

Determinants of Change in Physical Activity in Children and Adolescents

A Systematic Review

Christopher Craggs, Msc, Kirsten Corder, PhD, Esther M.F. van Sluijs, PhD, Simon J. Griffin, DM

Appendix A

Criteria used to assess study quality of all studies included in the review.

A	<p>Adequate description of study population Adequate reporting of baseline and follow-up participant characteristics, and physical activity at baseline and follow-up</p> <p>(Positive if information on baseline characteristics—level and/or distribution—of the exposure variables included in the analyses were provided, if the study setting was reported, and if levels of physical activity were reported for all strata at baseline and follow-up)</p>
B	<p>Adequate follow-up and information on representativeness of the study sample at baseline and follow-up, including information on potential systematic dropout</p> <p>(Positive if follow-up rates were documented and if information on characteristics of responders and nonresponders at baseline at follow-up were presented and potential differences statistically tested)</p>
C	<p>Validated measure of physical activity and adequate physical activity measurement</p> <p>(Positive if the same measure of physical activity was employed at both baseline and follow-up and if this method of measuring physical activity was validated and reported/referred to in the relevant age groups at both baseline age and follow-up age)</p>
D	<p>Validated measurement of exposure variables</p> <p>(Positive if standardized questionnaires and/or validated measures were used to assess exposure variables and were reported/referred to)</p>
E	<p>Potential confounders and sources of bias considered in analyses</p> <p>(Positive if statistical analyses have been adjusted for known or potential confounders; for instance, if multilevel modeling was employed to account for potential clustering at group level)</p>

Scoring:
 Positive
 Negative
 Not described or insufficient information provided

Appendix B

Summary characteristics of the studies included in the systematic review

Study	Country	Study characteristics: age (years); n (% girls); setting	Period of change (years); (# of measure- ments)	Physical activity measurement	Modeling of change	Change measured	Investigated exposures
Alderman (2010) ¹	U.S.	5.3 (SD 0.2); 96; university-based preschool movement program	1–9	Self-report	Difference testing	Change in physical activity	Gender
Anderson (1986) ²	U.S.	10–12; 238; School district in Iowa	5 (2)	Self-report (1-year recall)	Regression model	Change in sports participation	Gender, previous physical activity, satisfaction, reward
Armstrong (2000) ³	UK	11.1 (0.4); 202 (48); 15 state schools in Exeter, UK	2 (3)	Heart rate monitoring	Multilevel regression model	Change in MVPA	Gender, BMI/anthropometry, developmental stage, age
Ball (2009) ⁴	Australia	5–6 and 10–12; 1215 (53); 19 public elementary schools	3 (2)	Accelerometry	Linear regression model	Change in physical activity, MPA, VPA	Gender, SES
Barnett (2002) ⁵	Canada	9–11; 2318; 16 schools in Montreal, Canada	2 (3)	Self-report (7-day recall)	Multilevel regression model	Decline to less than one activity per day	Age, grade, BMI, ethnicity, smoking status, sedentary behavior, previous physical activity, region, SES, self- efficacy, parental/family support, parental role modeling
Bauer (2008) ⁶	U.S.	12.8 (SD 0.8); 5287; 31 middle and high schools in Minnesota	5 (2)	Self-report (7 day recall).	Regression model	Change in MVPA	SES, ethnicity, parental/family support, parental attitudes toward physical activity
Brodersen (2007) ⁷	UK	11–12; 474; 36 randomly selected schools in London, UK	4 (5)	Self-report (7-day recall)	Multilevel regression model	Change in average days spent in VPA	Gender, ethnicity, SES
Bruner (2009) ⁸	Canada	15.3 (SD 1.3); 40; mid-size public school	8 months (5)	Accelerometry	Generalized estimating equation	Change in physical activity	Gender, grade, VPA
Butcher (2001) ⁹	U.S.	9.1; 705 (100); seven elementary schools	1 (2)	Self-report	Regression model	Change in sports participation	Perceived competence, parental/family support
Callaghan (2010) ¹⁰	Hong Kong	16; 1055; public secondary schools	5 (20)	Self-report	Multivariate ANOVA	Change in exercise behavior	Self-efficacy, social liberation

