

APPENDIX 1A. DATA EXTRACTIONS

SR/MA Citation: Bea JW, Blew RM et al. Resistance training effects on metabolic function among youth: A systematic review. <i>Ped Exerc Sci</i> 2017;29(3):297-315.	
Purpose: To evaluate the relationship between resistance training and metabolic function in youth.	Abstract: Purpose: This systematic review evaluates the relationship between resistance training and metabolic function in youth. Methods: PubMed, Embase, Cochrane Library, Web of Science, CINAHL, and ClinicalTrials.gov were searched for articles that: (1) studied children; (2) included resistance training; (3) were randomized interventions; and (4) reported markers of metabolic function. The selected studies were analyzed using the Cochrane Risk-of-Bias Tool. Results: Thirteen articles met inclusion criteria. Mean age ranged from 12.2–16.9 years, but most were limited to high school (N=11) and overweight/obese (N=12). Sample sizes (N= 22–304), session duration (40–60min), and intervention length (8–52 wks) varied. Exercise frequency was typically 2–3 d/wk. Resistance training was metabolically beneficial compared to control or resistance plus aerobic training in 5 studies overall and 3 out of the 4 studies with the fewest threats to bias ($P \leq 0.05$); each was accompanied by beneficial changes in body composition, but only one study adjusted for change in body composition. Conclusions: Limited evidence suggests that resistance training may positively affect metabolic parameters in youth. Well-controlled resistance training interventions of varying doses are needed to definitively determine whether resistance training can mitigate metabolic dysfunction in youth and whether training benefits on metabolic parameters are independent of body composition changes.
Timeframe: Inception - 2015	
Total # studies included: 13	
Other details Evidence was from randomized trials only.	
Outcomes addressed: Cardiometabolic health: metabolic syndrome, insulin resistance, or any component of their definitions	

<p>SR/MA: Systematic review Citation: Belmon LS, van Stralen MM, Busch V, Harmsen IA, Chinapaw MJM. What are the determinants of children's sleep behaviour? A systematic review of longitudinal studies. Sleep Medicine Reviews 2019;43:60-70.</p>	
<p>Purpose: Review the longitudinal evidence on determinants of children's sleep behaviour</p>	<p>Abstract: BACKGROUND: Aim of the review is to systematically review the longitudinal evidence on determinants of children's sleep behaviour. DATA SOURCES: Systematic search of PubMed, PsychInfo and Web of Science for papers published until January 2017 with additional hand searching of papers found in reference lists. STUDY SELECTION: Papers were required to have a longitudinal design and include potential determinants of sleep behaviour (duration, quality and timing) and include participants aged 4-12 years of age. Papers had to be published in English. DATA EXTRACTION: Two independent reviewers screened all titles and abstracts. Full papers were extracted by one researcher and checked by another with discrepancies resolved by consensus. Study quality was assessed using a 13-item scale devised by one of the authors. Data for each question of interest were combined to provide an overall assessment of the quality of evidence, which was interpreted as strong, moderate or insufficient to draw conclusions. DATA SYNTHESIS: Forty-five studies were identified and of these 12 were classed as "high quality". The team found strong evidence for child age being associated with sleep duration. There was moderate strength evidence for an association between screen-time, past sleep behaviour and a difficult temperament being potential determinants of sleep duration. There was moderate evidence for a negative association between weekend schedule and sleep timing. There was insufficient evidence for the determinants of sleep quality. LIMITATIONS: Study limited to healthy children. Cannot assess causation in samples. CONCLUSIONS: Age associated with sleep duration and some evidence that screen-time, past sleep duration and temperament associated with sleep duration. There was a lack of high quality evidence to fully assess the key research questions suggesting that more evidence is needed in this area.</p>
<p>Timeframe: Papers published up to Jan 2017.</p>	
<p>Total # studies included: 45</p>	
<p>Other details: The relevance of the review to the research question is unclear as it focusses on the determinants of sleep behaviours not the associations between sleep behaviour and health outcomes or health outcomes and physical activity.</p>	
<p>Outcomes addressed: Sleep duration, sleep quality and sleep timing.</p>	

SR/MA Citation: Cao M, Quan M, Zhuang J. Effect of high-intensity interval training versus moderate-intensity continuous training on cardiorespiratory fitness in children and adolescents: a meta-analysis. <i>Int J Environ Res Public Health</i> 2019;16:1533.	
Purpose: To compare the effects between high-intensity interval training (HIIT) and moderate-intensity continuous training (MICT) on cardiorespiratory fitness in children and adolescents.	Abstract: Enhancing cardiorespiratory fitness (CRF) can lead to substantial health benefits. Comparisons between high-intensity interval training (HIIT) and moderate-intensity continuous training (MICT) on CRF for children and adolescents are inconsistent and inconclusive. The objective of this study was to perform a meta-analysis to compare the effects between HIIT and MICT on CRF in children and adolescents. We searched MEDLINE, PubMed, Web of Science, and Google Scholar to identify relevant articles. The standardized mean differences (SMD) and 95% confidence intervals (95% CI) were calculated to determine the pooled effect size of HIIT and MICT on CRF. A total of 563 subjects from 17 studies (18 effects) were identified. The pooled effect size was 0.51 (95% CI = 0.33–0.69) comparing HIIT to MICT. Moreover, intervention duration, exercise modality, work and rest ratio, and total bouts did not significantly modify the effect of HIIT on CRF. It is concluded that compared with endurance training, HIIT has greater improvements on cardiorespiratory fitness among children and adolescents.
Timeframe: Inception – February 2019	
Total # studies included: 17	
Other details: RCTs or controlled trials only.	
Outcomes addressed: Cardiorespiratory fitness	

