

Prevalence of Sleep Disorder in Chinese Preschoolers: A National Population-Based Study

Jing Hua^{1,*}, Jiajun Lyu^{1,*}, Wenchong Du^{1,2}

¹Shanghai Key Laboratory of Maternal Fetal Medicine, Shanghai First Maternity and Infant Hospital, School of Medicine, Tongji University, Shanghai, People's Republic of China; ²NTU Psychology, Nottingham Trent University, Nottingham, UK

*These authors contributed equally to this work

Correspondence: Wenchong Du, NTU Psychology, Nottingham Trent University, Burton Street, Nottingham, NG1 4BU, UK, Email vivienne.du@ntu.ac.uk; Jing Hua, Shanghai First Maternity and Infant Hospital, Tongji University School of Medicine, 2699 Gaoke Road, Shanghai, People's Republic of China, Email jinghua@tongji.edu.cn

Study Objectives: This study provides data on the prevalence of clinical sleep disorders in Chinese preschoolers aged 3–5 years old and examined their sleep behaviours and problems with a nationally representative sample.

Methods: A national population-based cohort study was conducted with 114,311 children aged 3–5 years old from 551 cities in China. Children's daily sleep hours and pediatric sleep disorders defined by the Children's Sleep Habits Questionnaire (CSHQ) were reported by parents.

Results: The estimated sleep disorder prevalence was 76.78% (95% CI: 76.54%, 77.03%). Rates of specific disorders were as follows: Bedtime resistance (97.00%, 95% CI: 96.90%, 97.10%), Daytime sleepiness (77.68%, 95% CI: 77.43%, 77.92%), Sleep duration (70.24%, 95% CI: 69.97%, 70.50%), Parasomnia (58.52%, 95% CI: 58.23%, 58.80%), Sleep anxiety (55.53%, 95% CI: 55.24%, 55.81%), Sleep onset delay (51.99%, 95% CI: 51.70%, 52.28%), Night wakings (30.37%, 95% CI: 30.10%, 30.63%) and Sleep-disordered breathing (21.86%, 95% CI: 21.62%, 22.09%). The prevalence of sleep disorder, daily sleep hours and rates of specific disorder varied across children of different sex and ages.

Conclusion: A high prevalence of sleep disorder was found in Chinese preschoolers, and the specific sleep problems of Chinese preschoolers vary from other cultures. A local standard may be required when using the CSHQ to define sleep disorders in children in China. An in-depth investigation into the reasons for the high sleep disorder prevalence should be conducted and supportive intervention should be provided to preschoolers in China.

Keywords: sleep disorder, Chinese preschooler, national prevalence, the Children's Sleep Habits Questionnaire

Introduction

A large number of studies have found that sleep problems are prevalent in childhood. Sleep disorders in children can lead to significant medical and behavioural problems, and children with sleep difficulties were also reported to experience higher rates of impaired cognitive function, learning disabilities, and mental and emotional problems.¹

An accurate report of the prevalence of sleep disorder in the healthy population is essential to provide the necessary guidelines to evaluate sleep difficulties in clinical practice. However, relatively few recent studies have addressed sleep patterns in preschoolers, and no studies are reporting sleep patterns or sleep disorder in Chinese preschool-aged children with a national sample according to our knowledge. Sleep behaviours and sleep problems in children are not only influenced by a wide range of biological and psychological factors but also by cultural and social factors, and in many reports, the prevalence rates of sleep disorders in childhood in different cultures are diversified.² Therefore, cultural sleep patterns and sleep disorder prevalence are needed to provide precise references to parents and clinical professionals.

The aims of this study were to (1) evaluate the prevalence of sleep disorder in Chinese children aged 3–5 years old with parent reports using the Children's Sleep Habits Questionnaire (CSHQ); (2) describe sleep patterns and problems in Chinese preschoolers.

Materials and Methods

Study Design and Participants

Data were obtained from the Chinese National Cohort of Motor Development (CNCMD).^{3,4} 2403 nurseries from 551 cities in China were recruited and data was collected from 2018 to 2019. Stratified cluster sampling was used to ensure that the study participants were representative of the Chinese population. The China 2018–2019 National Census was used for stratification by geographic region, age, sex, and socioeconomic status. Children were excluded from the study if they had severe visual, hearing, intellectual impairments, cerebral palsy or other severe developmental disorders including autism spectrum disorder. A total of 114,311 children with complete information on personal characteristics were included in the final analysis (Figure 1).

