International Journal of Innovative Technologies in Social Science

e-ISSN: 2544-9435

Operating Publisher
SciFormat Publishing Inc.
ISNI: 0000 0005 1449 8214

2734 17 Avenue SW,
Calgary, Alberta, T3E0A7,
Canada
+15878858911
editorial-office@sciformat.ca

ARTICLE TITLE	SLEEP–WAKE RHYTHM DISORDERS IN CHILDREN AND ADOLESCENTS: NEUROPSYCHIATRIC CONSEQUENCES
DOI	https://doi.org/10.31435/ijitss.3(51).2026.5987
RECEIVED	12 May 2026
ACCEPTED	08 August 2026
PUBLISHED	14 August 2026
LICENSE	The article is licensed under a **Creative Commons Attribution 4.0 International License.**

SLEEP–WAKE RHYTHM DISORDERS IN CHILDREN AND ADOLESCENTS: NEUROPSYCHIATRIC CONSEQUENCES

Aleksandra Kowalewska-Kurek *[AK] (Corresponding Author, Email: okowalewska.a@gmail.com)*
University Clinical Hospital No. 2 of the Pomeranian Medical University (PUM) in Szczecin, Lewandowskiego 30/7, 70-237 Szczecin, Poland
ORCID ID: 0009-0004-7686-0872

Katarzyna Kowalska *[KK]*
M. Kopernik Provincial Multispecialty Oncology and Traumatology Center in Łódź, ul. Pabianicka 62, 93-513 Łódź, Poland
ORCID ID: 0000-0001-6027-2620

Hanna Grygorcewicz *[HG]*
University Clinical Hospital No. 2 of the Pomeranian Medical University (PUM) in Szczecin, Poland
ORCID ID: 0009-0009-1260-8308

Laura Mikuła *[LM]*
Medical University of Warsaw, Żwirki i Wigury 61, 02-091 Warsaw, Poland
ORCID ID: 0009-0000-4827-2492

Justyna Strycharczuk *[JS]*
Independent Public Healthcare Institution of the Ministry of the Interior and Administration in Opole, Krakowska 44, 45-075 Opole, Poland
ORCID ID: 0009-0002-6612-2070

ABSTRACT

Background: Sleep is a key determinant of psychomotor and cognitive development in children and adolescents. Increasing exposure to evening blue light, irregular sleep schedules, and lifestyle factors contribute to circadian misalignment and sleep–wake rhythm disorders, which are increasingly recognized as clinically relevant in pediatric mental health.
Objective: To summarize current evidence on neuropsychiatric consequences of sleep–wake rhythm disorders in children and adolescents and to outline major contributing factors and management strategies.
Methods: A narrative review of the literature was conducted using PubMed and selected full-text publications, with emphasis on studies published within the last 10 years addressing sleep physiology, circadian regulation, and neuropsychiatric outcomes of sleep disturbances in pediatric populations.
Results: Circadian rhythm sleep–wake disorders, particularly delayed sleep–wake phase disorder, are common during adolescence and are driven by pubertal circadian phase delay, evening light exposure, and behavioral sleep restriction. Sleep–wake rhythm disruption is associated with internalizing symptoms, including anxiety and depression, and evidence supports a bidirectional relationship between sleep disturbances and mental disorders. Sleep problems are also frequent in attention-deficit/hyperactivity disorder and may exacerbate executive dysfunction, impulsivity, irritability, and behavioral dysregulation. Experimental and translational findings suggest that sleep loss during sensitive developmental periods may affect limbic functioning and synaptic plasticity, potentially contributing to long-term neurodevelopmental vulnerability.
Conclusions: Sleep–wake rhythm disorders represent modifiable risk factors for adverse neuropsychiatric outcomes in youth. Early identification, sleep hygiene, chronotherapy, and appropriately timed melatonin may improve sleep timing and daytime functioning and should be integrated into clinical practice and preventive strategies.

