruen W, Mullaney DJ, & Gillin JC (1992). Automatic wake/sleep identification from wrist activity. Sleep, 15(5), 461–469. Retrieved from https://academic.oup.com/sleep/article-abstract/15/5/46½749332 [PubMed: 1455130]

Cook RD (1977). Detection of Influential Observation in Linear Regression. Technometrics, 19(1), 15–18. 10.1080/00401706.1977.10489493

Eun JD, Paksarian D, He J-P, & Merikangas KR (2017). Parenting style and mental disorders in a nationally representative sample of US adolescents. Social Psychiatry and Psychiatric Epidemiology. 10.1007/s00127-017-1435-4

Gotlib IH, Mount JH, Cordy NI, & Whiffen VE (1988). Depression and perception of early parenting: A longitudinal investigation. British Journal of Psychiatry, 152, 24–27. [PubMed: 3167341]

Haynes PL, Mcquaid JR, Ancoli-Israel S, & Martin JL (2006). Disrupting life events and the sleep-wake cycle in depression. Psychological Medicine, 36(10), 1363–1373. 10.1017/S0033291706008208 [PubMed: 16834822]

Jean–Louis G, Mendlowicz MV, Gillin JC, Rapaport MH, Kelsoe JR, Zizi F, … von Gizycki H. (2000). Sleep estimation from wrist activity in patients with major depression. Physiology & Behavior, 70(1–2), 49–53. 10.1016/S0031-9384(00)00228-6 [PubMed: 10978477]

Johnson EO, Roth T, & Breslau N. (2006). The association of insomnia with anxiety disorders and depression: Exploration of the direction of risk. Journal of Psychiatric Research, 40(8), 700–708. 10.1016/j.jpsychires.2006.07.008 [PubMed: 16978649]

Keller P, & El-Sheikh M. (2011). Children's emotional security and sleep: Longitudinal relations and directions of effects. Journal of Child Psychology and Psychiatry and Allied Disciplines, 52(1), 64–71. 10.1111/j.1469-7610.2010.02263.x

Lee S, & Lemmon M. (2017). Dynamic Interplay Between Sleep and Family Life: Review and Directions for Future Research (pp. 201–209). 10.1007/978-3-319-64780-7_10

MacDonald K. (1992). Warmth as a Developmental Construct: An Evolutionary Analysis. Child Development, 63(4), 753–773. 10.1111/j.1467-8624.1992.tb01659.x

McKenna JJ, Thoman EB, Anders TF, Sadeh A, Schechtman V, & Glotzbach S. (1993). Infant-Parent Co-Sleeping in an Evolutionary Perspective: Implications for Understanding Infant Sleep Development and the Sudden Infant Death Syndrome. American Sleep Disorders Association and Sleep Research Society, 16(3), 263–282.

Moon RY (2016). SIDS and Other Sleep-Related Infant Deaths: Evidence Base for 2016 Updated Recommendations for a Safe Infant Sleeping Environment. Pediatrics, 138(5), e20162940–e20162940. 10.1542/peds.2016-2940

Murphy E, Wickramaratne P, & Weissman M. (2010). The stability of parental bonding reports: A 20-year follow-up. Journal of Affective Disorders, 125(1–3), 307–315. 10.1016/j.jad.2010.01.003 [PubMed: 20138671]

Parker G. (1981). Parental reports of depressives. An investigation of several explanations. Journal of Affective Disorders, 3(2), 131–140. 10.1016/0165-0327(81)90038-0 [PubMed: 6454707]

Parker G. (1986). Validating an experiential measure of parental style: the use of a twin sample. Acta Psychiatrica Scandinavica, 73(1), 22–27. 10.1111/j.1600-0447.1986.tb02660.x [PubMed: 3962700]

Parker G, Tupling H, & Brown LB (1979). A Parental Bonding Instrument. British Journal of Medical Psychology, 52(1), 1–10. 10.1111/j.2044-8341.1979.tb02487.x

Perlis ML, Giles DE, Buysse DJ, Tu X, & Kupfer DJ (1997). Self-Reported Sleep Disturbance as a Prodromal Symptom in Recurrent Depression-Google Scholar. Elsevier, 42, 209–212.