SR/MA	
Citation: Collins H, Fawker S et al. The effect of resistance training interventions on weight status in youth: a meta-analysis. <i>Sports Medicine Open</i> 2018;4:41.	
Purpose: To examine the effect of resistance training interventions on weight status in youth.	Abstract: Background: There has been a rise in research into obesity prevention and treatment programmes in youth, including the effectiveness of resistance-based exercise. The purpose of this meta-analysis was to examine the effect of resistance training interventions on weight status in youth. Methods: Meta-analysis followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines and was registered on PROSPERO (registration number CRD42016038365). Eligible studies were from English language peer-reviewed published articles. Searches were conducted in seven databases between May 2016 and June 2017. Studies were included that examined the effect of resistance training on weight status in youth, with participants of school age (5–18 years). Results: There were 24 complete sets of data from 18 controlled trials (CTs) which explored 8 outcomes related to weight status. Significant, small effect sizes were identified for body fat% (Hedges' $g = 0.215$, 95% CI 0.059 to 0.371, $P = 0.007$) and skinfolds (Hedges' $g = 0.274$, 95% CI 0.066 to 0.483, $P = 0.01$). Effect sizes were not significant for: body mass (Hedges' $g = 0.043$, 95% CI -0.103 to 0.189, $P = 0.564$), body mass index (Hedges' $g = 0.024$, 95% CI -0.205 to 0.253, $P = 0.838$), fat-free mass (Hedges' $g = 0.073$, 95% CI -0.169 to 0.316, $P = 0.554$), fat mass (Hedges' $g = 0.180$, 95% CI -0.090 to 0.451, $P = 0.192$), lean mass (Hedges' $g = 0.089$, 95% CI -0.122 to 0.301, $P = 0.408$) or waist circumference (Hedges' $g = 0.209$, 95% CI -0.075 to 0.494, $P = 0.149$). Conclusions: The results of this meta-analysis suggest that an isolated resistance training intervention may have an effect on weight status in youth. Overall, more quality research should be undertaken to investigate the impact of resistance training in youth as it could have a role to play in the treatment and prevention of obesity.
Timeframe: Inception - June 2017	
Total # studies included: 18 (24 datasets)	
Other details Evidence was from controlled trials only.	
Outcomes addressed: Adiposity and weight status	

SR/MA Citation: Eddolls WT, McNarry MA, Stratton G, Winn CO, Mackintosh KA. High-intensity interval training interventions in children and adolescents: A systematic review. <i>Sports Medicine</i> . 2017; 1;47(11):2363-74.	
Purpose: Assess impact of HIIT interventions on health outcomes in young people	Abstract: Background: Whilst there is increasing interest in the efficacy of high-intensity interval training in children and adolescents as a time-effective method of eliciting health benefits, there remains little consensus within the literature regarding the most effective means for delivering a high-intensity interval training intervention. Given the global health issues surrounding childhood obesity and associated health implications, the identification of effective intervention strategies is imperative. Objectives: The aim of this review was to examine high-intensity interval training as a means of influencing key health parameters and to elucidate the most effective high-intensity interval training protocol. Methods: Studies were included if they: (1) studied healthy children and/or adolescents (aged 5–18 years); (2) prescribed an intervention that was deemed high intensity; and (3) reported health-related outcome measures. Results: A total of 2092 studies were initially retrieved from four databases. Studies that were deemed to meet the criteria were downloaded in their entirety and independently assessed for relevance by two authors using the pre-determined criteria. From this, 13 studies were deemed suitable. This review found that high-intensity interval training in children and adolescents is a time-effective method of improving cardiovascular disease biomarkers, but evidence regarding other health-related measures is more equivocal. Running-based sessions, at an intensity of 90% heart rate maximum/100–130% maximal aerobic velocity, two to three times a week and with a minimum intervention duration of 7 weeks, elicit the greatest improvements in participant health. Conclusion: While high-intensity interval training improves cardiovascular disease biomarkers, and the evidence supports the effectiveness of running-based sessions, as outlined above, further recommendations as to optimal exercise duration and rest intervals remain ambiguous owing to the paucity of literature and the methodological limitations of studies presently available.
Timeframe: Inception to 09/2016	
Total # studies included: 13	
Other details (e.g. definitions used, exclusions etc): Only healthy (non-clinical) samples, and only interventional (not observational) research.	
Outcomes addressed: All were eligible. However, results only found CVD outcomes; including BMI, Blood Pressure and various biomarkers of cholesterol, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol, blood triglycerides, and insulin.	