KEYWORDS

Sleep Wake Disorders, Circadian Rhythm, Adolescent, Child, Sleep Deprivation, Insomnia, Attention Deficit Disorder With Hyperactivity, Anxiety Disorders Depressive Disorder, Melatonin

CITATION

Aleksandra Kowalewska-Kurek, Katarzyna Kowalska, Hanna Grygorcewicz, Laura Mikuła, Justyna Strycharczuk. (2026) Sleep–Wake Rhythm Disorders in Children and Adolescents: Neuropsychiatric Consequences. *International Journal of Innovative Technologies in Social Science*. 3(51). doi: 10.31435/ijitss.3(51).2026.5987

Introduction

Sleep is an essential factor in children's and adolescents' psychomotor and cognitive development [1–3]. Both sleep duration and sleep quality influence mental health, somatic functioning (including immune competence), cognitive performance, and family relationships [1–3]. Insufficient sleep is associated with poorer impulse control, increased aggressive behaviors, difficulties with emotion regulation, reduced concentration, and poorer academic outcomes [2,4].

In recent years, sleep problems have become increasingly prevalent in pediatric populations [1,5]. Evening exposure to blue light emitted by electronic devices, combined with irregular patterns of activity and sleep, promotes circadian phase delay and contributes to sleep–wake rhythm disruption [5–7]. Sleep disturbances are particularly common in adolescents, especially among individuals with chronic diseases or neuropsychiatric disorders [8]. Evidence indicates a bidirectional relationship between sleep problems and internalizing symptoms: disturbed sleep increases the risk of mental health difficulties, whereas anxiety and depressive symptoms further worsen sleep quality [9,10]. Anxiety disorders are typically associated with shorter sleep duration, poorer sleep continuity, and a higher frequency of subjective sleep complaints [11]. Depressive symptoms occur in a substantial proportion of individuals with insomnia, underscoring the close relationship between sleep and mood disorders [12].

Aim

This paper aims to summarize current evidence on the neuropsychiatric consequences of sleep–wake rhythm disorders in children and adolescents.

Methods

A narrative literature review was conducted using PubMed and selected full-text publications, with an emphasis on studies published within the last 10 years addressing sleep physiology, circadian regulation, and neuropsychiatric sequelae of sleep disturbances in the pediatric population.

Sleep physiology and circadian rhythm in development

During periods of marked neurobiological change, sleep is a key contributor to healthy development [9,13]. Sleep requirements vary by age: newborns typically need 16–19 hours of sleep per day, preschool children approximately 10 hours, and school-aged children about 8–9 hours per day [13].

In infancy, two primary sleep states are distinguished: quiet sleep (NREM) and active sleep (REM) [14,15]. With maturation of the central nervous system, EEG patterns become more differentiated and sleep architecture gradually stabilizes [14]. In adults, a sleep cycle lasts approximately 90 minutes; in children it is shorter, around 60 minutes [16]. NREM sleep comprises three stages characterized by distinct EEG features [17]. NREM stage 2 is marked by sleep spindles and K-complexes, which play important roles in sleep stabilization and memory consolidation [17–19].

Slow-wave sleep (SWS) is the deepest sleep stage and is associated with predominant slow cortical oscillations. Slow-wave activity (SWA) peaks in early childhood and then decreases, with a further decline during adolescence; this pattern has been interpreted as reflecting synaptic maturation [25]. REM sleep is characterized by high brain activity, rapid eye movements, and muscle atonia and is associated with vivid dreaming [20]. NREM sleep predominates early in the night, while the proportion of REM sleep increases in the second half of the sleep period [20].

Sleep macrostructure also changes with development: infant sleep is typically polyphasic, whereas preschool and school-age sleep becomes progressively monophasic [21]. With age, the proportion of REM sleep and SWS decreases, while NREM stage 2 increases [22]. Sleep spindle parameters show marked developmental changes and may be associated with cognitive performance [23,24].

Circadian regulation is primarily governed by the suprachiasmatic nucleus of the hypothalamus, which responds to light input and melatonin signaling [26]. Melatonin secretion, stimulated by darkness, synchronizes sleep–wake timing. Circadian rhythm disorders are diagnosed when the endogenous rhythm substantially interferes with functioning in accordance with social or school demands [26].

Factors contributing to sleep–wake rhythm disorders

A major contributor to poorer sleep duration and quality in children and adolescents is intensive social media use. In a study of 467 adolescents, higher social media engagement was associated with poorer sleep quality, lower self-esteem, and increased anxiety and depressive symptoms [28]. Night-time notifications may fragment sleep, and restricting access to messaging applications may itself be perceived as distressing [28]. In addition, evening use of electronic devices suppresses melatonin secretion via blue-light exposure and promotes circadian phase delay [5–7].

