

## PHYSICAL ACTIVITY

---

# Interventions to Promote Physical Activity in Young Children

**Stewart G. Trost, PhD**

Queensland University of Technology, Director Institute of Health and Biomedical Innovation (IHBI) at QLD Centre for Children's Health Research, Australia

June 2020, Éd. rév.

### Introduction

Adequate participation in physical activity during early childhood is considered essential for normal growth and development.<sup>1,2</sup> Physical activity is also an important contributing factor in the prevention of overweight and obesity in young children.<sup>1,2</sup> In recognition of the importance of regular physical activity, national guidelines issued recommend all children from birth to age five engage in daily physical activity that promotes health-related fitness and movement skills.<sup>3</sup> Similar recommendations that integrate movement behaviours across a 24 hour-period have been issued by clinicians, researchers and early childhood education stakeholders in Canada,<sup>4</sup> Australia<sup>5</sup> and the United Kingdom.<sup>6</sup> Yet, despite the importance of regular physical activity, objective monitoring studies conducted in North America, Australia and the United Kingdom suggest that less than half of young children meet physical activity recommendations related to participation in daily moderate-to-vigorous physical activity.<sup>7,8</sup>

### Subject

The widespread problem of physical inactivity, taken alongside the continued rise in the prevalence of obesity in children under the age of 5, underscores the need for effective but readily translatable policies and programs to promote physical activity in young children. This brief provides an updated review to summarize current knowledge on interventions to promote physical activity in early childhood settings.

## **Problem**

Despite there being an increased number of rigorously evaluated interventions to promote physical activity in children aged 5 years and under, there remains inconsistent evidence of their effectiveness. The scientific evidence to advise policy makers, service planners and providers suggests that educator led physical activity interventions delivered in centre-based childcare settings may be effective in increasing movement competence and physical activity. However, variations in intervention delivery, fidelity, evaluation methodologies and study outcomes make it difficult to provide explicit recommendations about what works or doesn't work, when it comes to getting young children more physically active.

## **Research Context**

A large percentage of children under the age of 5 are in some type of regular child care arrangement,<sup>9</sup> intervention studies have, therefore, been primarily implemented and tested in center-based early childhood education settings.<sup>10-12</sup> Notably, however, physical activity interventions targeting other types of childcare settings such as family child care homes, and those including parental involvement, are emerging in the research literature with greater regularity.<sup>13-17</sup>

## **Key Research Questions**

Published studies in this area have primarily addressed the question of whether curricula emphasizing structured physical activity, movement skill training or reductions in screen time are effective at increasing physical activity. Other studies have investigated the impact of environmental or policy changes on physical activity levels during childcare.

## **Recent Research Results**

A growing number of studies have employed experimental study designs to evaluate interventions to increase physical activity in young children. Sixteen studies tested the

effectiveness of specialized physical activity curricula or movement training programs.<sup>18-33</sup> Nine additional studies tested multi-component interventions targeting physical activity promoting policies and practices strategies,<sup>34-40</sup> including the effects of increasing free-play opportunities during child care attendance.<sup>41,42</sup>

Of the 16 trials testing curriculum-based approaches, activities ranged from highly prescriptive exercise training regimens (jumping, hopping, skipping, circuit training) to developmentally-appropriate, physically active imagination games.<sup>18-33</sup> Eight of these investigations included strategies to improve fundamental movement skills.<sup>19,22,24,26,27,32</sup> Childcare staff, research staff/experts or a combination of both implemented the planned activity sessions or lessons. Children participated in the intervention activities lessons for as little as 10 to 60 minutes between two and five days per week. The duration of these interventions ranged from 2 days,<sup>25,36</sup> 4- to 8-weeks,<sup>28,31</sup> between 3 and 5 months<sup>18,19,24,26,27,30</sup> and longer interventions of 6 to 18 months.<sup>22,23,37</sup> Accelerometers were used to measure physical activity in 10 of the studies, with nine using count cut offs to categorize time spent in different physical activity intensity levels.<sup>22,23,25,27-31,33</sup> Data collection times included, during child care hours,<sup>21,27,28,33</sup> total daily activity<sup>2,31</sup> or combinations of both.<sup>23,25,29,30</sup>

Of the 16 trials, 10 reported significant increases in physical activity level<sup>21,25,27-30</sup> or significant improvements in fundamental movement skills.<sup>22-24,32</sup> These studies were highly structured interventions that involved repetitive physical activity regimes performed by trained childcare staff who received professional development and ongoing support to implement the programs.