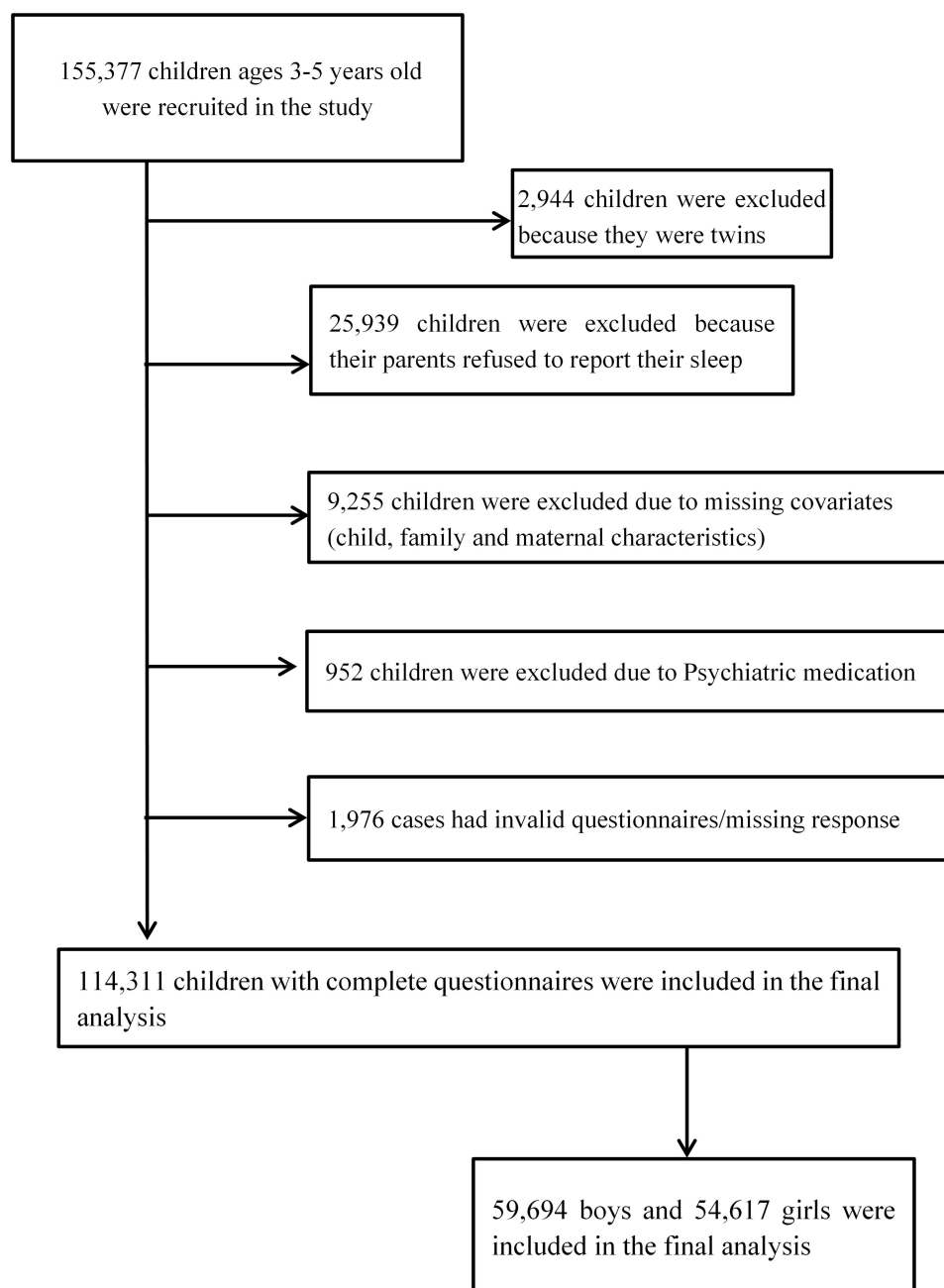


Figure 1 Flowchart of the study population.