Systematic Review	
Citation: Errisuriz VL, Golaszewski NM, Born K, Bartholomew JB. Systematic Review of Physical Education-Based Physical Activity Interventions Among Elementary School Children. <i>J Prim Prev</i> 2018;39(3):303–27.	
Purpose: To systematically review studies examining PE interventions designed to impact PA, fitness, and/or body composition; and to make recommendations for new research directions based upon these findings.	Abstract: Physical education (PE)-based interventions are a popular method to target children's physical activity (PA) and fitness; however, little is known about their effectiveness or what factors lead to successful interventions. This paper: (1) systematically reviews studies examining PE interventions designed to impact PA, fitness, and/or body composition; and (2) makes recommendations for new research directions based upon these findings. Our systematic review was limited to experimental and quasi-experimental studies conducted in elementary schools. We conducted literature searches using predetermined keywords in 3 databases, identified a total of 4964 potentially relevant studies, and screened their abstracts and full texts for eligibility. This resulted in 12 relevant studies. We used criteria established by Downs and Black (1998) to assess each study's methodological quality. PE interventions consistently showed increases in moderate-to-vigorous PA or vigorous PA during PE class but were less consistent in impacting leisure-time PA. PE interventions affected body composition differentially, depending on the assessment used (i.e., body mass index or skinfold thickness). Half of the studies assessing fitness did not show a significant impact; however, those that did were designed to influence fitness outcomes. Few studies assessed psychosocial determinants regarding PA, and no study demonstrated significant impacts on constructs other than knowledge. Interventions often contained multiple components (e.g., diet, family) implemented alongside PE interventions. Identifying effective intervention components was difficult due to lack of process evaluation. We identify the need for future research to use more objective and accurate PA measurements and adiposity, incorporate measurement of psychological constructs, expand interventions' theoretical basis, and include strong process evaluation.
Timeframe: Not reported.	
Total # studies included: 12	
Author-stated inclusion criteria: The study must have tested an intervention (i.e., a deliberate attempt to change usual teaching practice in PE) with the intention of increasing PA or fitness. Only studies utilizing experimental or quasi-experimental methods. Only elementary (or primary) schools.	
Outcomes addressed: Physical activity, physical fitness and body composition	
Populations analysed: Children, adolescents and young adults	Author-stated funding source: No funding source used.

SR/MA	
Citation: Fang K, Mu M et al. Screen time and childhood overweight/obesity: A systematic review and meta-analysis. <i>Child Care Health Dev.</i> 2019;45:744-753.	
Purpose: To estimate the relationship between screen time and overweight/obesity in children.	Abstract: Background: Controlling childhood overweight/obesity would help early prevention on children from getting chronic noncommunicable diseases, exposing to screen for long periods may increase the risk of overweight/obesity due to lack of physical activity and tend to intake too much energy, and the relationship between screen time and overweight/obesity is inconsistent. Thus, the object of the present study was to estimate the relationship between screen time and overweight/obesity in children (<18 years) by systematically review prevalence studies.
Timeframe: Inception – May 2019	Methods: We collected data from relevant studies published up to May 2019 using predefined inclusion/exclusion criteria. And all the literatures were searched in PubMed, ScienceDirect, Embase, and Web of Science.
Total # studies included: 16	Results: A total of 16 studies met the criteria and were included in the meta-analysis. When compared with the screen time <2 hr/day, an increased overweight/obesity risk among children was shown in the screen time ≥2 hr/day (OR = 1.67; 95% CI [1.48, 1.88], P < .0001). The subgroup analysis showed a positive association between the different types of screen time and overweight/obesity among children.
Other details: Evidence from cohort study, case–control or cross-sectional study designs. Screen time was categorized as <2 and ≥2 hr/day.	Conclusion: Based on our study, increasing screen time could be a risk factor for being overweight/obesity in children and adolescents.
Outcomes addressed: adiposity (overweight/obesity)	

SR/MA	
Citation: Koedijk JB, Rijswijk et al. Sedentary behaviour and bone health in children, adolescents and young adults: a systematic review. <i>Osteoporos Int</i> 2017;28:2507-2519.	
Purpose: To examine the association between SB and bone health in children, adolescents and young adults.	Abstract: Sedentary behaviour (SB) is increasing in Western societies and some studies suggest a deleterious effect of SB on bone. The aim of this systematic review was to examine the association between SB and bone health in children, adolescents and young adults. Electronic databases (PubMed, MEDLINE, PsycINFO and Science Citation Index) were searched for relevant articles up to January 9, 2017. Studies were included when results on bone health (e.g. strength, mass and structure) and either subjectively (questionnaires) or objectively (accelerometry) measured SB were reported in healthy participants ≤24 years. Two reviewers independently screened titles and abstracts for eligibility, rated methodological quality and extracted data. Seventeen observational studies were included. Several studies that used DXA or quantitative ultrasound suggested that objectively measured SB was negatively associated with lower extremity bone outcomes, such as femoral neck bone mineral density. The magnitude of this negative association was small and independent of moderate-to-vigorous physical activity. In contrast to the lower extremities, there was insufficient evidence for an association of lumbar spine bone outcomes with objectively measured SB. In high-quality studies that used DXA, no association was observed between objectively measured SB and total body bone outcomes. In studies using questionnaires, none of these relationships were observed. Well-designed longitudinal studies, objectively measuring SB, are needed to further unravel the effect of SB, physical activity and their interaction on bone health.
Timeframe: Inception – Jan. 2019	
Total # studies included: 17	
Other details There were no restrictions placed on study design.	
Outcomes addressed: Bone health	