The nine studies that evaluated environmental or policy interventions to promote physical activity have reported mostly positive findings.<sup>34-42</sup> Five studies incorporated modifications to the built environment or outdoor playtime,<sup>34,36-38,41,42</sup> 2 studies included parent involvement,<sup>37,38</sup> and 5 studies incorporated staff training or facilitated feedback to increase implementation of physical activity promoting policies.<sup>35,37,38,40,42</sup> The interventions ranged from 2-5 days,<sup>34,36,39</sup> 8-weeks to 6 months<sup>35,37,38,40-42</sup> and 12 months.<sup>39</sup> One ongoing study plans to report outcomes after 18 months.<sup>40</sup> Eight studies used accelerometers to measure physical activity via count cut offs to categorize time spent in different physical activity intensity levels.<sup>34-38,40-42</sup> Data collection times included during childcare<sup>34,35,37,40,42</sup> and total daily activity.<sup>36,38,41</sup> Significant increases in objectively measured daily physical activity were seen in 5 studies where a focus was primarily on the addition of portable playground equipment, providing multiple bouts of unstructured play, and training teachers to incorporate physical activity into regular learning experiences in literacy, numeracy, and science.<sup>34,35,38,41,42</sup>

## **Research Gaps**

To advance our understanding in this area, some key research questions would include: 1) What are the key behavioural settings for promoting physical activity in young children? 2) Are programs to promote movement or physical activity in infants and toddlers warranted, and if so, what settings and strategies would be effective? 3) Are modifications to the childcare environment such as incorporating natural playground design and improving service provider's physical activity leadership skills effective in increasing physical activity in young children? 4) Are structured physical activity programs led by physical education specialists or community-based physical activity providers feasible, sustainable, and effective in promoting physical activity in other behavior settings? 5) How can childcare providers engage and motivate parents and other caregivers to promote and support physical activity at home?

## **Conclusions**

There is now a significant number of studies examining the effectiveness of interventions to promote physical activity in young children. Overall, the evidence suggests that physical activity interventions implemented in early childhood education and care settings are effective at improving child physical activity levels. The challenge now is determining how such programs can be scaled up and implemented as routine practice in early childhood settings.

The available evidence, although still limited, suggests that simple modifications to the outdoor

play environment such as modified outdoor playtime schedules and the provision of “off the shelf” portable play equipment can increase physical activity behaviour. Additionally, training teachers to incorporate movement into the standard classroom curriculum appears to be effective in increasing physical activity levels during the preschool day. However, providing multiple short bouts of free-play capitalizes on the natural tendency for children to be active at the start of free-play session, and may be a simple option of changing policy and practice without the requirement for additional skills, training expertise or resources for centre staff. Nevertheless, more translational design studies to replicate these results, including ongoing educator support and resources, in larger cluster randomized trials are required. Of note, trials that include multiple constructs of practices or policies, within an intervention, create difficulty to independently assess the effect of a single practice or policy.

To date, providing curricula that offer opportunities for developmentally-appropriate moderate-to-vigorous active play and fundamental movement skill development have moderate effects in promoting physical activity. It may be that such approaches are simply ineffective and that alternative strategies require exploration. Nonetheless, it should be noted that these studies: 1) focused on obesity prevention rather than physical activity, 2) provided activity sessions that were relatively brief in duration (~ 30 min) and low in frequency (three days per week); 3) were implemented over a relatively short time period ( $\leq 6$  months); and 4) employed physical activity measurement protocols with limited sensitivity to detect changes in physical activity behaviour.

Adult-led physical activity programs delivering highly structured exercise training sessions on a daily basis resulted in higher levels of physical activity. However, it is important to note that these studies were primarily exercise training studies in which physical activity was the factor being changed, not the outcome of the change. Thus, it is questionable whether these findings can be generalized to public health approaches to promoting physical activity in young children.