Outcomes

Sleep disorders of the children were assessed using the Children's Sleep Habits Questionnaire (CSHQ)⁵ filled out by parents. The CSHQ is a widely used scale to measure the frequency of behaviours associated with common pediatric sleep difficulties, which has acceptable reliability and validity in Chinese children⁶. The 33 parent-rated items of the questionnaire are grouped into eight subscales: Bedtime Resistance, Sleep Onset Delay, Sleep Duration, Sleep Anxiety, Night Wakings, Parasomnias, Sleep Disordered Breathing, and Daytime Sleepiness. All eight subscales' ratings are summed to create a total sleep disorder index. A higher CSHQ score indicates more sleep difficulties, and a total score of over 41 indicates a pediatric sleep disturbance.⁵ Daily sleep hours were also reported by parents as the value of $5/7 \times \text{Sleep hours during weekdays} + 2/7 \times \text{Sleep hours at the weekends}$.

Statistical Analysis

Differences in the CSHQ scores, the prevalence of sleep disorder, subscale scores of CSHQ, and daily sleep hours by sex and ages were analyzed using independent t-tests, and Chi-squared tests. A statistical significance level was set at a p -value < 0.05 (two-tailed). The 95% confidence interval of the prevalence of sleep disturbance was calculated using the Wald method.⁷

Results

Of the 114,311 children included in the final analysis, the average daily sleep hours are 10.72 with a standard deviation of 2.69, and 87,773 children (76.78%, 95% CI: 76.54%, 77.03%) were reported to have a sleep disorder. Bedtime Resistance was reported most frequently as a problem in Chinese children's sleep (97.00%, 95% CI: 96.90%, 97.10%), other sleep problems including Daytime Sleepiness (77.68%, 95% CI: 77.43%, 77.92%), Sleep Duration (70.24%, 95% CI: 69.97%, 70.50%), Parasomnia (58.52%, 95% CI: 58.23%, 58.80%), Sleep Anxiety (55.53%, 95% CI: 55.24%, 55.81%), Sleep Onset Delay (51.99%, 95% CI: 51.70%, 52.28%), Night Wakings (30.37%, 95% CI: 30.10%, 30.63%) and Sleep Disordered Breathing (21.86%, 95% CI: 21.62%, 22.09%).

Table 1 shows the CSHQ scores and the prevalence of sleep disorder by sex and age. Girls had higher total scores of CSHQ and had a higher prevalence of sleep disorder. Girls also had more problems on subscales of Sleep Duration, Daytime Sleepiness, and Sleep Anxiety, and fewer problems with Bedtime Resistance, Parasomnia, and Sleep Disordered Breathing than boys. The daily sleep hours, and the subscores of Sleep Onset Delay or Night Wakings were not influenced by sex (each $p > 0.05$) (Table 1). Younger children had more disturbances than the older ones, reflected in the total score, the subscores of Sleep Onset Delay, Night Wakings, and Parasomnia. Younger children had longer daily

Table 1 The Sex and Age-Specific Sleep Problems in Preschool Children (n=114,311)

Characteristics	Total	Sex			Age (Years Old)			
		Boys	Girls	p	3	4	5	p
Daily sleep hours Mean (SD)	10.72(2.69)	10.71(2.696)	10.72(2.689)	0.669	10.81(2.631)	10.71(2.685)	10.61(2.768)	<0.001
Sleep disorder prevalence % (95% CI)	76.78 (76.54, 77.03)	76.45 (76.11, 76.79)	77.15 (76.80, 77.50)	0.005	78.41 (77.99, 78.82)	77.45 (77.06, 77.84)	73.99 (73.52, 74.47)	<0.001
CSHQ Score Mean (SD)								
Total	46.71(7.58)	46.64(7.57)	46.78(7.59)	0.001	46.86(7.25)	46.78(7.5)	46.42(7.97)	<0.001
Bedtime resistance	11.12(2.26)	11.15(2.25)	11.09(2.20)	<0.001	11.40(2.18)	11.16(2.231)	10.75(2.34)	<0.001
Sleep onset delay	1.65(0.70)	1.65(0.70)	1.65(0.70)	0.302	1.68(0.70)	1.65(0.69)	1.61(0.69)	<0.001
Sleep duration	4.79(1.51)	4.78(1.51)	4.8(1.51)	0.019	4.69(1.50)	4.80(1.51)	4.90(1.52)	<0.001
Sleep anxiety	4.79(1.51)	4.78(1.51)	4.8(1.51)	0.009	4.69(1.50)	4.80(1.51)	4.90(1.52)	<0.001
Night wakings	3.58(1.12)	3.59(1.12)	3.58(1.12)	0.244	3.65(1.12)	3.57(1.10)	3.53(1.12)	<0.001
Parasomnia	8.58(2.27)	8.61(2.28)	8.56(2.27)	<0.001	8.66(2.19)	8.55(2.26)	8.54(2.38)	<0.001
Sleep-disordered breathing	3.37(0.95)	3.4(0.96)	3.35(0.94)	<0.001	3.34(0.88)	3.37(0.95)	3.41(1.031)	<0.001
Daytime sleepiness	10.77(2.66)	10.63(2.65)	10.91(2.67)	<0.001	10.62(2.66)	10.84(2.66)	10.84(2.66)	<0.001