SR/MA	
Citation: Krahenbühl T, Guimarães RF et al. Bone geometry and physical activity in children and adolescents: systematic review. <i>Rev Paul Pediatr.</i> 2018;36(2):230-237.	
Purpose: To examine the influence of physical activity and/or sports on bone geometry in children and adolescents.	Abstract: Objective: To perform a systematic review on the practice of physical activity and/or sports in health and its influence on bone geometry of healthy children and adolescents. Data source: The method used as reference was the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). Databases searched for articles published from 2006 to 2016, with “Bone geometry” AND (Sport* OR Exercise* OR “Physical Activity”) as descriptors, were PubMed, BIREME/LILACS and SciELO. Data syntheses: After the selection, 21 articles were included. Most studies stated that practice of physical activity and/or sports was beneficial for bone geometry and bone mineral density. Only two studies presented values of bone parameters for control individuals better than those of swimmers. Physical activities and sports studied were: gymnastics (n=7), rhythmic gymnastics (n=2), tennis (n=1), soccer (n=3), <i>capoeira</i> (n=1), swimming (n=4), cycling (n=0), jumping activities (n=2), studies relating physical activity with isokinetic peak torque (n=1), physical activity measured by questionnaire (n=4), and additional physical education classes (n=2). Conclusions: Among the sports and physical activities found, gymnastics, soccer, and more intense physical activity assessed by questionnaires were mentioned along with better results in bone geometry compared to the absence of physical activity, whereas swimming and jumping exercises did not influence it. Therefore, sports activities with weight bearing and those practiced more frequently and intensively are beneficial for bone geometry.
Timeframe: 2006 until 2016	
Total # studies included: 21	
Other details: Evidence from observational studies only (13 cross-sectional and 8 longitudinal studies).	
Outcomes addressed: Bone geometry	

<p>SR/MA: Systematic review Citation: Lee, Pope and Gao. The role of Youth Sports in promoting children’s physical activity and preventing pediatric obesity: A systematic review. Behavioural Medicine 2018;44(1):62-76.</p>	
<p>Purpose: Examine the impact of youth sports participation on daily physical activity and paediatric obesity in children aged 6 to 19.</p>	<p>Abstract: BACKGROUND: Aim of the paper was to examine the impact of youth sports participation on daily physical activity and pediatric obesity in children aged 6 to 19. DATA SOURCES: English-language studies in Web of Science, Academic Search Premier, Google Scholar, Pub Med, PsychInfo and ERIC were searched for studies published up to January 2014 with additional hand searching of papers found in reference lists. STUDY SELECTION: Studies had to include children <19 years of age and examine association between sport participation, and physical activity related outcomes [(adherence to PA guidelines, leisure time physical activity, total energy expenditure, time in MVPA and/or obesity related outcomes (BMI, body fat percentage, skinfold and or obesity related outcomes)]. Studies that combined PE with after-school sports and studies targeting participants with disabilities were excluded. DATA EXTRACTION: Data extracted by one reviewer and verified by another. Discrepancies resolved by consensus. Quality of study findings and methodology were assessed using a 9-item checklist that had been developed by the team. DATA SYNTHESIS: Twenty-seven articles were found with samples ranging from 21 to 71,854. Of the included studied 16 focused on adolescents only. A total of 17 studies examined associated between youth sport and physical activity and of these 15 showed that greater amounts and frequency of engagement in organized youth sport were associated with physical activity in youth or later in adolescence. From the 7 studies, 7 presented odds ratios to quantify the magnitude of the sports participation and PA relationship and these ranged from 17.4 (95% CI = 1.13 to 2.67) to 13.2 (95% CI = 9.4 to 18.7). In the studies that investigated the relationship of school-based sports and physical activity sports-based participants were more likely to engage in MVPA (OR = 3.21 [95% CI = 2.95 to 3.49] than non-participants. Seventeen studies examined the association between youth sports participation and obesity status with sample sizes from 21 to 12,188 and age ranges from 6 to 19 years of age. Evidence for an association between sports participation and obesity were mixed and inconsistent. LIMITATIONS: The majority of the studies had self-reported measures of physical activity (only 7 used accelerometers or pedometers). Most of the sport participation surveys used a single item and did not assess frequency, duration or type of participation. CONCLUSION: Participating in youth sports is positively associated with MVPA and there is some evidence that these associations persist into later adolescence and adulthood. There is inconsistent evidence of an association between youth sports participation and indicators of obesity related outcomes.</p>
<p>Timeframe: Up to Jan 2014</p>	
<p>Total # studies included: 27</p>	
<p>Other details Majority of the studies used single item assessments of sports participation. Limited information about frequency, intensity etc.</p> <p>It is a narrative synthesis and no pooling of data across studies. Although study quality is assessed the link between study quality and interpretation is unclear.</p>	
<p>Outcomes addressed: Physical activity (MVPA) and obesity status which was defined as BMI, body fat percentage, and waist circumference.</p>	

