ENCYCLOPEDIA
on Early Childhood
Development

PHYSICAL ACTIVITY

Levels of Habitual Physical Activity in Early Childhood

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Introduction

Preventable lifestyle diseases continue to be major contributors to the burden of disease internationally.[1] Physical inactivity is a key contributing risk factor[2] that has a global economic burden in excess of $(INT$) 50 billion.[3] Intervention during the earliest developmental years might be required to ensure health promoting behaviours, such as physical activity, are established.[4] Despite being the most active segment of the population, monitoring studies suggest that many young children may be insufficiently active for adequate development and health.[5-8]

Subject

Physical activity is typically categorized into different intensities and is measured in metabolic equivalents (METs; 1 MET is equivalent to rest).[9] Light intensity physical activities (1.5-3.9 METs) for young children include dressing up in costumes, standing and painting, and slow walking. Moderate-to-vigorous physical activities (MVPA)(≥4 METs) include those of a higher intensity, such as running, jumping, and playing ball games. Sedentary behaviours (<1.5 METs) are those characterized by sitting or lying down, and include using electronic devices to watch

entertainment programs or play electronic games, reading, and drawing. Young children's natural activity patterns are described as intermittent, and are characterized by cycles of short intense bursts of activity followed by periods of rest or lower intensity activity.[10] This activity predominantly occurs through active play[11] rather than exercise.

Physical activity has beneficial effects on health and development in the early years of life and contributes to improved motor and cognitive development, fitness, and psychosocial, cardiometabolic, bone and skeletal health.[12] Activity patterns also appear to track during childhood,[13] and from childhood and adolescence to adulthood,[14] suggesting that early life experiences of physical activity may shape later behaviour and subsequent health.

Although there is evidence that more physical activity is better for health, there is insufficient evidence of the precise "dose" or amount and intensity of physical activity required for adequate health and development in early childhood.[12] For this reason, the amount of physical activity specified in recommendations for infants (<1 year), toddlers (1 to 3 years) and preschoolers (3 to 4[15] or 5 years[16]) differs between the United States[17] and other countries such as Canada[15] and Australia.[16] U.S. guidelines[17] recommend that "preschool-aged children should be physically active throughout the day to enhance growth and development", but do not specify the duration or intensity of physical activity. Guidelines released in Canada[15] and Australia[16], as well as those by the World Health Organization,[18] combine physical activity recommendations for the early years with recommendations for sleep and sedentary behaviour. These guidelines, which differ by developmental stage, recommend that:

- infants (less than 1 year) who are not yet mobile should accumulate at least 30 min per day in the prone position (tummy time) spread throughout the day while awake;
- children 1-2 years of age should spend at least 180 minutes per day in a variety of types of physical activities at any intensity, including moderate- to vigorous-intensity physical activity, spread throughout the day;
- children 3-4 years of age should spend at least 180 minutes per day in a variety of types of physical activities at any intensity, of which at least 60 minutes is moderate- to vigorous-intensity physical activity, spread throughout the day.

Problems and Research Context

Difficulties in accurately measuring the unique physical activity patterns of young children have delayed progress in this area. Self-reports are inappropriate and parent-proxy reports have inherent biases.[19,20] In part, this is because young children's physical activity does not occur in easily distinguishable blocks of exercise as is typical among adults. Direct observation offers a more objective approach, however this is only appropriate for confined settings, such as the child care centre/preschool.[19,20] Accelerometers are feasible, acceptable and have adequate validity and reliability for assessing physical activity among youth, and because they collect objective, real-time data and are adequately sensitive to low intensity movements they are particularly suitable for use with young children.[21] One limitation of accelerometry is that different cut-point definitions for defining sedentary behaviour, light physical activity and MVPA are often used in studies of young children, and the use of different definitions can have substantial effects on prevalence estimates.[22,23] Cross-validation studies have been conducted in toddlers[24] and preschoolers[25,26] in an effort to achieve consensus on the most accurate cut-point definitions for commonly used accelerometers in young children. Key Research Questions

Research using accelerometry has investigated young children's habitual physical activity levels over the course of a typical week. These studies have also attempted to quantify the amount of time preschoolers spend in light physical activity and MVPA, and have investigated compliance with physical activity guidelines.