Plantes MM, Prusoff BA, Brennan J, & Parker G. (1988). Parental representations of depressed outpatients from a U.S.A. sample. Journal of Affective Disorders, 15(2), 149–155. 10.1016/0165-0327(88)90083-3 [PubMed: 2975685]

Sadeh A. (2011). The role and validity of actigraphy in sleep medicine: An update. Sleep Medicine Reviews, 15(4), 259–267. 10.1016/j.smrv.2010.10.001 [PubMed: 21237680]

Shear MK, Greeno C, Kang J, Ludewig D, Frank E, Swartz HA, & Hanekamp M. (2000). Diagnosis of Nonpsychotic Patients in Community Clinics. American Journal of Psychiatry, 157(4), 581–587. 10.1176/appi.ajp.157.4.581 [PubMed: 10739417]

Shibata M, Ninomiya T, Anno K, Kawata H, Iwaki R, Sawamoto R, Hosoi M. (2016). Perceived inadequate care and excessive overprotection during childhood are associated with greater risk of sleep disturbance in adulthood: the Hisayama Study. BMC Psychiatry, 16(1), 215 10.1186/s12888-016-0926-2 [PubMed: 27388724]

Singh Vinit Kumar, Khess C, Bhattacharjee D, Singh N. (2016). Parental bonding among individuals with recurrent depressive disorder, and normal controls : A comparative study. Indian Journal of Health and Wellbeing, 7(6), 671.

Spitzer RL, Williams JBW, Gibbon M, & First MB (1992). The Structured Clinical Interview for DSM-III-R (SCID). Archives of General Psychiatry, 49(8), 624 10.1001/archpsyc.1992.01820080032005 [PubMed: 1637252]

Stein D, Williamson DE, Birmaher B, Brent DA, Kaufman J, Dahl RE, … Ryan ND (2000). Parent-child bonding and family functioning in depressed children and children at high risk and low risk for future depression. Journal of the American Academy of Child and Adolescent Psychiatry, 39(11), 1387–1395. 10.1097/00004583-200011000-00013 [PubMed: 11068894]

Ward TCS (2014). Reasons for Mother-Infant Bed-Sharing: A Systematic Narrative Synthesis of the Literature and Implications for Future Research. Maternal and Child Health Journal, 19(3), 675–690. 10.1007/s10995-014-1557-1

Wilhelm K, Gillis I, & Parker G. (2016). Parental Bonding and Adult Attachment Style : The Relationship between Four Category Models. Int J Womens Health Wellness, 2(1).

Wilhelm K, Niven H, Parker G, & Hadzi-Pavlovic D. (2005). The stability of the Parental Bonding Instrument over a 20-year-period. Psychological Medicine, 35(3), 387–393. [PubMed: 15841874]

Worthman CM, & Melby MK (2002). Toward a comparative developmental ecology of human sleep In Carskadon MA (Ed.), Adolescent sleep patterns: Biological, social, and psychological influences (pp. 69–117). New York, NY, US: Cambridge University Press10.1017/CBO9780511499999.009

Yap MBH, & Jorm AF (2015). Parental factors associated with childhood anxiety, depression, and internalizing problems: A systematic review and meta-analysis. Journal of Affective Disorders, 175, 424–440. 10.1016/j.jad.2015.01.050 [PubMed: 25679197]

Yap MBH, Pilkington PD, Ryan SM, & Jorm AF (2014). Parental factors associated with depression and anxiety in young people: a systematic review and meta-analysis. Journal of Affective Disorders, 156, 8–23. 10.1016/j.jad.2013.11.007 [PubMed: 24308895]