Systematic Review	
Citation: Marker C, Gnamb T, Appel M. Exploring the myth of the chubby gamer: A meta-analysis on sedentary video gaming and body mass. Soc Sci Med [Internet]. 2019 Jun 9;(September 2018):112325. Available from: https://doi.org/10.1016/j.socscimed.2019.05.030 .	
Purpose: To provide an estimate of the average effect size of the relationship between sedentary video gaming and body mass and to provide additional evidence on processes (i.e., displacement effect of physical activity by video gaming time)	Abstract: RATIONALE: High body mass and obesity are frequently linked to the use of sedentary media, like television (TV) or non-active video games. Empirical evidence regarding video gaming, however, has been mixed, and theoretical considerations explaining a relationship between general screen time and body mass may not generalize to non-active video gaming. OBJECTIVE: The current meta-analysis had two main goals. First, we wanted to provide an estimate of the average effect size of the relationship between sedentary video gaming and body mass. In doing so we acknowledged several context variables to gauge the stability of the average effect. Second, to provide additional evidence on processes, we tested the displacement effect of physical activity by video gaming time with the help of a meta-analytic structural equation model (MASEM).
Timeframe: Inception – June 2018	METHOD: Published and unpublished studies were identified through keyword searches in different databases and references in relevant reports were inspected for further studies. We present a random-effects, three-level meta-analysis based on 20 studies (total N = 38,097) with 32 effect sizes.
Total # studies included: 24	RESULTS: The analyses revealed a small positive relationship between non-active video game use and body mass, $\rho^{\wedge}=.09$, 95% CI [0.03, 0.14], indicating that they shared less than 1% in variance. The studies showed significant heterogeneity, $Q(31) = 593.03$, $p < .001$, $I^2 = 95.13$. Moderator analyses revealed that the relationship was more pronounced for adults, $\rho^{\wedge}=.22$, 95% CI [0.04, 0.40], as compared to adolescents, $\rho^{\wedge}=.01$, 95% CI [-0.21, 0.23], or children, $\rho^{\wedge}=.09$, 95% CI [-0.07, 0.25]. Meta-analytic structural equation modeling found little evidence for a displacement of physical activity through time spent on video gaming.
Author's definition of sedentary video gaming: The authors focus on time and frequency of video gaming only for sedentary (non-active) video games. They exclude studies focused on active video games.	CONCLUSION: These results do not corroborate the assumption of a strong link between video gaming and body mass as respective associations are small and primarily observed among adults.
Outcomes addressed: Body mass	
Populations analysed: Children, adolescents and young adults	Author-stated funding source: This work was supported by the German Science Foundation (DFG) Grant AP 207/2-1 awarded to Markus Appel

SR/MA: Systematic review	
Citation: Marques A, Santos DA, Hillman CH, Sardinha LB. How does academic achievement relate to cardiorespiratory fitness, self-reported physical activity and objectively reported physical activity: a systematic review in children and adolescents aged 6-18 years. <i>Br J Sports Med</i> (in press).	
Purpose: Review evidence of the association between objective and self-reported physical activity and cardiorespiratory fitness with academic achievement	Abstract: BACKGROUND: Aim of the study was to systematically review the evidence from 2000 to 2016 of an association between objective and self-reported physical activity and cardiorespiratory fitness with academic achievement in children and adolescents. DATA SOURCES: Systematic review of Embase, ERIC, PubMed, PsychINFO, SPORTdiscus and Web of Science. Studies published in English, Spanish or Portuguese were eligible if published from 2000 to 2016. STUDY SELECTION: Studies had to include children or adolescents aged 6-18, had to have school grade or standardised test as an outcome and assess either self-reported or objectively assessed physical activity or cardiorespiratory fitness. Cross-sectional, longitudinal and intervention (trials) were eligible. Studies with a sample of less than 30 participants were excluded.
Timeframe: 2000 to 2016	DATA EXTRACTION: Titles and abstracts reviewed by two assessors. Full text articles reviewed by same individuals. Discrepancies resolved by consensus. Study quality assessed using the "Quality Assessment Tool for Quantitative Studies".
Total # studies included: 51	DATA SYNTHESIS: Fifty-one articles were identified and of these 41 were cross-sectional, 8 longitudinal and 2 intervention. In half of the studies the outcome variable was student marks at school and the other was standardised test scores. There were 11 studies that included objective assessments of physical activity and academic achievement. There was inconsistent evidence. There were 18 studies that used self-reported assessments of physical activity and of these 12 reported a positive association between physical activity and academic achievement. The 28 studies that assessed the relationship between cardio-respiratory fitness and academic achievement reported a general positive association with high fitness associated with higher academic achievement (but direction of causation unclear).
Other details (e.g. definitions used, exclusions etc) Studies with less than 30 participants excluded. English, Spanish and Portuguese language studies only.	LIMITATIONS: Narrative synthesis. Studies were not ranked based on size. Grades from teachers are not standardised and can be open to bias making comparisons across schools challenging.
Outcomes addressed: School grade (teacher assessed) or standardised test score.	CONCLUSIONS: Overall findings support a positive association between self-reported physical activity plus cardio-respiratory fitness and academic achievement. Objectively measured physical activity was inconsistently associated with academic achievement. Physical activity DOES NOT have a detrimental effect on academic achievement.

