



# Meeting new Canadian 24-Hour Movement Guidelines and associations with adiposity among toddlers living in Edmonton, Canada

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## Abstract

**Background:** Canada has recently released guidelines that include toddler-specific recommendations for physical activity, screen-based sedentary behaviour, and sleep. This study examined the proportions of toddlers meeting the new Canadian 24-Hour Movement Guidelines for the Early Years (0–4 years) and associations with body mass index (BMI) z-scores in a sample from Edmonton, Canada.

**Methods:** Participants included 151 toddlers (aged  $19.0 \pm 1.9$  months) for whom there was complete objectively measured physical activity data from the Parents' Role in Establishing healthy Physical activity and Sedentary behaviour habits (PREPS) project. Toddlers' physical activity was measured using ActiGraph wGT3X-BT monitors. Toddlers' screen time and sleep were measured using the PREPS questionnaire. Toddlers' height and weight were objectively measured by public health nurses and BMI z-scores were calculated using World Health Organization growth standards. Meeting the overall 24-Hour Movement Guidelines was defined as:  $\geq 180$  min/day of total physical activity, including  $\geq 1$  min of vigorous physical activity. Based on the findings of this study, identifying modifiable correlates of screen time to inform appropriate strategies to reduce screen time appears key for increasing the proportion of toddlers meeting the 24-Hour Movement Guidelines for the Early Years. Future research should examine the associations between meeting the new guidelines and other health indicators. Furthermore, future high-quality studies examining dose-response relationships between movement behaviours and health indicators are needed to inform guideline updates.

**Keywords:** Physical activity, Sedentary behaviour, Sleep, Guidelines, Toddlers, Body mass index

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## Background

(0–4 years)

1. 2–8,

2. 3, 5–8, 10, 11.

12, 13,

2012 14, 15.

16, 17.

18

19

18, 19.

20.

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5,

6, 7,

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*24-Hour Movement Guidelines,*



... ..  
... ..  
... ..  
... ..  
... ..  
... ..

**Sleep duration**

... ..  
... ..  
(... ..)  
... ..  
... ..  
... ..



15.2% ... 82.1%  
 ... **A** ... 11.5%  
 ... 15.2%  
 ... 81.5%  
 ... 11.5%  
 ... ( ... )  
 ... 72.5%  
 ... 15.2%  
 ... 148 ...  
 151 ... 12-23 ...  
 ... 2 ...  
 ... ( ... ≥60 ... **A** ... )  
 ... ≥180 ... **A** ... ≥20, ≥30,  
 ≥45, ... ≥60 ... **A** ... 55.3%, 54.7%,  
 78.1%, ... 44.4%

2.

Table 2 Associations between meeting the combinations of the 24-Hour Movement Guidelines and adiposity among toddlers (n = 134)

Meeting recommendations	BMI z-score	
	Unadjusted B (95% CI)	Adjusted B (95% CI)
Specific combinations of movement behaviours		
Physical activity + screen time + sleep		
Not met	Reference	Reference
Met	0.268 (-0.375, 0.910)	0.198 (-0.468, 0.863)
At least physical activity + screen time		
Not met	Reference	Reference
Met	0.181 (-0.400, 0.762)	0.047 (-0.559, 0.653)
At least physical activity + sleep		
Not met	Reference	Reference
Met	0.130 (-0.399, 0.659)	0.230 (-0.316, 0.776)
At least screen time + sleep		
Not met	Reference	Reference
Met	0.268 (-0.375, 0.910)	0.198 (-0.468, 0.863)
At least physical activity		
Not met	Reference	Reference
Met	0.919 (-1.434, 3.272)	0.391 (-2.064, 2.846)
At least screen time		
Not met	Reference	Reference
Met	0.181 (-0.400, 0.762)	0.047 (-0.559, 0.653)
At least sleep		
Not met	Reference	Reference
Met	0.087 (-0.451, 0.625)	0.222 (-0.339, 0.783)
General combinations of movement behaviours		
All three	Reference	Reference
Two out of three	-0.254 (-0.905, 0.398)	-0.175 (-0.851, 0.502)
One out of three	-0.335 (-1.139, 0.468)	-0.302 (-1.126, 0.522)
None	NA	NA

15% (44%) 60 1 34% 15% (55%) 24 30

(0.5%–6.5%)  
 43 80%  
 24, 37, 44  
 45  
 46  
 46, 47  
 48  
 60  
 45  
 (82%)  
 24-Hour Movement Guidelines. 202  
 , 7.7% 30  
 24-Hour Movement Guidelines  
 18, 15, 66.0%  
 50, 66.2% 523 28, 85.5%  
 2800 25  
 51

... ( ) ...  
... 52, 53 ...  
... 15% ...  
... ( , 21.5% ...



1. The first part of the document is a list of names and their corresponding page numbers. The names are listed in a single column, and the page numbers are listed in a second column to the right of the names. The names are: A. B. C. D. E. F. G. H. I. J. K. L. M. N. O. P. Q. R. S. T. U. V. W. X. Y. Z. The page numbers are: 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100. The names and page numbers are listed in a single column, and the page numbers are listed in a second column to the right of the names.

**A**

BMI: Body mass index; ICC: Intraclass correlation; LPA: Light-intensity physical activity; MVPA: Moderate- to vigorous-intensity physical activity; PREPS: Parents' Role in Establishing healthy Physical activity and Sedentary behaviour habits; TPA: Total physical activity; WHO: World Health Organization

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**F**

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The data set for the current study is available from the corresponding author upon reasonable request.

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EL analyzed the data, and led the interpretation of the results as well as the writing of the paper. VC conceived and designed the study, secured funding, oversaw the study's conduct, conducted the data reduction of accelerometry data, and assisted with the interpretation of results and writing of the paper. SH and NK helped with data collection. All authors critically revised the paper for important intellectual content, and read and approved the final manuscript.

**E**

Ethics approval was obtained from the University of Alberta Human Research Ethics Board, and all participating parents provided written informed consent.

**C**

Not applicable.

**C**

The authors declare that they have no competing interests.

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