Abbreviations: CSHQ, children's sleep habit questionnaire; SD, standard deviation.

sleep hours, and fewer problems with Bedtime Resistance, Sleep Duration, Sleep Anxiety, Sleep Disordered Breathing, and Daytime Sleepiness (each $p < 0.05$) (Table 1).

Discussion

The prevalence of sleep disorders in healthy Chinese preschoolers was reported in the current study with a large nationally representative sample. Sleep disorder defined with a CSHQ score was found to be prevalent in 76.78% of Chinese preschoolers. Bedtime resistance was reported as the most frequently reported sleep problem by parents of Chinese children.

The remarkably high incidence of CSHQ-indicated sleep disorder is consistent with previous studies using the CSHQ which also reported a very high prevalence of sleep disorders in Japanese preschoolers and Chinese preschoolers with smaller multi-regional samples,⁸ but higher than the reports in western culture.^{9–11} The clinical cutoff for a global sleep disorder on the CSHQ was based on data obtained from American children,⁵ and our results suggest the cultural features in the sleep behaviours of children, and a local standard may be required when using the CSHQ to define sleep disorders in Chinese children. The CSHQ is a widely used tool in clinical settings to screen children's sleep problems including in China, and our results suggested that the CSHQ should be used with great caution, especially in preschoolers considering the very high incidence of sleep disorder in Chinese children as defined by the CSHQ. Previous studies reported that environmental factors such as air pollution¹² and co-sleeping¹³ may be the reasons explaining the cultural differences in childhood sleep patterns. However, what is considered normal sleep by parents in different cultures, and both subjective and objective sleep measurements with cross-culture populations should also be further investigated for a better understanding of cultural influences on sleep.

Child age was associated with almost all sleep problems. Specific sleep disturbances in Sleep Onset Delay, Night Wakings and Parasomnia were more common in younger children; and Bedtime Resistance, Sleep Duration, Sleep Anxiety, Sleep Disordered Breathing and Daytime Sleepiness were more prevalent in older children, which might reflect the child's normal development. Girls had a higher prevalence of sleep disorder and generally experienced more sleep problems than boys but not in all areas. This demonstrated important features in the sleep patterns of Chinese children. Future research should be conducted to investigate the mechanism underlying age- and sex-variance of sleep to examine if it is necessary to develop the sex- and age-specific norms for the CSHQ.

The current study was the first to report the national prevalence of sleep disorder in preschoolers with a large national representative sample. However, our study also had the limitation. In our study, the parent-filled CSHQ was used to measure sleep disorder which may lead to subjective bias or inaccuracy. Thus, large-scale studies using objective measures of sleep instead of parent reports would add substantially to the theoretical and practical utility of future findings.

Conclusion

The high prevalence of sleep disorders in healthy Chinese preschoolers is comparable to the percentages previously reported in East Asia but remarkably higher than in Western countries. Specific sleep problems of Chinese preschoolers vary from other cultures. An in-depth investigation into the reasons for these cultural sleep differences in children should be conducted in future research using a culturally sensitive and comparable approach to ensure appropriate supportive intervention. Our study also emphasized the importance to include the establishment of culturally appropriate norms in studying child sleep.

Data Sharing Statement

The datasets analysed in the current study are available from the corresponding authors on reasonable request.

Ethics Approval and Consent to Participate

The study was approved by the Ethics Committee of Shanghai First Maternity and Infant Hospital (KS18156). All information acquired was kept confidential and was only accessible to the researchers.