Other lifestyle-related factors influencing sleep–wake regulation include irregular meal timing, caffeine consumption, procrastination, low physical activity, and poor sleep hygiene. Social jet lag—defined as a discrepancy between sleep timing on school days and weekends—also represents an important risk factor [34].

Classification and prevalence

Circadian rhythm sleep–wake disorders (CRSWDs) in children and adolescents constitute a significant clinical problem [26]. According to ICSD-3, CRSWDs result from misalignment between an individual's internal circadian rhythm and social, school, or occupational requirements [32]. These disorders primarily involve sleep timing rather than sleep architecture; however, persistent misalignment may lead to significant health and psychosocial consequences [26,32].

Delayed sleep phase syndrome/disorder (DSPS) is one of the most commonly recognized CRSWDs in adolescence, with an estimated prevalence of 7–16% [31,32]. Predisposing factors include genetic influences, increased sensitivity to evening light, and reduced responsiveness to morning light, which together make it difficult to fall asleep and to wake early [31]. A physiologic circadian delay during puberty, combined with screen light exposure, may further perpetuate DSPS [5–7,31]. Consequences include impaired morning functioning, school absenteeism, and poorer academic performance [4,31]. Adolescents with CRSWDs also more frequently present with co-occurring mood symptoms [9,10].

Idiopathic insomnia in children is defined as difficulty initiating or maintaining sleep despite adequate sleep conditions; increasing attention has been paid to its associations with circadian dysregulation and its transdiagnostic nature in child and adolescent psychiatry [29]. Irregular sleep–wake rhythm disorder (ISWRD) is characterized by the absence of one consolidated sleep period across 24 hours and is more common in children with neurodevelopmental disorders, creating a substantial burden for caregivers [26]. Insufficient sleep syndrome (ISSD) results from behaviorally induced sleep restriction and has a population-level character; sleep deficiency affects a substantial proportion of school-aged children and most adolescents [30,34]. In this group, social jet lag may reach 3–4 hours [34].

Neuropsychiatric consequences

Table 1. Circadian Sleep–Wake Rhythm Disorders in Children and Adolescents: Characteristics and Neuropsychiatric Consequences

Disorder	Core Characteristics	Most Affected Age Group	Neuropsychiatric Consequences	Key References
Delayed Sleep–Wake Phase Disorder (DSWPD	Persistent delay in sleep onset and wake time relative to social demands; difficulty waking in the morning	Adolescents	Anxiety, depressive symptoms, academic impairment, daytime sleepiness	[4,9,31]
Irregular Sleep–Wake Rhythm Disorder (ISWRD)	Absence of a consolidated sleep period within 24 hours; fragmented sleep	Children with neurodevelopmental disorders	Behavioral dysregulation, caregiver burden, emotional instability	[26,46]
Insufficient Sleep Syndrome (ISS)	Voluntary or behaviorally induced chronic sleep restriction	School-aged children and adolescents	Reduced attention, impulsivity, mood instability, poor academic performance	[1,30,34]
Idiopathic Insomnia	Difficulty initiating or maintaining sleep despite adequate conditions	Children and adolescents	Increased risk of anxiety, depression, suicidal ideation	[12,29,38]
Circadian Rhythm Disruption due to Social Jet Lag	Discrepancy between weekday and weekend sleep timing	Adolescents	Emotional dysregulation, depressive symptoms, aggression	[34,43,44]

Sleep and circadian rhythm disturbances are among the most frequently reported problems in child and adolescent psychiatry [26]. Increasing evidence suggests they are not merely accompanying symptoms but represent modifiable risk factors influencing emotional functioning, cognitive performance, and brain development [29,30].

Insufficient sleep is associated with poorer psychological well-being and more severe anxiety and depressive symptoms; in adolescents, it has also been linked to lower self-esteem [28]. Chronic sleep restriction may reduce resilience to stress and contribute to the development of mood disorders [35]. A bidirectional association between sleep disturbances and mental disorders has been consistently reported [10,36]. Insomnia is considered a major modifiable risk factor for depression and suicidal behaviors, and its effective treatment may contribute to prevention and improved prognosis [12,38,39].