Recent Research Results

Findings from studies using accelerometry offer important insights into young children's physical activity patterns. Studies among toddlers from Canada and Australia provided almost identical findings in that toddlers spent approximately 60 minutes per day in MVPA and approximately 240 minutes per day in light physical activity.[5,6] Consequently, 97%-99% of toddlers met physical activity guidelines of at least 180 min per day of physical activity of any intensity.[5,6]

Studies in preschool children have been less consistent. Using similar methods to those used among toddlers, one Australian study reported that 3- to 5-year-old preschoolers spent approximately 100 minutes per day in MVPA and approximately 270 minutes per day in light physical activity.[8] In that study, 93% of preschoolers met the physical activity guideline of at least 180 min per day of physical activity including at least 60 min of MVPA.[8] In contrast, a nationally-representative study of Canadian 3- to 4-year-old preschool children used different methodologies for assessing physical activity and reported that children spent approximately 68 minutes per day

in MVPA and approximately 210 minutes per day in light physical activity.[7] In that study, 62% of preschoolers met the physical activity guideline of at least 180 min per day of physical activity including at least 60 min of MVPA.[7] Methodological issues, such as the application of different measurement instruments and the use of different definitions for physical activity intensities are likely to contribute to this variation between studies[8] and continue to influence our understanding of physical activity patterns during the early years.

Research Gaps

To our knowledge, only Canada has nationally-representative accelerometer data among 3- to 4-year-old children to describe levels of objectively-measured physical activity. National monitoring surveys are urgently needed to understand more precisely how active young children are, and to ascertain the proportion of the early childhood population achieving the recommended amount of physical activity each day. Very little data are currently available for children under 3 years of age, and it is unclear if specific socio-demographic groups are in particular need of support to meet guidelines. Despite the existence of guidelines, there is not yet consensus on the precise amount and intensity of physical activity required for optimum health and development in the early years, resulting in different recommendations in different countries. Thus, research on the relationships between objectively measured physical activity and developmental and health outcomes is still needed.

Conclusions

Physical activity plays an important role in young children’s health and development, however contemporary lifestyles and environments appear to be preventing some young children from engaging in adequate levels of physical activity. As the origins of an active lifestyle begin in the early years of life, physical inactivity during early childhood has consequences for children’s current and future health, behaviour, social and emotional development, and cognitive function.

Implications for Parents, Services and Policy

Influential people and institutions in the lives’ of young children must ensure they receive adequate opportunities to engage in the recommended amount of developmentally-appropriate and health-enhancing physical activity. This should occur through unstructured active play and structured learning experiences, in the home and child care centres, through active transportation, and in socially- and culturally-accepted and enjoyable ways. National surveillance

systems are required to accurately describe children's activity levels and patterns during the early years and to determine if targeted interventions are required for specific segments of the population.