SR/MA	
Citation: Martin R, Murtagh EM. Effect of active lessons on physical activity, academic, and health outcomes: a systematic review. <i>Research Quarterly for Exercise and Sport</i> 2017;88(2):149-68.	
Purpose: Examine the benefits of PA interventions integrated within school lessons, for learning, PA and health outcomes	Abstract:
Timeframe: 01/1990 – 03/2015	Purpose: The purpose of this study was to conduct a systematic review of classroom-based physical activity interventions that integrate academic content and assess the effectiveness of the interventions on physical activity, learning, facilitators of learning, and health outcomes.
Total # studies included: 15	Method: Six electronic databases (ERIC, PubMed, Google Scholar, Science Direct, Cochrane Library, and EMBASE) and reference lists were searched for English-language articles, published January 1990 through March 2015, reporting classroom-based interventions that deliberately taught academic content using physically active teaching methods for at least 1 week duration, with physical activity, health, learning, or facilitators-of-learning outcomes. Two authors reviewed full-text articles. Data were extracted onto an Excel spreadsheet, and authors were contacted to confirm accuracy of the information presented.
Other details (e.g. definitions used, exclusions etc): All classroom-based PA interventions which reported on PA outcomes, health outcomes, or learning-related outcomes.	Results: Fifteen studies met the inclusion criteria. Six studies reporting on physical activity levels were found to have medium-to-large effect sizes. All 4 studies reporting learning outcomes showed positive effects of intervention lessons. Teachers and students were pleased with the programs, and enhanced on-task behaviour was identified (n = 3). Positive effects were also reported on students' body mass index levels (n = 3).
Outcomes addressed: Physical activity levels, Learning outcomes, Teacher and Student satisfaction with classroom-based PA, and BMI.	Conclusions: Physically active academic lessons increase physical activity levels and may benefit learning and health outcomes. Both students and teachers positively received and enjoyed these teaching methods. These findings emphasize the need for such interventions to contribute toward public health policy.

SR/MA	
Citation: Miguel-Berges ML, Reilly JJ et al. Associations between pedometer-determined physical activity and adiposity in children and adolescents: systematic review. <i>Clin J Sport Med.</i> 2018;28:64-75.	
Purpose: To examine the evidence on the associations between pedometer-determined physical activity and adiposity.	Abstract: Objective: The present review sought to examine the evidence on the associations between pedometer-determined physical activity and adiposity. Design: Of 304 potentially eligible articles, 36 were included. A search for observational studies was carried out using Cochrane Library (CENTRAL), the OVID (MEDLINE, Embase, and PsycINFO), EBSCOhost (Sportdiscus), and PEDro database from their commencement to July 2015. Of 304 potentially eligible articles, 36 were included. Results: Most studies (30/36; 83%) were cross sectional and all used proxies for adiposity, such as body mass index (BMI) or BMI z-score as the outcome measure. Few studies (2/36; 6%) focused on preschool children. There was consistent evidence of negative associations between walking and adiposity; significant negative associations were observed in 72% (26/36) of studies overall. Conclusions: The present review supports the hypothesis that higher levels of walking are protective against child and adolescent obesity. However, prospective longitudinal studies are warranted; there is a need for more research on younger children and for more “dose-response” evidence.
Timeframe: Inception – July 2015	
Total # studies included: 36	
Other details: Evidence from observational studies only (83% cross-sectional studies).	
Outcomes addressed: Adiposity	