Sleep problems are common in children with attention-deficit/hyperactivity disorder (ADHD), most often including difficulty falling asleep, poorer sleep quality, and more frequent nocturnal awakenings [40–42]. Sleep-focused interventions may improve daytime functioning, including impulse control and behavioral regulation [29]. A later chronotype and sleep deprivation have also been associated with increased aggression and antisocial behaviors in children and adolescents [43,44].

Neurobiological studies indicate that stress and internalizing symptoms co-occurring with sleep deficiency may be related to adverse changes in limbic system functioning [45]. In animal models,

developmental sleep disruption resulted in an imbalance between excitation and inhibition in key neuronal circuits, resembling mechanisms observed in neurodevelopmental disorders [46]. Sleep deficiency during critical developmental periods may have long-lasting consequences; longitudinal research suggests early alterations in brain development may precede clinical manifestation of neurodevelopmental conditions [47]. Sleep is also crucial for synaptic plasticity, and disruption of sleep may negatively affect neuroplastic processes [46].

Management strategies

The cornerstone of management is psychoeducation and sleep hygiene, including maintaining regular sleep–wake schedules, limiting evening screen exposure, and involving parents in promoting healthy sleep habits [34]. In younger children, maintaining consistent routines regardless of the day of the week is particularly important [34].

If behavioral interventions are insufficient, chronotherapeutic approaches may be used, including morning exposure to bright light to advance the circadian phase [29]. As an alternative or adjunct, low-dose melatonin administered before the planned bedtime may be used to shift circadian timing [37]. Combined chronotherapy and melatonin has been reported to be effective in selected populations, including children and adolescents with ADHD and delayed sleep phase [49,50]. Psychological support aimed at reducing tension and anxiety may also indirectly improve sleep quality [36].

Discussion

The available evidence highlights associations between sleep and circadian rhythm disturbances and adverse outcomes in mental health and cognitive functioning among children and adolescents [9,10,29]. Insufficient sleep is associated with poorer academic performance [4], and poorer sleep quality more often co-occurs with anxiety and depressive symptoms [9,10]. Night-time social media use has emerged as an increasingly important risk factor; beyond sleep curtailment, emotional engagement and sleep fragmentation due to notifications appear clinically relevant [28].

The findings support the concept of sleep disturbances as transdiagnostic phenomena co-occurring with ADHD, mood disorders, and neurodevelopmental conditions [29,46,47]. Limitations of the literature include the predominance of cross-sectional studies and reliance on subjective measures, which restrict causal inference. Future research should more widely use objective methods such as actigraphy, assessment of dim light melatonin onset (DLMO), and long-term monitoring of sleep parameters [26,29]. Socioeconomic and cultural factors should also be considered as potential moderators of sleep quality and access to interventions. Randomized controlled trials evaluating emerging treatments (e.g., orexin receptor antagonists or phototherapy) in pediatric populations remain limited.

Conclusions

Sleep and wake disturbances are common in children and adolescents and substantially impair school, social, and emotional functioning by affecting attention, emotion regulation, and quality of life.

The relationship between sleep disturbance and anxiety/depressive symptoms is bidirectional. Sleep problems may accompany mood disorders but may also precede them and increase the risk of their development, emphasizing the need for early recognition and treatment.

In children and adolescents with ADHD, sleep problems are frequent and may exacerbate executive dysfunction, impulsivity, and daytime irritability; heterogeneity of findings supports individualized sleep assessment.

Behavioral interventions—especially consistent sleep hygiene and reduction of evening screen exposure—are the foundation of management and can substantially improve sleep and mental functioning. Parental and caregiver engagement is crucial for effectiveness.

Further research should focus on objective sleep assessment and identification of factors that differentiate vulnerability to sleep disturbances to optimize preventive and therapeutic interventions in pediatric populations.