### **Implications for Parents, Services and Policy**

For policy makers and service providers, the extant research literature provides limited guidance as to what approaches are effective in promoting physical activity in young children. The research suggests that training childcare staff to increase opportunities for physical activity in the classroom and during recess may be an effective strategy. The challenges being in intervention compliance, where increased fidelity may result in higher levels of physical activity when outcomes are assessed. Interventions requiring multiple health policies or practices in these

settings may require additional or different types of implementation support. From a public health perspective, the focus on childcare provider training is particularly attractive, since the trainings could be mandated as a licensure requirement and delivered through existing childcare worker education and training networks.

Based on the evidence, policy makers and service providers should be wary of adopting stand-alone curricula offering structured physical activity and movement skill training, as there is mixed evidence to support their effectiveness. However, it should be noted that structured programs are not likely to do harm to young children; and in practice, such programs may offer substantial benefit to children when they are implemented in a responsible, developmentally-appropriate manner.

While the evidence related to physical activity interventions in child care settings is not definitive, it is well-established that parents play a significant role in shaping and supporting their children's physical activity behaviour.<sup>2,13-17,38</sup> In the constraints of evidence-based programs to promote physical activity in childcare settings, parents must be willing to take responsibility for encouraging and supporting their children's physical activity behaviour. The development of programs to educate and support parents in this endeavour should therefore be a priority.

## References

1. Burdette HL, Whitaker RC. Resurrecting free play in young children: looking beyond fitness and fatness to attention, affiliation, and affect. *Archives of Pediatric and Adolescent Medicine*. 2005;159(1):46-50.
2. Hinkley T, Crawford D, Salmon J, Okely AD, Hesketh K. Preschool children and physical activity: a review of correlates. *American Journal of Preventive Medicine*. 2008;34(5):435-41.
3. Goodway J, Getchell N, Raynes D. Active Start: A Statement of Physical Activity Guidelines for Children from Birth to Age 5. Champaign, IL: Human Kinetics; 2009.
4. Tremblay MS, Chaput J-P, Adamo KB, Aubert S, Barnes JD, Choquette L, Duggan M, Faulkner G, Goldfield GS, Gray CE, Gruber R, Janson K, Janssen I, Janssen X, Jaramillo Garcia A, Kuzik N, LeBlanc C, MacLean J, Okely AD, Poitras VJ, Rayner M-E, Reilly JJ, Sampson M, Spence JC, Timmons BW, Carson V. 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(5):874.
5. Okely AD, Ghersi D, Hesketh KD, Santos R, Loughran SP, Cliff DP, Shilton T, Grant D, Jones RA, Stanley RM, Sherring J, Hinkley T, Trost SG, McHugh C, Eckermann S, Thorpe K, Waters K, Olds TS, Mackey T, Livingstone R, Christian H, Carr H, Verreder A, Pereira JR, Zhang Z, Downing KL, Tremblay MS. 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(Suppl 5):869.
6. Gibson-Moore H. UK Chief Medical Officers' physical activity guidelines 2019: What's new and how can we get people more active? *Nutrition Bulletin*. 2019;44(4):320-328.
7. Christian H, Rosenberg M, Trost S, Schipperijn J, Maitland C, Trapp G, Lester L, Boruff B, Thornton A, Zubrick S, Powell J, Wenden E. A snapshot of the PLAYCE project: Findings from the Western Australian PLAY Spaces and Environments for Children's Physical Activity Study. *Supportive Childcare Environments for Physical Activity in the Early Years*