Funding

This study was supported by the National Science Foundation of China (81673179), the Science and Technology Commission of Shanghai Municipality (18140903100, 19140903100), Shanghai Municipal Health Commission (2020YJZX0213), Pudong Municipal Health Commission (PW2020D-11).

Disclosure

The authors report no conflicts of interest in this work.

References

1. Carter KA, Hathaway NE, Lettieri CF. Common sleep disorders in children. *Am Fam Physician*. 2014;89(5):368–377.
2. Owens JA. Sleep in children: cross-cultural perspectives. *Sleep Biol Rhythms*. 2004;3(2):165–173. doi:10.1111/j.1479-8425.2004.00147.x
3. Hua J, Barnett AL, Williams GJ, et al. Association of Gestational Age at Birth With Subsequent Suspected Developmental Coordination Disorder in Early Childhood in China. *JAMA Netw Open*. 2021;4(12):e2137581. doi:10.1001/jamanetworkopen.2021.37581
4. Lyu J, Groeger JA, Barnett AL, et al. Associations between gestational age and childhood sleep: a national retrospective cohort study. *BMC Med*. 2022;20(1):253. doi:10.1186/s12916-022-02443-9
5. Owens JA, Spirito A, McGuinn M. The Children's Sleep Habits Questionnaire (CSHQ): psychometric properties of a survey instrument for school-aged children. *Sleep*. 2000;23(8):1043–1051. doi:10.1093/sleep/23.8.1d
6. Liu Z, Wang G, Tang H, Wen F, Li N. Reliability and validity of the Children's Sleep Habits Questionnaire in preschool-aged Chinese children. *Sleep Biol Rhythms*. 2015;12(3):548.
7. Newcombe RG. Two-sided confidence intervals for the single proportion: comparison of seven methods. *Stat Med*. 1998;17(8):857–872. doi:10.1002/(SICI)1097-0258(19980430)17:8<857::AID-SIM777>3.0.CO;2-E
8. Takahashi M, Wang G, Adachi M, et al. Differences in sleep problems between Japanese and Chinese preschoolers: a cross-cultural comparison within the Asian region. *Sleep Med*. 2018;48:42–48. doi:10.1016/j.sleep.2017.11.1145
9. Lionetti F, Dellagiulia A, Verderame C, et al. The Children's Sleep Habits Questionnaire: identification of sleep dimensions, normative values, and associations with behavioral problems in Italian preschoolers. *Sleep Health*. 2021;7(3):390–396. doi:10.1016/j.sleh.2021.03.002
10. Sneddon P, Peacock GG, Crowley SL. Assessment of sleep problems in preschool aged children: an adaptation of the children's sleep habits questionnaire. *Behav Sleep Med*. 2013;11(4):283–296. doi:10.1080/15402002.2012.707158
11. van Litsenburg RR, Waumans RC, van den Berg G, Gemke RJ. Sleep habits and sleep disturbances in Dutch children: a population-based study. *Eur J Pediatr*. 2010;169(8):1009–1015. doi:10.1007/s00431-010-1169-8
12. Cai J, Shen Y, Zhao Y, et al. Early Life Exposure to PM2.5 and Sleep Disturbances in Preschoolers from 551 Cities of China. *Am J Respir Crit Care Med*. 2022. doi:10.1164/rccm.202204-0740OC
13. Li S, Jin X, Yan C, Wu S, Jiang F, Shen X. Bed- and room-sharing in Chinese school-aged children: prevalence and association with sleep behaviors. *Sleep Med*. 2008;9(5):555–563. doi:10.1016/j.sleep.2007.07.008

Nature and Science of Sleep

Dovepress

Publish your work in this journal

Nature and Science of Sleep is an international, peer-reviewed, open access journal covering all aspects of sleep science and sleep medicine, including the neurophysiology and functions of sleep, the genetics of sleep, sleep and society, biological rhythms, dreaming, sleep disorders and therapy, and strategies to optimize healthy sleep. The manuscript management system is completely online and includes a very quick and fair peer-review system, which is all easy to use. Visit <http://www.dovepress.com/testimonials.php> to read real quotes from published authors.

Submit your manuscript here: <https://www.dovepress.com/nature-and-science-of-sleep-journal>