24-HOUR MOVEMENT BEHAVIORS AND COGNITIVE MEASURES IN PRESCHOOL CHILDREN WITH DEVELOPMENTAL DIFFERENCES: A SCOPING REVIEW

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INTRODUCTION

- Preschool years include sensitive periods for cognitive development, influencing school readiness and long-term developmental outcomes (1).
- 24-hour movement behaviors (physical activity, sedentary behavior, and sleep) are associated with cognitive outcomes in children and adolescents (2-3).
- Emerging evidence suggests these relations may also be important during the preschool years (4-5).
- Little research has examined these associations in preschoolers with developmental disabilities, despite the potential to inform early, inclusive interventions that support cognitive development.

PURPOSE: This scoping review aimed to determine the influence of 24-hour movement behaviors on behavioral and neural measures of cognition in preschool children with developmental disabilities.

METHODS

PROTOCOL

1. Development → 2. Search → 3. Screening → 4. Synthesis

CRITERIA

Population
- Human participants
- 33 to 72 months
- Developmental differences

Exposure
- At least one 24-hour movement behavior (activity, sedentary, or sleep)

Outcome
- Behavioral measure of cognition, &/or
- Neural measure of cognition

Other
- Original researchl study
- Peer-reviewed journal
- In English

PRISMA DIAGRAM

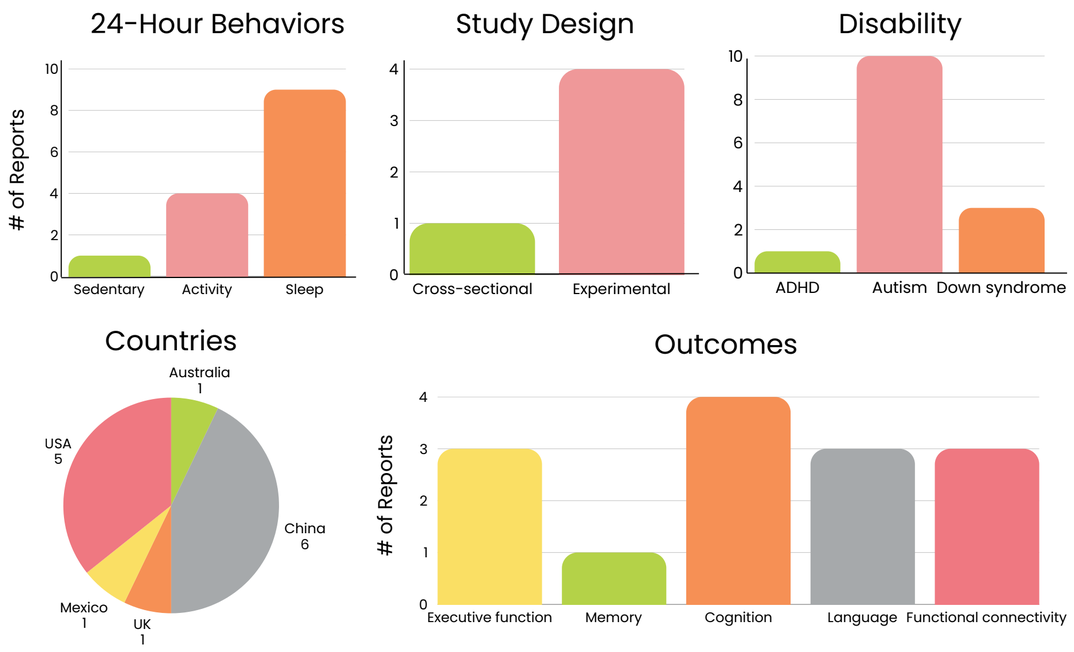
Identification
- Studies from 8 databases & registries = 19,598
- Other sources = 12
- Duplicates removed = 7,419

Screening
- Titles & abstracts screening = 12,191
- Full-text screened = 887
- Initially included = 223

Included
- Included reports = 14
- Publication dates = 2003 to 2025
- Sample sizes = 24 to 679

RESULTS

DESCRIPTIVE SUMMARIES



ANALYTIC SYNTHESES

Cross-sectional Studies

Behavior	Sample	Outcome	Associations
Sed. (6)	ASD	Hearing & speech	●
Sleep (7-8)	DS	Language	● ●
Sleep (9)	ADHD	Executive function	●
Sleep (10-13)	ASD	Cognition	● ● ●
Sleep (14)	ASD	Structural brain network	●

Experimental Studies

Behavior	Sample	Design	Outcome	Effects
Sleep (15)	DS	Cross-over	Memory	●
Sleep (16)	DS	Cross-over	Memory	●
Activity (17)	ASD	3-arm RCT	Executive function	●
Activity (18)	ASD	2 arm-quasi	EC network	●
Activity (19)	ASD	2 arm-quasi	Regional homo-geneity	●

● No association/effect ● One association/effect ● 2+ associations/effects ● Non-beneficial effect

CONCLUSIONS

- Movement behaviors were associated with cognitive outcomes, but patterns differed between children with and without developmental disabilities.
- Research examining multiple movement behaviors together is limited, restricting understanding of their combined effects on cognition.
- Future studies should consider the full 24-hour movement profile to inform early, developmentally tailored strategies for supporting cognitive health.