REFERENCES

1. Owens, J. A. (2015). Insufficient sleep in adolescents: Causes and consequences. *Nature and Science of Sleep, 7*, 1–12. https://doi.org/10.2147/NSS.S55807
2. Shochat, T., Tavor, O., & Tzischinsky, O. (2015). Functional consequences of inadequate sleep in adolescents: A systematic review. *Nature and Science of Sleep, 7*, 1–16. https://doi.org/10.2147/NSS.S51941
3. Short, M. A., & Louca, M. (2015). Sleep deprivation leads to mood deficits in healthy adolescents. *Nature and Science of Sleep, 7*, 57–68. https://doi.org/10.2147/NSS.S73536
4. Dewald-Kaufmann, J. F., Oort, F. J., & Meijer, A. M. (2016). The effects of sleep extension on adolescents' academic performance: A systematic review. *Sleep Medicine Reviews, 28*, 29–38. https://doi.org/10.1016/j.smrv.2015.06.006
5. Chang, A. M., Aeschbach, D., Duffy, J. F., & Czeisler, C. A. (2015). Evening use of light-emitting eReaders negatively affects sleep, circadian timing, and next-morning alertness. *Proceedings of the National Academy of Sciences of the United States of America, 112*(4), 1232–1237. https://doi.org/10.1073/pnas.1418490112
6. Cain, N., & Gradisar, M. (2016). Electronic media use and sleep in school-aged children and adolescents: A review. *Sleep Medicine, 20*, 64–72. https://doi.org/10.1016/j.sleep.2015.11.013
7. Touitou, Y., Touitou, D., & Reinberg, A. (2017). Disruption of adolescents' circadian clock: The vicious circle of media use, exposure to light at night, sleep loss and risk behaviors. *Nature and Science of Sleep, 9*, 247–259. https://doi.org/10.2147/NSS.S125637
8. Meltzer, L. J., Williamson, A. A., & Mindell, J. A. (2018). Sleep and pediatric chronic illness: A systematic review. *Sleep Medicine Reviews, 41*, 211–221. https://doi.org/10.1016/j.smrv.2018.02.003
9. Gregory, A. M., & Sadeh, A. (2020). Annual research review: Sleep problems in childhood psychiatric disorders—A review of the latest science. *The Lancet Psychiatry, 7*(6), 497–508. https://doi.org/10.1016/S2215-0366(20)30042-1
10. Alvaro, P. K., Roberts, R. M., & Harris, J. K. (2017). A systematic review assessing bidirectionality between sleep disturbances and mental disorders. *Sleep Medicine Reviews, 36*, 29–45. https://doi.org/10.1016/j.smrv.2016.09.002
11. Alfano, C. A., & Gamble, A. L. (2019). The role of sleep in childhood anxiety disorders. *Child and Adolescent Psychiatric Clinics of North America, 28*(3), 457–468. https://doi.org/10.1016/j.chc.2019.02.002
12. Baglioni, C., Battagliese, G., Feige, B., et al. (2016). Insomnia as a predictor of depression: A meta-analytic evaluation. *The Lancet Psychiatry, 3*(6), 524–534. https://doi.org/10.1016/S2215-0366(16)00099-1