- . Perth, Western Australia: The University of Western Australia, School of Population and Global Health; 2018.
8. Dias KI, White J, Jago R, Cardon G, Davey R, Janz KF, Pate RR, Puder JJ, Reilly JJ, Kipping R. International comparison of the levels and potential correlates of objectively measured sedentary time and physical activity among three-to-four-year-old children. *International Journal of Environmental Research and Public Health*. 2019;16(11):1929.
  9. OECD. Enrolment in childcare and pre-school. Paris: OECD Publishing; 2019.
  10. Ward DS, Vaughn A, McWilliams C, Hales D. Interventions for increasing physical activity at child care. *Medicine and Science in Sports and Exercise*. 2010;42(3):526-534.
  11. Wolfenden L, Jones J, Williams CM, Finch M, Wyse RJ, Kingsland M, Tzelepis F, Wiggers J, Williams AJ, Seward K, Small T, Welch V, Booth D, Yoong SL. Strategies to improve the implementation of healthy eating, physical activity and obesity prevention policies, practices or programmes within childcare services. *The Cochrane database of systematic reviews*. 2016;10:Cd011779.
  12. Stacey FG, Finch M, Wolfenden L, Grady A, Jessop K, Wedesweiler T, Bartlem K, Jones J, Sutherland R, Vandevijvere S, Wu JHY, Yoong SL. Evidence of the potential effectiveness of centre-based childcare policies and practices on child diet and physical activity: consolidating evidence from systematic reviews of intervention trials and observational studies. *Current Nutrition Reports*. 2017;6(3):228-246.
  13. Trost S, Messner L, Fitzgerald K, Roths B. Evaluation of a nutrition and physical activity intervention program for family child care homes. *Obesity*. 2008;16(suppl):S163.
  14. Rice KR, Joschtel B, Trost SG. Validity of family child care providers' proxy reports on children's physical activity. *Childhood Obesity*. 2013;9(5):393-398.
  15. De Bock F, Genser B, Raat H, Fischer JE, Renz-Polster H. A participatory physical activity intervention in preschools: a cluster randomized controlled trial. *American Journal of Preventive Medicine*. 2013;45(1):64-74.
  16. Christian H, Maitland C, Enkel S, Trapp G, Trost SG, Schipperijn J, Boruff B, Lester L, Rosenberg M, Zubrick SR. Influence of the day care, home and neighbourhood environment on young children's physical activity and health: protocol for the PLAYCE observational study. *BMJ open*. 2016;6(12):e014058.
  17. Neshteruk CD, Mazzucca S, Ostbye T, Ward DS. The physical environment in family childcare homes and children's physical activity. *Child: care, health and development*. 2018;44(5):746-752.
  18. Fitzgibbon ML, Stolley MR, Schiffer L, Van Horn L, KauferChristoffel K, Dyer A. Hip-hop to health Jr. for Latino preschool children. *Obesity*. 2006;14(9):1616-1625.
  19. Eliakim A, Nemet D, Balakirski Y, Epstein Y. The effects of nutritional-physical activity school-based intervention on fatness and fitness in preschool children. *Journal of Pediatric Endocrinology & Metabolism*. 2007;20(6):711-718.
  20. Fitzgibbon ML, Stolley MR, Schiffer L, Van Horn L, KauferChristoffel K, Dyer A. Two-year follow-up results for Hip-Hop to Health Jr.: A randomized controlled trial for overweight prevention in preschool minority children. *The Journal of Pediatrics*. 2005;146(5):618-25.
  21. Specker B, Binkley T. Randomized trial of physical activity and calcium supplementation on bone mineral content in 3- to 5-year-old children. *Journal of Bone and Mineral Research*. 2003;18(5):885-92.
  22. Reilly JJ, Kelly L, Montgomery C, Williamson A, Fisher A, McColl JH, Lo Conte R, Paton JY, Grant S. Physical activity to prevent obesity in young children: cluster randomised controlled trial. *Bmj*. 2006;333(7577):1041.
  23. Alhassan S, Nwaokelemeh O, Ghazarian M, Roberts J, Mendoza A, Shitole S. Effects of locomotor skill program on minority preschoolers' physical activity levels. *Pediatric Exercise Science*. 2012;24(3):435-349.
  24. Bellows LL, Davies PL, Anderson J, Kennedy C. Effectiveness of a physical activity intervention for head start preschoolers: a randomized intervention study. *American Journal of Occupational Therapy*. 2013;67(1):28-36.
  25. Van Cauwenberghe E, De Craemer M, De Decker E, De Bourdeaudhuij I, Cardon G. The impact of a teacher-led structured

