

# Sleep Disorders of Child and Mental Health

Subjects: Others

Contributor: Lawrence Lam

Some common sleep disorders have been identified and included as childhood sleep disorders, such as obstructive sleep apnea, parasomnias, behavioral insomnia, delayed sleep phase disorder, and restless legs syndrome. For adolescent mental health problems, the standard definition and diagnostic criteria of the Diagnostic and Statistical Manual of Mental Disorders – 5th Edition (DSM-5) by the American Psychiatric Association (APA) were followed. Common adolescent mental health problems include, but are not limited to: anxiety disorder, mood disorders, attention deficit and hyperactivity disorders, and disruptive behavior disorders.

Keywords: early childhood ; sleep disorders ; mental health problems ; adolescents ; longitudinal studies ; systematic review

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## 1. Introduction

The association between sleep problems, particularly sleep disorders, and mental health has long been established <sup>[1][2][3][4]</sup>. From the epidemiological perspective, this association could either be unidirectional or bidirectional in terms of the relationship between these two health conditions <sup>[5][6][7]</sup>. Two possible scenarios could result in a unidirectional associative relationship between these two conditions. First, among others, sleep disorders are one of the risk factors in the causal pathway of mental health problems. In this case, sleep disorders precede mental health problems in the developmental trajectory of the latter <sup>[8]</sup>. Second, mental health problems and sleep disorders are comorbidities, with sleep disorders a manifestation of underlying mental health problems <sup>[9]</sup>. For the bidirectional understanding of the association between these two conditions, there could be a mutual and reciprocal cause-and-effect relationship operating between each, such that mental health problems may induce sleep disorders and, in return, sleep disorders exert an effect on mental health problems at different phases of development. This has been demonstrated in the relationship between mental health and other health conditions <sup>[10]</sup>.

Contrasting definitions of childhood exist. A child is defined by the United Nations in the “Convention on the Rights of the Child” as a person with an age of 18 years or younger <sup>[11]</sup>, however, the World Health Organization (WHO) defines adolescents as people between 10 and 19 years of age <sup>[12]</sup>. Therefore, a large proportion of adolescents are also considered as children by these two definitions. However, for early childhood, a clearer definition has been found—the WHO defines early childhood as the period between 0–8 years <sup>[13]</sup>. To maintain the consistency of terms and definitions, the WHO definitions of early childhood and adolescence were adopted. In terms of sleep disorders in children, the definition provided by the American Academy of Sleep Medicine (AASM) was used <sup>[14]</sup>. Some common sleep disorders have been identified and included as childhood sleep disorders, such as obstructive sleep apnea, parasomnias, behavioral insomnia, delayed sleep phase disorder, and restless legs syndrome <sup>[15]</sup>. For adolescent mental health problems, the standard definition and diagnostic criteria of the Diagnostic and Statistical Manual of Mental Disorders – 5th Edition (DSM-5) by the American Psychiatric Association (APA) were followed <sup>[16]</sup>. Common adolescent mental health problems include, but are not limited to: anxiety disorder, mood disorders, attention deficit and hyperactivity disorders, and disruptive behavior disorders <sup>[16]</sup>.

## 2. Sleep Disorders in Early Childhood and the Development of Mental Health Problems in Adolescents: A Systematic Review

The procedures described in the methods were applied for an extensive search on the six electronic databases. Twenty-six articles on the relationship between sleep problems at an earlier stage of life and subsequent mental health problems were identified. Of these, 11 were selected as potential studies for further analyses to be reviewed by both authors with an examination of the full text <sup>[17][18][19][20][21][22][23][24][25][26][27]</sup>. After concordance discussions and resolution of any discrepancies, it was found that seven articles satisfied the selection criteria fully with statistical information on the relationship between early childhood sleep disorders and mental health problems in adolescence <sup>[18][21][22][23][24][25][26]</sup>. The main reasons for the four articles to be excluded were: (1) the focus of the study was not on early childhood sleep

disorders, but sleep problems during adolescence and the association with a mental health problem at a later stage of life development; (2) the study did not provide sufficient information for the effect estimate, or (3) the assessment of the exposure and/or the outcome variables did not fulfill the selection criteria [\[17\]\[19\]\[20\]\[27\]](#). Detailed information was extracted from these seven articles and is summarized in **Table 1**.

**Table 1.** Information extracted from the selected studies on early childhood sleep problems and mental health problems in adolescents.