13. Paruthi, S., Brooks, L. J., D'Ambrosio, C., et al. (2016). Recommended amount of sleep for pediatric populations: A consensus statement. *Journal of Clinical Sleep Medicine, 12*(6), 785–786. https://doi.org/10.5664/jcsm.5866
14. Blumberg, M. S., Gall, A. J., & Todd, W. D. (2017). The development of sleep–wake rhythms and the search for elemental circuits in the infant brain. *Sleep Medicine Reviews, 32*, 66–76. https://doi.org/10.1016/j.smrv.2016.03.007
15. Sadeh, A., Tikotzky, L., & Kahn, M. (2015). Sleep in infancy and childhood: Implications for emotional and behavioral development. *Nature and Science of Sleep, 7*, 19–28. https://doi.org/10.2147/NSS.S75589
16. Tarokh, L., Raffray, T., Van Reen, E., & Carskadon, M. A. (2016). Developmental changes in the human sleep EEG during early adolescence. *Current Opinion in Neurobiology, 40*, 64–69. https://doi.org/10.1016/j.conb.2016.06.014
17. Fernandez, L. M. J., & Lüthi, A. (2020). Sleep spindles: Mechanisms and functions. *Nature Reviews Neuroscience, 21*(9), 473–485. https://doi.org/10.1038/s41583-020-0364-6
18. Helfrich, R. F., Mander, B. A., Jagust, W. J., Knight, R. T., & Walker, M. P. (2019). Old brains come uncoupled in sleep: Slow wave–spindle synchrony, brain atrophy, and forgetting. *Trends in Cognitive Sciences, 23*(9), 666–679. https://doi.org/10.1016/j.tics.2019.06.005
19. Purcell, S. M., Manoach, D. S., Demanuele, C., et al. (2017). Characterizing sleep spindles in 11,630 individuals. *Neuron, 95*(4), 1–13. https://doi.org/10.1016/j.neuron.2017.06.048
20. Scammell, T. E., Arrigoni, E., & Lipton, J. O. (2017). Neural circuitry of wakefulness and sleep. *Neuron, 93*(4), 747–765. https://doi.org/10.1016/j.neuron.2017.01.014
21. Galland, B. C., Taylor, B. J., Elder, D. E., & Herbison, P. (2018). Normal sleep patterns in infants and children: A systematic review. *Sleep Medicine Reviews, 40*, 92–101. https://doi.org/10.1016/j.smrv.2017.06.001
22. Ohayon, M. M., Carskadon, M. A., Guilleminault, C., & Vitiello, M. V. (2017). Meta-analysis of quantitative sleep parameters from childhood to old age. *Sleep, 40*(3), zsx001. https://doi.org/10.1093/sleep/zsx001
23. McClain, I. J., Lustenberger, C., Achermann, P., et al. (2016). Developmental changes in sleep spindle characteristics and their relation to learning. *Developmental Cognitive Neuroscience, 20*, 67–75. https://doi.org/10.1016/j.dcn.2016.06.007
24. Ujma, P. P., Sandor, P., Szakadat, S., et al. (2019). Sleep spindles and intelligence in early childhood. *Sleep Medicine Reviews, 44*, 1–11. https://doi.org/10.1016/j.smrv.2018.12.001
25. Campbell, I. G., & Feinberg, I. (2016). Maturational patterns of EEG activity during non-REM sleep in childhood and adolescence. *Sleep, 39*(6), 1–12. https://doi.org/10.5665/sleep.5826