- physical activity session on preschoolers' sedentary and physical activity levels. *Journal of Science and Medicine in Sport*. 2013;16(5):422-426.
26. Finch M, Wolfenden L, Morgan PJ, Freund M, Jones J, Wiggers J. A cluster randomized trial of a multi-level intervention, delivered by service staff, to increase physical activity of children attending center-based childcare. *Preventive Medicine*. 2014;58:9-16.
  27. Jones RA, Riethmuller A, Hesketh K, Trezise J, Batterham M, Okely AD. Promoting fundamental movement skill development and physical activity in early childhood settings: a cluster randomized controlled trial. *Pediatric Exercise Science*. 2011;23(4):600-615.
  28. Annesi JJ, Smith AE, Tennant GA. Effects of the start for life treatment on physical activity in primarily african american preschool children of ages 3-5 years. *Psychology, Health & Medicine*. 2013;18(3):300-309.
  29. Alhassan S, Nwaokelemeh O, Lyden K, Goldsby T, Mendoza A. A pilot study to examine the effect of additional structured outdoor playtime on preschoolers' physical activity levels. *Child Care in Practice*. 2013;19(1):23-35.
  30. De Craemer M, De Decker E, Verloigne M, De Bourdeaudhuij I, Manios Y, Cardon G. The effect of a kindergarten-based, family-involved intervention on objectively measured physical activity in Belgian preschool boys and girls of high and low SES: the ToyBox-study. *International Journal of Behavioral Nutrition and Physical Activity*. 2014;11(1):38.
  31. O'Dwyer MV, Fairclough SJ, Ridgers ND, Knowles ZR, Fowweather L, Stratton G. Effect of a school-based active play intervention on sedentary time and physical activity in preschool children. *Health Education Research*. 2013;28(6):931-942.
  32. Hardy LL, King L, Kelly B, Farrell L, Howlett S. Munch and Move: evaluation of a preschool healthy eating and movement skill program. *International Journal of Behavioral Nutrition and Physical Activity*. 2010;7:80.
  33. Jones RA, Okely AD, Hinkley T, Batterham M, Burke C. Promoting gross motor skills and physical activity in childcare: A translational randomized controlled trial. *Journal of Science and Medicine in Sport*. 2016;19(9):744-749.
  34. Hannon JC, Brown BB. Increasing preschoolers' physical activity intensities: an activity-friendly preschool playground intervention. *Preventive Medicine*. 2008;46(6):532-536.
  35. Trost SG, Fees B, Dziewaltowski D. Feasibility and efficacy of a "move and learn" physical activity curriculum in preschool children. *Journal of Physical Activity and Health*. 2008;5(1):88.
  36. Alhassan S, Sirard JR, Robinson TN. The effects of increasing outdoor play time on physical activity in Latino preschool children. *International Journal of Pediatric Obesity*. 2007;2(3):153-158.
  37. Bonvin A, Barral J, Kakebeeke TH, Kriemler S, Longchamp A, Schindler C, Marques-Vidal P, Puder JJ. Effect of a governmentally-led physical activity program on motor skills in young children attending child care centers: a cluster randomized controlled trial. *International Journal of Behavioral Nutrition and Physical Activity*. 2013;10:90.
  38. Adamo KB, Wasenius NS, Grattan KP, Harvey ALJ, Naylor P-J, Barrowman NJ, Goldfield GS. Effects of a Preschool Intervention on Physical Activity and Body Composition. *The Journal of Pediatrics*. 2017;188:42-9.e2.
  39. Finch M, Stacey F, Jones J, Yoong SL, Grady A, Wolfenden L. A randomised controlled trial of performance review and facilitated feedback to increase implementation of healthy eating and physical activity-promoting policies and practices in centre-based childcare. *Implementation Science : IS*. 2019;14(1):17.
  40. Okely AD, Stanley RM, Jones RA, Cliff DP, Trost SG, Berthelsen D, Salmon J, Batterham M, Eckermann S, Reilly JJ, Brown N, Mickle KJ, Howard SJ, Hinkley T, Janssen X, Chandler P, Cross P, Gowers F. 'Jump start' childcare-based intervention to promote physical activity in pre-schoolers: six-month findings from a cluster randomised trial. *International Journal of Behavioral Nutrition and Physical Activity*. 2020;17(1):6.
  41. Razak LA, Yoong SL, Wiggers J, Morgan PJ, Jones J, Finch M, Sutherland R, Lecathelnais C, Gillham K, Clinton-McHarg T, Wolfenden L. Impact of scheduling multiple outdoor free-play periods in childcare on child moderate-to-vigorous physical activity: a cluster randomised trial. *International Journal of Behavioral Nutrition and Physical Activity*. 2018;15(1):34.



42. Tucker P, Vanderloo LM, Johnson AM, Burke SM, Irwin JD, Gaston A, Driediger M, Timmons BW. Impact of the Supporting Physical Activity in the Childcare Environment (SPACE) intervention on preschoolers' physical activity levels and sedentary time: a single-blind cluster randomized controlled trial. *International Journal of Behavioral Nutrition and Physical Activity*. 2017;14(1):120.