References

1. Roth GA, Abate D, Abate KH, et al. Global, regional, and national age-sex-specific mortality for 282 causes of death in 195 countries and territories, 1980–2017: a systematic analysis for the Global Burden of Disease Study 2017. *The Lancet* 2018;392(10159):1736-1788.
2. World Health Organization. *Global health risks: mortality and burden of disease attributable to selected major risks.* World Health Organization; 2009.
3. Ding D, Lawson KD, Kolbe-Alexander TL, et al. The economic burden of physical inactivity: a global analysis of major non-communicable diseases. *The Lancet* 2016;388(10051):1311-1324.
4. National Preventative Health Taskforce Alcohol Working Group. Australia: the healthiest country by 2020. In: Commonwealth of Australia Canberra; 2009.
5. Lee E-Y, Hesketh KD, Hunter S, et al. Meeting new Canadian 24-Hour Movement Guidelines for the Early Years and associations with adiposity among toddlers living in Edmonton, Canada. *BMC Public Health* 2017;17(5):840.
6. Santos R, Zhang Z, Pereira JR, Sousa-Sá E, Cliff DP, Okely AD. Compliance with the Australian 24-hour movement guidelines for the early years: associations with weight status. *BMC Public Health* 2017;17(5):867.
7. Chaput J-P, Colley RC, Aubert S, 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(5):829.
8. Cliff DP, McNeill J, Vella SA, et al. Adherence to 24-Hour Movement Guidelines for the Early Years and associations with social-cognitive development among Australian preschool children. *BMC Public Health* 2017;17(5):857.
9. Sallis JF, Owen N. Physical activity and behavioural medicine. Thousand Oaks, CA: Sage; 1999.
10. Obeid J, Nguyen T, Gabel L, Timmons BW. Physical activity in Ontario preschoolers: prevalence and measurement issues. *Applied Physiology, Nutrition, and Metabolism* 2011;36(2):291-297.
11. Burdette HL, Whitaker RC. Resurrecting free play in young children: looking beyond fitness and fatness to attention, affiliation, and affect. *Archives of Pediatrics and Adolescent Medicine* 2005;159(1):46-50.
12. Carson V, Lee E-Y, Hewitt L, et al. Systematic review of the relationships between physical activity and health indicators in the early years (0-4 years). *BMC Public Health* 2017;17(5):854.
13. Jones RA, Hinkley T, Okely AD, Salmon J. Tracking physical activity and sedentary behavior in childhood: a systematic review. *American Journal of Preventive Medicine* 2013;44(6):651-658.
14. Telama R, Yang X, Viikari J, Valimaki I, Wanne O, Raitakari O. Physical activity from childhood to adulthood: a 21-year tracking study. *American Journal of Preventive Medicine* 2005;28(3):267-273.
15. Tremblay MS, Chaput JP, Adamo KB, et al. Canadian 24-Hour Movement Guidelines for the Early Years (0-4 years): An Integration of Physical Activity, Sedentary Behaviour, and Sleep. *BMC Public Health* 2017;17.
16. Okely AD, Ghersi D, Hesketh KD, et al. A collaborative approach to adopting/adapting guidelines - The Australian 24-Hour Movement Guidelines for the early years (Birth to 5 years): an integration of physical activity, sedentary behavior, and sleep. *BMC Public Health* 2017;17(5):869.
17. Piercy KL, Troiano RP, Ballard RM, et al. The physical activity guidelines for Americans. *JAMA* 2018;320(19):2020-2028.

18. World Health Organization. *WHO Guidelines on physical activity, sedentary behaviour and sleep for children under 5 years of age*. Geneva: World Health Organization; 2019.

19. Oliver M, Schofield GM, Kolt GS. Physical activity in preschoolers: understanding prevalence and measurement issues. *Sports Medicine* 2007;37(12):1045-1070.

20. Trost SG. State of the art reviews: measurement of physical activity in children and adolescents. *American Journal of Lifestyle Medicine* 2007;1(4):299-314.

21. Cliff DP, Reilly JJ, Okely AD. Methodological considerations in using accelerometers to assess habitual physical activity in children aged 0-5 years. *Journal of Science and Medicine in Sport* 2009;12(5):557-567.

22. Cliff DP, Okely AD. Comparison of two sets of accelerometer cut-off points for calculating moderate-to-vigorous physical activity in young children. *Journal of Physical Activity and Health* 2007;4(4):509-513.

23. Beets MW, Bornstein D, Dowda M, Pate RR. Compliance with national guidelines for physical activity in US preschoolers: measurement and interpretation. *Pediatrics* 2011;127(4):658-664.

24. Trost SG, Fees BS, Haar SJ, Murray AD, Crowe LK. Identification and validity of accelerometer cut-points for toddlers. *Obesity* 2012;20(11):2317-2319.

25. Janssen X, Cliff DP, Reilly JJ, et al. Predictive validity and classification accuracy of actigraph energy expenditure equations and cut-points in young children. *PLoS ONE* 2013;8(11).

26. Janssen X, Cliff D, Reilly J, et al. Evaluation of Actical equations and thresholds to predict physical activity intensity in young children. *Journal of Sports Sciences* 2015;33(5):498-506.