Study	Country	Study characteristics: age (years); n (% girls); setting	Period of change (years); (# of measure- ments)	Physical activity measurement	Modeling of change	Change measured	Investigated exposures
Carver (2009) ¹¹	Australia	5–6 and 10–12; 1215 (53); 19 public elementary schools	3 (2)	Accelerometry	Linear regression model	Change in MVPA	Age, gender, road traffic, physical activity infrastructure, road length, intersection density, number of speed bumps, number of traffic lights, local road index
Corder (2010) ¹²	UK	10.2 (SD 0.3); 884 (58); 92 primary schools in Norfolk, UK	1 (2)	Accelerometry	Multilevel linear regression models	Change in total physical activity, MVPA	Baseline physical activity, gender, SES, body fat %, Index of Multiple Deprivation
Crawford (2010) ¹³	Australia	5–6 and 10–12; 1215 (53); 19 public elementary schools	3 (2)	Accelerometry	Linear regression model	Change in MVPA	BMI, SES, road traffic, number of siblings, sibling physical activity, parental role modeling, number of rules for physical activity and sedentary behavior, parental marital status, parental support, parental physical activity participation, physical activity infrastructure, distance to school, road length
Crocker (2003) ¹⁴	Canada	15–16; 178 (100); city and town (32%) high schools in Saskatoon, Canada	1 (2)	PAQ-A (7-day recall)	Regression model	Change in physical activity	BMI, physical perception, self-worth, satisfaction, self-esteem, dietary habits
Davison (2007) ¹⁵	U.S.	11.3 (SD 0.3); 221 (60); 10-year longitudinal study in five-county radius in Pennsylvania	2 (2)	Self-report (Children's Physical Activity Scale) and accelerometry	Structural equation model	Change in MVPA	Developmental stage, perceived competence, physical perception, depressive symptoms, maturity fears

Study	Country	Study characteristics: age (years); n (% girls); setting	Period of change (years); (# of measure- ments)	Physical activity measurement	Modeling of change	Change measured	Investigated exposures
de Bruijn (2006) ¹⁶	Netherlands	15.1 (SD 1.9); 221 (60); 23 general practitioners from nine family practice centers in Eindhoven, Netherlands	4 months (2) [May–November]	Self-report	Structural equation model	Change in physical activity	Previous physical activity, physical activity attitude, perceived behavioral control, intention, social subjective norm, availability of physical activity infrastructure, neighborhood safety, aesthetics in the environment
DiLorenzo (1998) ¹⁷	U.S.	11.2 (SD 0.7); 242 (50); two randomly selected community schools	3 (2)	Self-report (physical activity)	Regression model	Change in daily MET tasks	Self-efficacy, enjoyment of physical activity, exercise knowledge, interest in sports media, sedentary behavior, parental/family support, parental role modeling, parental self-efficacy, peer social support, parental physical activity, barriers, availability of physical activity equipment
Dishman (2006) ¹⁸	U.S.	14.1 (SD 0.6); 1037 (100); 22 public high schools in South Carolina	3 (2)	3DPAR (3-day recall)	Structural equation model	Change in 3-day MET tasks	Ethnicity, physical activity attitude, satisfaction, social subjective norm, perceived behavioral control, self-efficacy, goal setting
Dishman (2009) ¹⁹	U.S.	14.1 (SD 0.6); 1037 (100); 22 public high schools in South Carolina	3 (2)	3DPAR (3-day recall)	Structural equation model	Change in physical activity	Self-efficacy, social support
Dovey (1998) ²⁰	New Zealand	15; 421 (100); cohort of live births at a Dunedin hospital, New Zealand	3 (2)	Self-report (1 year recall, by month)	Repeated measures ANOVA	Decline in time spent in physical activity	Gender
Dowda (2007) ²¹	U.S.	13.6 (SD 0.6); 421 (100); 24 high schools in South Carolina	5 (3)	3DPAR	Growth curve model	Change in MET tasks	Ethnicity, SES, physical activity attitude, parental/family support, self-efficacy, availability of sports equipment