<p>SR/MA: Systematic review Citation: Mohammadi S, Jalaludin MY, Su TT, Dahlui M, Mohamed MNA and Majid HA. Dietary and physical activity patterns related to cardiometabolic health among Malaysian adolescents: a systematic review. BMC Public Health 2019;19:251</p>	
<p>Purpose: Examine the review of the associations in observational and intervention studies of the association between diet, physical activity and cardiometabolic risk factors in Malaysian adolescents.</p>	<p>Abstract: BACKGROUND: Systematic review of the associations in observational and intervention studies of the association between diet, physical activity and cardiometabolic risk factors in Malaysian adolescents. (As diet is not related to the current research question data have not been abstracted below). DATA SOURCES: Systematic search of PubMed, Science Direct, Cochrane Review and Web of Science until 31st August 2017.</p>
<p>Timeframe: Up to August 2017.</p>	<p>STUDY SELECTION: Observation and intervention studies that included Malaysian adolescents age 13-18. Studies had to include physical activity (including sedentary) or diet as an outcome.</p>
<p>Total # studies included: 17</p>	
<p>Other details (e.g. definitions used, exclusions etc) The bulk of the review focusses on dietary factors not summarised as out of scope.</p> <p>The sample is limited to studies conducted in Malaysia.</p> <p>Inconsistencies in how results are summarised (i.e. refers to objective measures when it appears as assessments of physical activity are self-reported).</p>	<p>DATA EXTRACTION: Titles, abstracts and papers were independently screened by two assessors. Disagreements discussed and resolved by two further authors. Risk of bias assessed using a modified Newcastle-Ottawa scale. DATA SYNTHESIS: Seventeen studies (16 cross-sectional and one intervention) were found. All 17 studies were classed as poor quality. Physical activity was assessed in ten studies all of which used the Physical Activity Questionnaire for Older children. Seven studies examined the link between physical activity and cardiometabolic health. Three found no evidence of associations. Three studies reported associations between physical activity and weight status, three found associations with BMI, two with percentage of body fat and one with waist circumference. Two studies reported that the mean physical activity score was higher of underweight and normal weight participants when compared to overweight and obese adolescents. There was equivocal evidence of an association between physical activity intensity and cardiometabolic health. Two studies assessed sedentary behaviour. One study reported an association between sedentary time and BMI while the other found no association. LIMITATIONS: Self-report measures of physical activity. Poor study quality. CONCLUSIONS: Weak evidence of an association between physical activity and indicators of cardiometabolic health (all indicators of adiposity).</p>
<p>Outcomes addressed: BMI and Body weight</p> <p>Although the title talks about cardiometabolic health the outcomes are all indicators of body mass (BMI and body weight).</p>	

SR/MA	
Citation: Pozuelo-Carrascosa DP, Cavero-Redondo I, Herraiz-Adillo A et al. School-Based Exercise Programs and Cardiometabolic Risk Factors: A Meta-analysis. <i>Pediatrics</i> . 2018;142(5):e20181033	
Purpose: To provide a comprehensive synthesis of the effectiveness of school-based PA interventions on cardiometabolic risk factors in children	Abstract: CONTEXT: The effects of school-based physical activity (PA) programs on different cardiometabolic risk factors and the most appropriate features of PA programs to achieve maximum effectiveness are unclear. OBJECTIVE: To provide a comprehensive synthesis of the effectiveness of school-based PA interventions on cardiometabolic risk factors in children. DATA SOURCES: We identified studies from database inception to February 22, 2018. STUDY SELECTION: We selected studies that were focused on examining the effect of school-based PA interventions on cardiometabolic risk factors in children. DATA EXTRACTION: Random-effects models were used to calculate the pooled effect size (ES) for the included cardiometabolic risk factors (waist circumference [WC], triglycerides, total cholesterol, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol, systolic blood pressure and diastolic blood pressure (DBP), and fasting insulin and glucose). RESULTS: Nineteen randomized controlled trials (which included 11 988 children aged 3–12 years) were included in the meta-analysis. School-based PA programs were associated with a significant small improvement in WC (ES = -0.14; 95% confidence interval [CI]: -0.22 to -0.07; <i>P</i> < .001), DBP (ES = -0.21; 95% CI: -0.42 to -0.01; <i>P</i> = .040), and fasting insulin (ES = -0.12; 95% CI: -0.20 to -0.04; <i>P</i> = .003). LIMITATIONS: Authors of few studies described the implementation conditions of their interventions in detail, and compliance rates were lacking in most studies. In addition, results by sex were provided in a small number of studies. CONCLUSIONS: School-based PA interventions improve some cardiometabolic risk factors in children, such as WC, DBP, and fasting insulin.
Timeframe: Inception until February 22 2018	
Total # studies included: 19	
Other details (e.g. definitions used, exclusions etc) All studies were RCT	
Outcomes addressed: Cardio-metabolic risk factors (waist circumference, triglycerides, total cholesterol, LDL cholesterol, blood pressure, insulin and glucose)	