26. Kaczor, M., & Skalski, M. (2015). Circadian sleep–wake cycle disorders in adolescents: A literature review. *Current Problems of Psychiatry, 49*(3), 349–356. https://doi.org/10.20966/chn.2015.49.349
27. Gruber, R., Salamon, L., Tauman, R., & Al-Yagon, M. (2023). Sleep disturbances in adolescents with attention-deficit/hyperactivity disorder. *Nature and Science of Sleep, 15*, 275–286. https://doi.org/10.2147/NSS.S386435
28. Woods, H. C., & Scott, H. (2016). #Sleepyteens: Social media use in adolescence is associated with poor sleep quality, anxiety, depression and low self-esteem. *Journal of Adolescence, 51*, 41–49. https://doi.org/10.1016/j.adolescence.2016.05.008
29. Arns, M., Kooij, J. J. S., & Coogan, A. N. (2021). Identification and management of circadian rhythm sleep disorders as a transdiagnostic feature in child and adolescent psychiatry. *Journal of the American Academy of Child & Adolescent Psychiatry, 60*(9), 1085–1095. https://doi.org/10.1016/j.jaac.2020.12.035
30. Ordway, M. R., Logan, S., & Sutton, E. H. (2022). Sleep deficiency in young children. *Clinics in Chest Medicine, 43*(2), 229–237. https://doi.org/10.1016/j.ccm.2022.02.007
31. Crowley, S. J., Acebo, C., & Carskadon, M. A. (2007). Sleep, circadian rhythms, and delayed sleep–wake phase in adolescence. *Sleep Medicine, 8*(6), 602–612. https://doi.org/10.1016/j.sleep.2006.12.002
32. American Academy of Sleep Medicine. (2014). *International classification of sleep disorders* (3rd ed.). American Academy of Sleep Medicine.
33. Tonetti, L., Fabbri, M., Martoni, M., & Natale, V. (2012). Circadian typology and mood seasonality in adolescents. *Psychiatry and Clinical Neurosciences, 66*(2), 157–159. https://doi.org/10.1111/j.1440-1819.2011.02290.x
34. Walęcka-Matyja, K. K., & Tabała, K. (2025). Family system and sleep and circadian rhythm disorders in children and adolescents. *Fides et Ratio, 61*(1), 33–46.
35. Shinjyo, N., Waddell, G., & Green, J. (2020). Valerian root in treating sleep problems and associated disorders: A systematic review and meta-analysis. *Journal of Evidence-Based Integrative Medicine, 25*, 2515690X20967323. https://doi.org/10.1177/2515690X20967323
36. Lin, K. H., Chang, Y. J., Chang, T. M., et al. (2025). Impact of sleep disturbance on mental health in schoolchildren with atopic dermatitis. *JAAD International, 24*, 50–60. https://doi.org/10.1016/j.jdin.2025.08.013
37. Royant-Parola, S. (2021). International expert opinions on the use of melatonin in insomnia and circadian sleep disturbances. *Frontiers in Psychiatry, 12*, 688890. https://doi.org/10.3389/fpsyt.2021.688890
38. Wilson, S., Anderson, K., Baldwin, D., et al. (2019). Evidence-based guidelines for the treatment of insomnia and circadian rhythm disorders. *Journal of Psychopharmacology, 33*, 923–947. https://doi.org/10.1177/0269881119855343
39. Palagini, L., Manni, R., Aguglia, E., et al. (2020). Consensus recommendations on the assessment and management of insomnia. *Frontiers in Psychiatry, 11*, 558. https://doi.org/10.3389/fpsyt.2020.00558
40. Diaz-Roman, A., Hita-Yanez, E., & Buela-Casal, G. (2016). Sleep characteristics in children with ADHD: Systematic review and meta-analysis. *Journal of Clinical Sleep Medicine, 12*, 747–756. https://doi.org/10.5664/jcsm.5890
41. Bandopadhyay, U., Diaz-Orueta, U., & Coogan, A. N. (2021). Sleep and circadian rhythms in children with ADHD: A systematic review. *Journal of Attention Disorders, 25*, 1087054720978556. https://doi.org/10.1177/1087054720978556
42. Larsson, I., Aili, K., Lönn, M., et al. (2023). Sleep interventions for children with ADHD: A systematic review. *Sleep Medicine, 102*, 64–75. https://doi.org/10.1016/j.sleep.2022.12.021
43. Jankowski, K. S., & Linke, M. (2020). Bad night owls: Emotionality and aggressiveness in adolescent chronotypes. *Chronobiology International, 37*, 1–8. https://doi.org/10.1080/07420528.2019.1709335
44. Schlarb, A. A., Sopp, R., Ambiel, D., & Grünwald, J. (2013). Aggression and antisocial behavior in relation to chronotype. *Chronobiology International, 31*, 1–16. https://doi.org/10.3109/07420528.2013.809421
45. Ochoa-Fuentes, D. A., et al. (2022). Stress, anxiety and depression in children and adolescents. *Revista Médica del Instituto Mexicano del Seguro Social, 60*(3), 338–344.
46. Milman, N. E. P., Tinsley, C. E., Raju, R. M., & Lim, M. M. (2022). Consequences of developmental sleep disruption. *Neurobiology of Sleep and Circadian Rhythms, 14*, 100085. https://doi.org/10.1016/j.nbscr.2022.100085
47. Dawson, G., Rieder, A. D., & Johnson, M. H. (2023). Prediction of autism in infants. *The Lancet Neurology, 22*(3), 244–254. https://doi.org/10.1016/S1474-4422(22)00407-0
48. Horne, J. A., & Östberg, O. (1976). A self-assessment questionnaire to determine morningness–eveningness. *International Journal of Chronobiology, 4*, 97–110.
49. van Andel, E., Bijlenga, D., Vogel, S. W. N., et al. (2020). Chronotherapy in ADHD with delayed sleep–wake phase disorder. *Chronobiology International, 29*, 1–10. https://doi.org/10.1080/07420528.2020.1835943
50. Van der Heijden, K. B., Smits, M. G., Van Someren, E. J. W., et al. (2007). Effect of melatonin on sleep, behavior and cognition in ADHD. *Journal of the American Academy of Child & Adolescent Psychiatry, 46*, 233–241. https://doi.org/10.1097/01.chi.0000246055.76167.0d