Reference (Author, Year, Place)	Participants	Study Methodology	Exposure, Confounding Variables and Measures	Outcome Variable and Measures	Method of Analysis and Variables Adjusted	Results	Comments
Gregory and O'Connor, (2002), CO, USA	Participants of the study were part of the Colorado Adoption Project with children and parents recruited from adoptive and non-adoptive families. In total, 490 families were recruited with an equal number of family types.	Parents and children were recruited and followed since birth. Assessment on children was conducted annually since recruitment. Baseline assessment on sleep problems was conducted at the time when the child was 4 years old when sleep problems were first assessed. Mental health assessment was evaluated annually until 15 years old (n = 490).	Exposure: Early Childhood sleep problems with common symptoms of sleep disorders, including nightmares, sleepwalking and talking, trouble in falling asleep. Measures: The Sleep Problem Scale of the Child Behavior Checklist (CBCL) Confounding variables: Child sex, adoption status, anxiety/depression at age 4, attention problems at age 4, and aggression at age 4, assessed by CBCL.	Outcome: Anxiety/depression and attention problems. Measures: The Behavioral/Emotional Scale of the CBCL.A combined assessment across 13, 14, and 15 years because of attrition.	Relations between early childhood sleep problems and anxiety/depression, as well as attentional problems were examined with hierarchical linear regression with adjustment for child's sex, adoption status, and behavioral/emotional problems at age 4.	Regression analyses results suggested sleep problems at 4 year significantly predicted anxiety/depression in mid-adolescence ( $\beta = 0.16$ , $p < 0.01$ , $R^2 = 0.12$ ). Similarly sleep problems at age 4 also significantly predicted attentional problems at mid- adolescence ( $\beta = 0.11$ , $p < 0.05$ , $R^2 = 0.25$ ).	<b>Strengths and Limitations:</b> The study was limited by a high attrition rate (26%), although the original sample was of a reasonable size (n = 490). Furthermore, the assessments on sleep problems and mental health problems were self-parents. Without an additional informant, especially the child at the adolescence period, report basis might be an issue. Some important confounding variables, such as parental mental health, might be missing

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Silva et al. (2011), Tucson, USA	Children, aged 6–12 years of Hispanic and Caucasian origin were recruited in the Tucson Children's Assessment of Sleep Apnea Study. Children were recruited from the Tucson Unified School District, excluding those who had a history of tonsillectomy and mental disorders. The mean age was 8.9 years at baseline assessment.	Children were followed after baseline assessments (n = 503) on sleep apnea and behavioral/emotional problems. They were followed for about 5 years with 304 participants retained in the study for outcome assessments. All assessments were conducted during the in-home visit (n = 304).	Exposure: Sleep apnea and sleep history characteristics. Measures: Sleep apnea was assessed using unattended home polysomnograms (PSGs). Sleep scores were calculated by a somnographic technologist who was blind to the child's mental status. Sleep history and characteristics were assessed using the Sleep Habits Questionnaires (SHQs) by parental reports. Confounding variables: Baseline BMI, ethnicity, sleep apnea at follow-up, age at follow-up, caffeine use at follow-up, and anxiety/depression at baseline were included in the analyses.	Outcome: Anxiety/depression. Measures: Assessed using Child Behaviour Checklist (CBCL) completed by parents at the follow- up visit.	Multivariate mixed- effect linear regression modeling was applied to examine the effect of childhood sleep problems on anxiety/depression at adolescence, controlling for confounding factors.	Short duration of sleep (<7.5 h/night) at childhood was marginally predictive of the anxiety/depression at adolescence but not significant at 5% Type I error rate (OR = 3.3, 95% CI = 0.83– 13.5).	Strengths and Limitations: Sleep apnea was measured objectively using polysomnograms. However, the actual measures on sleep apnea were used in the analyses. Instead, the duration of sleep was used as the outcome variable, although it would be argued that a short duration of sleep was highly correlated to the symptoms of sleep apnea. Some important confounding variables, such as parental mental health, might be missing