Zanarini MC, Skodol AE, Bender D, Dolan R, Sanislow C, Schaefer E, Gunderson JG (2000). The Collaborative Longitudinal Personality Disorders Study: Reliability of Axis I and II Diagnoses. Journal of Personality Disorders, 14(4), 291–299. 10.1521/pedi.2000.14.4.291 [PubMed: 11213787]
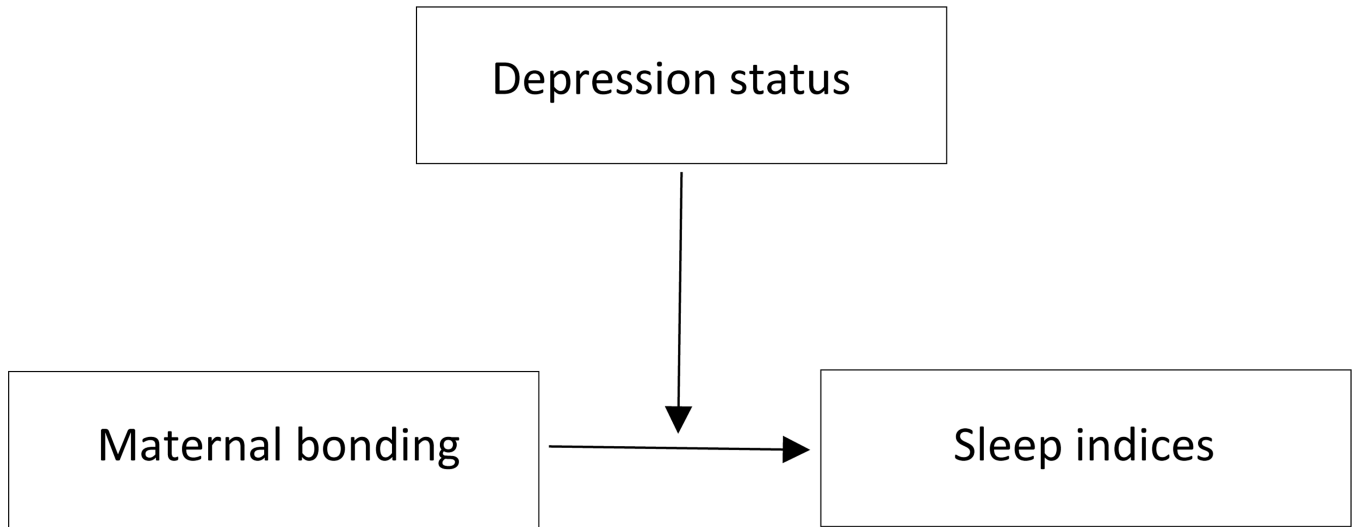
Figure 1.
Evaluated moderation model

Table 1.

Sample characteristics and differences by group

Variable	Total sample (n = 70)		NC (n = 36)		MDD (n = 34)		
	n	%	n	%	n	%	χ^2
Ethnicity							18.01[b]*
Caucasian(non-Hispanic)	50	71	22	61	28	82	
Hispanic	7	10	7	19	0	0	
African-American	3	4	2	6	1	3	
Pacific Islander	3	4	3	8	0	0	
Asian-American	2	3	2	6	0	0	
Other	5	7	0	0	5	15	
Employed							18.34[a]***
Yes	48	69	33	92	15	44	
No	22	31	3	8	19	56	
Married/Cohabitating							11.54[a]**
Yes	31	44	23	64	8	24	
No	39	56	13	36	26	77	
Parental divorce							0.18[a]
Yes	24	34	13	36	11	32	
No	35	50	17	47	18	53	
Veteran							4.67[a]*
Yes	36	51	14	39	22	65	
No	34	49	22	61	12	35	
Mental disorder (not MDD)							10.38[a]**
Yes	42	60	15	21	27	39	
No	28	40	21	30	7	10	
Medical disorder							4.28[a]*
Yes	45	64	19	27	26	37	
No	25	36	17	24	8	11	
Cigarette use							14.14[a]***
Yes	17	24	2	3	15	21	
No	53	76	34	49	19	27	

NC, normal controls; MDD, patients with major depressive disorder. Eleven participants were missing information on parental divorce, and 10 were missing information on whether their mother lived in the home.

[a] df=1,

[b] df=6,

* p<.05,

** p<.01,

***
p<.001

Table 2.

Sleep and maternal bonding indices and differences by group

	Total sample (n = 70)	NC (n = 36)	MDD (n = 34)	
Variable	**M (SD)**	**M (SD)**	**M (SD)**	**F**
Maternal bonding				
Care	25.00 (8.81)	28.33 (6.40)	21.47 (9.70)	11.53[**]
Overprotection	14.16 (8.44)	12.08 (6.08)	16.35 (9.99)	13.60[*]
Actigraphy				
WASO (min)	42.22 (37.14)	25.62 (18.76)	59.78 (43.51)	19.83[***]
TIB (min)	485.64 (79.91)	467.04 (56.12)	505.32 (96.12)	11.61[*]
TST (min)	443.42 (72.76)	441.42 (58.30)	445.54 (86.34)	9.06
SE (%)	91.61 (6.77)	94.47 (3.99)	88.58 (7.78)	8.48[***]
# Awakenings	6.01 (4.82)	3.99 (3.23)	8.15 (5.32)	10.85[***]
M duration of awakenings (min)	4.43 (2.38)	3.66 (2.11)	5.24 (2.40)	0.45[**]

NC, normal controls; MDD, patients with major depressive disorder; WASO, wake after sleep onset; TIB, time in bed; TST, total sleep time; SE, sleep efficiency.

[*] <.05,

[**] <.01,

[***] <.001