Study	Country	Study characteristics: age (years); n (% girls); setting	Period of change (years); (# of measure- ments)	Physical activity measurement	Modeling of change	Change measured	Investigated exposures
Duncan (2007) ²²	U.S.	12.1 (SD 1.63); 371 (50.1); 58 neighborhoods in the Pacific North West	3 (4)	Three self-report items (two taken from Youth Risk Behavior Survey - YRBS) and pedometer	Latent growth curve model	Change in physical activity	BMI, developmental stage, SES, ethnicity, self-efficacy, peer social support, peer physical activity
Dzewaltowski (2007) ²³	U.S.	12.4; 629 (53); 16 middle schools in Kansas	2 (3)	3DPAR	Latent growth curve model	Change in MVPA	Self-efficacy
Findlay (2009) ²⁴	Canada	4–11; 8817 (51); national longitudinal survey	7 (7)	Self-report	Group based trajectory modeling	Change in physical activity	SES, parental marital status, urban–rural status
Fuchs (1988) ²⁵	West Germany	13.3 (SD 0.9); 932 (46); 22 schools in Berlin and Bremen, Germany	2 (3)	1-year physical activity recall	Wilcoxon test for trend	Change in total physical activity, MVPA, and VPA	Gender, SES
Garcia (1998) ²⁶	U.S.	10–12; 132 (58); junior high schools	1 (2)	7-day recall (CAAL-Child/Adolescent Activity Log)	Structural equation model	Change in physical activity	Gender, ethnicity, physical activity attitude
Goran (1998) ²⁷	U.S.	5.5 (girls, SD 0.9); 5.3 (boys, SD 0.9); 22 (50); cohort in Burlington, VT	5 (3)	Doubly labeled water over 14 days	ANOVA	Change in total energy expenditure, AEE, activity (hours/day)	Gender
Hampson (2007) ²⁸	U.S.	9.5; 846 (50); 15 elementary schools in one school district in Oregon	7 (5)	Self-report	Latent growth curve model	Change in athleticism	Age, gender, BMI, physical activity attitude
Kahn (2008) ²⁹	U.S.	10–16; 12,812 (57); children from 50 states in the U.S., offspring from the Nurses Health Study	2 (3)	1-year physical recall	Mixed regression model	Change in MVPA	Age, gender, BMI, self-esteem, value of health and appearance, peer attitudes, parental attitudes to physical activity, parental physical activity, social group subjective norm
Knowles 2009) ³⁰	UK	11.8 (0.4); 204; 17 primary schools and six secondary schools in Edinburgh, UK	1 (2)	PAQ-C (7-day recall)	Linear regression	Change in physical activity	Developmental stage, physical self-perceptions
McMurray (2008) ³¹	U.S.	10; 765 (49); 21 elementary schools and 16 high schools in North Carolina	5 (2)	Self-report (7-day recall)	ANOVA	Decline in total physical activity, MPA and VPA	Gender, BMI, ethnicity, region, developmental stage, SES