Reference (Author, Year, Place)	Participants	Study Methodology	Exposure, Confounding Variables and Measures	Outcome Variable and Measures	Method of Analysis and Variables Adjusted	Results	Comments
Armstrong et al. (2013), Wisconsin, USA	The sample was drawn from the Wisconsin Study of Family and Work for this secondary data analysis study.	Families were recruited from pregnancy and followed until the child reached 18 years. Of the original 570 families recruited, 341 had complete data on both childhood sleep problems at the age of 4.5 and 9 years and mental health at age 18 (n = 341).	Exposure: Sleep problems included insomnia, sleep movement, hypersomnia, and a range of parasomnias. Due to low frequencies in other problems, the study focused on persistent insomnia and sleep movement defined as having the individual problem at both 4.5 and 9 years. Measures: Sleep problems were assessed using the Children's Sleep Habits Questionnaires (SHQs) by maternal reports. Confounding variables: Potential confounding variables were included in the final analyses. These were the child's sex, medication of psychostimulant.	Outcome: Anxiety, depression, externalizing behaviors, and ADHD Measures: Assessed using the MacArthur Health and Behavior Questionnaire (HBQ) self-reported by the child at the age of 18.	Multivariate analysis of variance (MONOVA) was used to examine the association between persistent sleep problems at age 9 and mental health problems at 18 years controlling for confounding factors.	Persistent insomnia was significantly related to anxiety and externalizing behaviours in adolescence ( $F_{(2,334)} = 4.82, p = 0.009$ and $F_{(2,334)} = 4.53, p = 0.011$ ). Persistent sleep movement was also significantly associated with ADHD at adolescence ( $F_{(2,334)} = 6.68, p = 0.001$ ).	Strengths and Limitations: The study was well-executed and the follow-up process was complete with comparisons on many demographic variables between the participating and on-participating families. Two main limitations were identified: (1) most demographic variables were not included in the analyses to be considered as potentially confounding; (2) assessments on the exposure and outcome variables were conducted by self-reported questionnaires risking certain degree of report bias by mothers and children. (3) Other important confounding variables, such as parental mental health, might be missing.

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<b>References</b>							
1. Simonds, J.F.; Parraga, H.			Exposure: Childhood sleep				Strengths and limitations. This secondary data analysis study utilized a large sample size and a long period of follow-up.
2. Edis, T.E.; Rosenberg, L.; Hudnell, G.; Jones, J.			Exposure: Common symptoms of sleep disorders,				Similar to the Armstrong et al.'s study, two main limitations were identified: (1) assessments on the exposure and outcome variables were conducted by self-reported questionnaires, thus, the risk of self-report bias by mothers and children was high; (2) simple comparisons on main outcome variables between groups were conducted without any considerations of potential confounding factors during results. (3) Should also consider confounding issues.
3. Bartle, E.J.; Sun, J.H.; Thompson, L.; Light, A.; McCool, C.; Heaton, S.	Women between 16 and 20 years of gestation were recruited from the public antenatal clinic. On the participating sites.	Textbook of Psychiatric Epidemiology, John Wiley & Sons, Hoboken, NJ, USA.	Exposure: Including nightmares, sleepwalking and talking, trouble in falling asleep, measures.				
4. Sleep and Mental Health Disorders.	This secondary data analysis study drew the sample from the Western Australian Pregnancy Cohort (Raine) Study.	The Sleep Problem Scale of the Child Behavior Checklist (CBCL) which is a youth version of the self-reported by the child at the age of 17.		Outcome: Anxiety, depression, externalizing	Simple independent sample Student's t-tests were applied to examine the differences in the scores on the YSR between normal and troubled sleepers.	Mtroubled = 5.73, $p < 0.05$ . No significant differences in anxiety and depression were observed between groups.	
5. Tsuang, M.; Kremen, W.	Followed annually until the child reached the age of 18. Assessments were conducted via questionnaire and physical examination. This study focused on childhood sleep problems and mental health from 5, 8, 10, 14-year follow-up and mental health from 18 years (n = 1182).	Dev. Psychol. 2014, 50, 674–682.					
6. Ferrie, J.E.; Kivimäki, M.; Singh-Manoux, A.; Kivimäki, M.							
7. Tavernier, R.; Willoughby, J.							
8. Wakeford, R.							
9. Golden, S.H.; Lazo, M.; Carnethon, M.; Bertoni, A.G.; Schreiner, P.J.; Roux, A.V.D.; Lee, H.B.; Lyketsos, C.			Confounding factors: Not mentioned in the study.				
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13. WHO. Improving Early Childhood Development: WHO Guideline; World Health Organization: Geneva, Switzerland, 2020.							
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15. Carter, K.A.; Hathaway, N.E.; Lettieri, C.F.							
16. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders, 5th ed.; APA: Arlington, VA, USA, 2013.							
17. Johnson, E.O.; Chilcoat, H.D.; Breslau, N.							
18. Gregory, A.M.; O'Connor, T.G.							
19. Paavonen, E.J.; Solantaus, T.; Almqvist, F.; Aronen, E.T.							
20. Ong, S.H.; Wickramaratne, P.; Tang, M.; Weissman, M.M.							
21. Silva, G.E.; Goodwin, J.L.; Parthasarathy, S.; Sherrill, D.L.; Vana, K.D.; Drescher, A.A.; Quan, S.F.							
22. Armstrong, J.M.; Ruttle, P.L.; Klein, M.H.; Essex, M.J.; Benca, R.M.							
23. Wang, B.; Isensee, C.; Becker, A.; Wong, J.; Eastwood, P.R.; Huang, R.-C.; Runions, K.C.; Stewart, R.M.; Meyer, T.; Brüni, L.G.; et al.							