REFERENCES

1. Brown TT, Jernigan TL. Brain development during the preschool years. Neuropsychol Rev. 2012;22(4):313–33.
2. Donnelly JE, Hillman CH, Castelli D, Etnier JL, Lee S, Tomporowski P, et al. Physical activity, fitness, cognitive function, and academic achievement in children: A systematic review. Med Sci Sports Exerc. 2016;48(6):1197–222.
3. Chaput JP, Colley RC, Aubert S, Carson V, Janssen I, Roberts KC, et al. Proportion of preschool-aged children meeting the Canadian 24-Hour Movement Guidelines and associations with adiposity: Results from the Canadian Health Measures Survey. BMC Public Health. 2017;17(Suppl 5).
4. St. Laurent CW, Burkart S, Andre C, Spencer RMC. Physical Activity, Fitness, School Readiness, and Cognition in Early Childhood: A Systematic Review. J Phys Act Health. 2021;18(8):1004–13.
5. Chaput JP, Gray CE, Poitras VJ, Carson V, Gruber R, Birken CS, et al. Systematic review of the relationships between sleep duration and health indicators in the early years (0–4 years). BMC Public Health. 2017;17(5):855.
6. Peng X, Xue Y, Dong H, Ma C, Jia F, Du L. A study of the effects of screen exposure on the neuropsychological development in children with autism spectrum disorders based on ScreenQ. BMC Pediatr. 2024;24(1).
7. Arias-Trejo N, Angulo-Chavira AQ, Demara B, Figueroa C, Edgin J. The influence of sleep on language production modalities in preschool children with Down syndrome. J Sleep Res. 2021;30(3).
8. Edgin JO, Tooley U, Demara B, Nyhuis C, Anand P, Spanò G. Sleep Disturbance and Expressive Language Development in Preschool-Age Children With Down Syndrome. Child Dev. 2015; 86(6):1984–98.
9. Lam JTY, Dupaul GJ, Kern L, Dever B v. Parenting, self-regulation, and sleep in young children at-risk for attention-deficit/hyperactivity disorder. J Pediatr Psychol. 2025;50(4):335–45.
10. Roussis S, Richdale AL, Katz T, Malow BA, Barbaro J, Sadka N. Behaviour, cognition, and autism symptoms and their relationship with sleep problem severity in young children with autism spectrum disorder. Res Autism Spectr Disord. 2021;83.
11. Joyce A, Dimitriou D. Sleep-disordered breathing and cognitive functioning in preschool children with and without Down syndrome. Journal of Intellectual Disability Research. 2017; 61(8):778–91.
12. Farmer CA, Chilakamarri P, Thurm AE, Swedo SE, Holmes GL, Buckley AW. Spindle activity in young children with autism, developmental delay, or typical development. Neurology. 2018; 91(2):e112–22.
13. O'Brien LM, Holbrook CR, Mervis CB, Klaus CJ, Bruner JL, Raffield TJ, et al. Sleep and Neurobehavioral Characteristics of 5- to 7-Year-Old Children With Parentally Reported Symptoms of Attention-Deficit/Hyperactivity Disorder. Pediatrics. 2003;111(3): 554-563.
14. Bai M, Xiao J, Zhao T, Chen R, Xue Y, Mohamed ZA, et al. Associations between sleep problems, cortical morphometry, and structural brain network organization in preschool children with autism: a retrospective observational study. Eur J Pediatr. 2025;184(8).
15. Spanò G, Gómez RL, Demara BI, Alt M, Cowen SL, Edgin JO. REM sleep in naps differentially relates to memory consolidation in typical preschoolers and children with Down syndrome. Proc Natl Acad Sci U S A. 2018;115(46):11844–9.
16. Wang JG, Cai KL, Liu ZM, Herold F, Zou L, Zhu LN, et al. Effects of mini-basketball training program on executive functions and core symptoms among preschool children with autism spectrum disorders. Brain Sci. 2020;10(5).
17. Zhang Y, Tian H, Tao Y, Li Y, Wang D, Qin L. A study on the effects of three game intervention programs on executive functions of preschool autistic children. Int J Dev Disabil. 2025;71(1):168–78.
18. Yang S, Liu Z, Xiong X, Cai K, Zhu L, Dong X, et al. Effects of mini-basketball training program on social communication impairment and executive control network in preschool children with autism spectrum disorder. Int J Environ Res Public Health. 2021;;18(10).
19. Yang Y, Chen D, Cai K, Zhu L, Shi Y, Dong X, et al. Effects of mini-basketball training program on social communication impairments and regional homogeneity of brain functions in preschool children with autism spectrum disorder. BMC Sports Sci Med Rehabil. 2024;16(1).

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