Study	Country	Study characteristics: age (years); n (% girls); setting	Period of change (years); (# of measure- ments)	Physical activity measurement	Modeling of change	Change measured	Investigated exposures
Morgan (2008) ³²	U.S.	6–12; 257; two public elementary schools, U.S.	27 months (2)	Pedometers (4 days—elementary students; 8 days—junior high)	Regression model	Change in steps taken	Age, gender, BMI, perceived competence, physical self-perception
Motl (2004) ³³	U.S.	12.7 (SD 0.4); 3878 (49); 16 schools in Minneapolis, MN	2 (3)	Self-report	Latent growth curve model	Change in physical activity	Gender, depressive symptoms, alcohol consumption, smoking status
Motl (2005) ³⁴	U.S.	13.6 (SD 0.6); 856 (100); 24 high schools in South Carolina	1 (2)	3DPAR	Structural equation model	Change in physical activity, MPA and VPA	Ethnicity, self-efficacy, perceived behavioral control
Motl (2006) ³⁵	U.S.	12.7 (SD 0.4); 3878 (49); 16 schools in Minneapolis, MN	2 (3)	Self-report	Latent growth curve model	Change in physical activity	Gender, grade, value of health and appearance, sedentary behavior, smoking status
Nader (2008) ³⁶	U.S.	9.0 (SD 0.03); 771 (51); recruitment at community hospitals at 10 university data collection sites, U.S.	6 (4)	Accelerometry	Growth curve model	Change in weekday physical activity	Gender, BMI, SES, ethnicity, region
Neumark-Sztainer (2003) ³⁷	U.S.	15.4 (SD 1.1); 201 (100); six high schools (three control schools) in the Minneapolis/St. Paul, MN area	1 (3)	Self-report (7-day recall)	Regression model	Change in MVPA, MPA, and VPA	Self-acceptance, satisfaction, barriers, sedentary behavior, physical perception, depressive symptoms, perceived competence, self-efficacy, enjoyment of physical activity, benefits of physical activity, parental attitudes to physical activity, parental marital status
Raudsepp (2008) ³⁸	Estonia	12.6 (SD 0.5); 193 (100); four high schools in Tartu, Estonia	1.75 (4)	3DPAR	Latent growth curve model	Combined change in MET tasks, MVPA, and VPA	BMI, peer social support
Raudsepp (2008) ³⁹	Estonia	12.3 (SD 0.4); 345 (50); four high schools in Tartu, Estonia	1.75 (4)	3DPAR	Latent growth curve model	Change in MET tasks, MVPA, and VPA	Sedentary behavior
Rhodes (2006) ⁴⁰	Canada	11.2 (SD 0.6); 364 (51); 10 schools in British Columbia, Canada	1 (2)	Self-report	Structural equation model	Change in physical activity	Intention, perceived behavioral control

Study	Country	Study characteristics: age (years); n (% girls); setting	Period of change (years); (# of measure- ments)	Physical activity measurement	Modeling of change	Change measured	Investigated exposures
Robinson (1993) ⁴¹	U.S.	12.4 (SD 0.7); 674 (100); four middle schools in northern California	1 (3)	Self-report	Regression model	Change in physical activity	Sedentary behavior
Sagatun (2008) ⁴²	Norway	15–16; 2489 (55%); 32 secondary schools in Oslo	3 (2)	Accelerometry and self-report	ANOVA and linear regression model	Change in leisure time activity	Ethnicity, SES
Sallis (1999) ⁴³	U.S.	9.5 (SD 0.6); 732 (51); seven suburban public schools in San Diego	20 months (2)	Accelerometer measurement, child self-report, and parent report	Regression model	Change in physical activity index	BMI, anthropometry, SES, ethnicity, preference for physical activity, perceived competence, physical perception, self-worth, self-acceptance, physical activity attitude, PE attitude, Intention, sedentary behavior, parental/family support, parental physical activity, parental marital status, neighborhood safety
Sigmund (2009) ⁴⁴	Czech Republic	5–7; 208; 11 kindergarten schools in Marovia	1 (2)	Accelerometry and self-report	ANOVA	Change in AEE	Days of the week
Spadano (2005) ⁴⁵	U.S.	9.9 (SD 0.4); 28 (100); recruitment in Cambridge, MA and Somerville, MA public schools and Massachusetts Institute of Technology summer camp	5 (3)	Doubly labeled water and indirect calorimetry	Mixed-model repeated measure analyses	Change in AEE	BMI/anthropometry, ethnicity, developmental stage, parental weight status
Viira (2003) ⁴⁶	Estonia	13.1 (boys, SD 0.2); 13.0 (girls, SD 0.4); 197 (53); middle and high schools in Estonia	1 (2)	Self-report (7-day recall)	Regression model	Change in MVPA	Peer attitudes, enjoyment of physical activity, physical perception, barriers, parental physical activity

If the mean age of the sample was not reported, the reported age group or age range was included.

AEE, activity energy expenditure; MPA, moderate physical activity; MVPA, moderate-to-vigorous physical activity; N/A, data were not reported; PAQ, physical activity questionnaire; PE, physical education; VPA, vigorous physical activity; 3DPAR, 3-day physical activity recall

References for Appendix B

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