Reference (Author, Year, Place)	Participants (Study Characteristics)	Measures (Study Variables and Measures)	Outcome Variable (Study Variables and Measures)	Method of Analysis (Study Variables and Measures)	Results	Comments
24. Lereya, S.T.; Winsper, C.; Tang, N.K.; Wolke, D. Sleep Problems in Childhood and Borderline Personality Disorder Symptoms in Early Adolescence. <i>J. Abnorm. Child Psychol.</i> 2017, 45, 1981–2005.				Logistic regression analysis as the primary analytical approach and verified with path analysis	Adjusted	
25. Morales-Muñoz, I.; Broome, M.R.; Marwaha, S. Association of Parent-Reported Sleep Problems in Early Childhood with Psychotic and Borderline Personality Disorder Symptoms in Adolescence. <i>JAMA Psychiatry</i> 2020, 77, 1256–1265.						
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27. Carpena, M.X.; Munhoz, T.N.; Xavier, M.C.; Lira, L.A.; Santos, I.S.; Del-Ponte, B.; Barros, F.C.; Matijasevich, A.; Tovo-Rodrigues, L. The Role of Sleep Duration and Sleep Problems during Childhood in the Development of ADHD in Adolescence: Findings From a Population-Based Birth Cohort. <i>J. Atten. Disord.</i> 2020, 24, 590–600.						
Retrieved from <a href="https://encyclopedia.pub/entry/history/show/39321">https://encyclopedia.pub/entry/history/show/39321</a>						
Lereya et al. (2017), Avon, UK	This was another secondary data analysis study using data collected in the Avon Longitudinal Study of the Parents and Children (ALSPAC) in the UK.	Mother and child dyads were recruited in the Avon birth cohort study with an initial 14,541 pregnant women enrolled. Parents responded to postal questionnaires on their child's health development during follow-up. The Child was assessed annually via face-to-face interviews on psychosocial and physical health. This study utilized data collected on borderline personality disorder when the child was about 12 years (mean age 11.8 years) (n = 6050).	Sleep problems were assessed by duration of questions when the child was 3.5, 4.8, and 6.8 years of age. In this study, sleep problems were categorized as follows: no nightmare at all, nightmare at 1 time point, 2 time points, 3 or more time points. Confounding variables: A number of potential confounding variables were controlled. These included: sex, emotional temperament at 2 years, family adversity index, physical and sexual abuse at 2.5, 3.5, 4.8, or 6.8 years, preschool maladaptive parenting, Developmental and Wellbeing Assessment at 7 years, and emotional and behavioral problems at 9.5 and 11.7 years.	Outcome: Borderline personality disorder (BPD) symptoms. Measures: Assessed by a trained psychologist at face-to-face interview using the UK Childhood Interview for DSM-IV-Borderline Personality Disorder at about 12 years.	Logistic regression analysis as the primary analytical approach and verified with path analysis	Having persistent nightmares (i.e., nightmares assessed as positive at 3 or more time points) during early childhood was significantly associated with BPD symptoms at adolescence after controlling for potential confounding variables (OR = 1.62, 95% CI = 1.12–2.32). Results were also verified with path analysis.
						Strengths and Limitations: Similar to the previous study in this review, this secondary data analysis study utilized a large data set that could provide sufficient power for demonstrating a true effect between the exposure and outcome variables. Another strength of the study was that sufficient control for potential confounding effects was in place to ensure the precision of the effect estimate.

Reference (Author, Year, Place)	Participants	Study Methodology	Exposure, Confounding Variables and Measures	Outcome Variable and Measures	Method of Analysis and Variables Adjusted	Results	Comments
Morales- Munoz et al. (2020), Avon, UK	This was another secondary data analysis study using data of the same Avon Longitudinal Study of the Parents and Children (ALSPAC) in UK as Lereya et al.	Mother and child dyads were recruited in the Avon birth cohort study with an initial 14,541 pregnant women enrolled. Parents responded to postal questionnaires on their child's health development during follow-up. The Child was assessed annually via face-to- face interviews on psychosocial and physical health (n = 7155). This study utilized data collected on Psychotic symptoms and BPD since the child was 12 years. The main focus of the study was on psychotic symptoms (n = 7155).	Exposure: Childhood sleep problems included nightmares, duration of sleep, sleep maintenance problems, and sleep routine regularity. Measures: Sleep problems were assessed by a set of sleep questions when the child was 6 months, 18 months, 30 months, 3.5, 4.8, and 5.8 years of age. This study focused on the duration of sleep, sleep maintenance, and sleep routine. Confounding variables: A number of potential confounding variables were controlled. These included: sex, emotional temperament at 2 years, family adversity index, physical and sexual abuse, prematurity, and maternal age when the child was born.	Outcome: Psychotic symptoms. Measures: Assessed by a trained psychologist at face-to-face interview using the Psychotic-Like Symptom Interview.	Logistic regression analysis as the primary analytical approach. Of interest to the authors was also the possible mediating effect of depression at 10 years on the relationship between early childhood sleep problems and psychotic symptoms with path analysis which was similar to Lereya's study.	There were significant relationships between a regular sleep routine and psychotic symptoms. Children with a regular sleep routine at 6 months had a reduced odds of psychotic symptoms at 12 to 13 years by about 30% (OR = 0.68, 95% CI = 0.50–0.93). Children with a regular sleep routine at 30 months had a reduced odds of psychotic symptoms of about 35% 4 (OR = 0.68, 95% CI = 0.44–0.95). Children with a regular sleep routine at 5.8 years had an even greater reduction in odds of psychotic symptoms at 12 to 13 years by about 70% (OR = 0.32, 95% CI = 0.19– 0.53). Results were obtained after the adjustment of confounding variables. A possible mediating effect of depression on children's regular sleep routine at 5.8 years and psychotic symptoms at 12 to 13 years was also reported.	Strengths and Limitations: Similar to Lereya's study utilizing the same data set, this study shared the same strengths that the large sample size could provide sufficient power for demonstrating a true effect between the exposure and outcome variables. Similarly, sufficient control for potential confounding effect was in place to ensure the precision of the effect estimate was another strength of the study.

Reference (Author, Year, Place)	Participants	Study Methodology	Exposure, Confounding Variables and Measures	Outcome Variable and Measures	Method of Analysis and Variables Adjusted	Results	Comments
Slykerman et al. (2020), Auckland, New Zealand	This was a secondary data analysis study utilizing data collected from the Auckland Birthweight Collaborative Study (ABC Study).	Mothers, mainly of European ethnicity, and their newborn children were recruited to the Study. All children were born full-term with a gestation of 37 weeks or longer between October 1995 and November 1997. Children were then followed until 11 years. Data on sleep problems were collected at 7 years and mental health problems were assessed at 11 years. In total, 547 children had provided data on both the exposure and outcome variables. (n = 547).	Exposure: Sleep duration at 7 years was the only sleep variable of interest. Measures: Sleep duration was measured by actigraphy for 24 h. Confounding variables: Birthweight, sex, gestation, socioeconomic status, maternal smoking during pregnancy, marital status at the time the child was born, maternal school leaving age, and child intelligence were included in the analyses for adjustment.	Outcome: Emotional/behavioral difficulties and ADHD. Measures: Emotional/ behavioral difficulties were assessed by the Strengths and Difficulties Questionnaire (SDQ) self-reported by both parent and child at age 11. For ADHD, it was assessed using the Conner's Rating Scale (CRS) filled in by parents and teachers when the child was 11 years old.	Logistic regression analyses were applied to examine the relationship between the exposure and outcome variables.	After adjusting for potential confounding factors, there was no significant relationship between sleep duration at 7 years and emotional/behavioral problems as well as ADHD at 11 years.	Strengths and Limitations: Similar to other studies in this review, this study suffered similar shortcomings as the other. Despite the objective measures of sleep problems using actigraphy, sleep duration was the only variable under investigation. Given the sound approach in exposure assessment, other sleep variables should also be considered. The self-reporting on the outcome variables might incur some report biases by parents, children, and teachers. Another shortcoming of this study was the lack of information on sleep problems of children at their earlier stage of development.