SR/MA	
Citation: Singh AS, Saliassi E, van den Berg V, et al. Effects of physical activity interventions on cognitive and academic performance in children and adolescents: a novel combination of a systematic review and recommendations from an expert panel. <i>Br J Sports Med</i> 2019;53:640-47	
Purpose: To summarise the current evidence on the effects of physical activity (PA) interventions on cognitive and academic performance in children, and formulate research priorities and recommendations.	Abstract: Objective To summarise the current evidence on the effects of physical activity (PA) interventions on cognitive and academic performance in children, and formulate research priorities and recommendations. Design Systematic review (following PRISMA guidelines) with a methodological quality assessment and an international expert panel. We based the evaluation of the consistency of the scientific evidence on the findings reported in studies rated as of high methodological quality. Data sources PubMed, PsycINFO, Cochrane Central, Web of Science, ERIC, and SPORTDiscus. Eligibility criteria for selecting studies PA intervention studies in children with at least one cognitive or academic performance assessment.
Timeframe: Until September 2017	Results Eleven (19%) of 58 included intervention studies received a high-quality rating for methodological quality: four assessed effects of PA interventions on
Total # studies included: 58	cognitive performance, six assessed effects on academic performance, and one on both. All high-quality studies contrasted the effects of additional/adapted PA
Other details (e.g. definitions used, exclusions etc) 11 studies with high quality selected for evidence synthesis. No adverse effects of PA on any outcome.	activities with regular curriculum activities. For cognitive performance 10 of 21 (48%) constructs analysed showed statistically significant beneficial intervention effects of PA, while for academic performance, 15 of 25 (60%) analyses found a significant beneficial effect of PA. Across all five studies assessing PA effects on mathematics, beneficial effects were reported in six out of seven (86%) outcomes. Experts put forward 46 research questions. The most pressing research priority cluster concerned the causality of the relationship between PA and cognitive/academic performance. The remaining clusters pertained to PA characteristics, moderators and mechanisms governing the 'PA-performance' relationship and miscellaneous topics.
Outcomes addressed: At least one cognitive or academic performance	Conclusion There is currently inconclusive evidence for the beneficial effects of PA interventions on cognitive and overall academic performance in children. We conclude that there is strong evidence for beneficial effects of PA on maths performance. The expert panel confirmed that more 'high-quality' research is warranted. By prioritising the most important research questions and formulating recommendations we aim to guide researchers in generating high-quality evidence. Our recommendations focus on adequate control groups and sample size, the use of valid and reliable measurement instruments for physical activity and cognitive performance, measurement of compliance and data analysis.

SR/MA	
Citation: Skrede T, Steene-Johannessen et al. The prospective association between objectively measured sedentary time, moderate-to-vigorous physical activity and cardiometabolic risk factors in youth: a systematic review and meta-analysis. <i>Obes Rev</i> 2019;20:55-74.	
Purpose: To summarize the evidence on a prospective relationship between objectively measured sedentary time, MVPA and cardiometabolic health indicators in youth.	Abstract: Sedentary time and moderate-to-vigorous physical activity (MVPA) may be uniquely related to cardiometabolic health. Excessive sedentary time is suggested as an independent cardiometabolic risk factor, while MVPA is favourably associated with cardiometabolic health. This systematic review and meta-analysis summarizes the evidence on a prospective relationship between objectively measured sedentary time, MVPA and cardiometabolic health indicators in youth. PubMed, Embase, CINAHL, PhysciNFO and SPORTDiscus were systematically searched from January 2000 until April 2018. Studies were included if sedentary time and physical activity were measured objectively and examined associations with body mass index, waist circumference, triglycerides, high-density lipoprotein, insulin, blood pressure or the clustering of these cardiometabolic risk factors. We identified 30 studies, of which 21 were of high quality. No evidence was found for an association between sedentary time and cardiometabolic outcomes. The association between MVPA and individual cardiometabolic risk factors was inconsistent. The meta-analysis for prospective studies found a small but significant effect size between MVPA at baseline and clustered cardiometabolic risk at follow-up (ES -0.014 [95% CI, 0.024 to 0.004]). We conclude that there is no prospective association between sedentary time and cardiometabolic health, while MVPA is beneficially associated with cardiometabolic health in youth.
Timeframe: Jan. 2000 – April 2018	
Total # studies included: 30	
Other details Evidence was from prospective studies only.	
Outcomes addressed: Cardiometabolic health	

SR/MA	
Citation: Stanczykiewicz B, Banik A, Knoll N et al. Sedentary behaviors and anxiety among children, adolescents and adults: a systematic review and meta-analysis. BMC Public Health. 2019;9:459	
Purpose: summarize the evidence for the SB--anxiety relationship. (1) synthesize the associations between SB and anxiety symptoms and (2) examine if SB-anxiety associations are moderated by the age group (children/adolescents vs. adults), participants' health status (general population vs. people with a chronic physical or mental illness).	Abstract: Background: Although the number of studies examining the relationships between sedentary behaviors (SB) and anxiety is growing, an overarching evidence, taking into account children, adolescents, and adults as well as different types of SB and different categories of anxiety outcomes, is still missing. Thus, this systematic review and meta-analysis aimed at obtaining a comprehensive overview of existing evidence. Methods: A search in the following databases: PsycINFO, PsycARTICLES, Academic Search Complete, ERIC, HealthSource: Nursing/Academic Edition and MEDLINE, resulted in k = 31 original studies included in the systematic review (total N = 99,192) and k = 17 (total N = 27,443) included in the meta-analysis. Main inclusion criteria referred to testing the SB--anxiety relationship, the quality score (above the threshold of 65%), and the language of publications English). The study was following the PRISMA statement and was registered at PROSPERO (CRD42017068517). Results: Both the systematic review and meta-analysis indicated that overall average effects were small: higher levels of symptoms of anxiety were associated with higher levels of SB (weighted r = .093, 95% CI [.055, .130], p < .001). Moderator analyses indicated that trends for stronger effects were observed among adults, compared to children/ adolescents (p = .085). Conclusions: Further longitudinal studies are necessary to elucidate the predictive direction of the anxiety—SB relationship and to clarify whether the effects depend on the type of anxiety indicators.
Timeframe:	
Total # studies included: 31	
Other details (e.g. definitions used, exclusions etc) Most studies were x-sectional. Seven prospective and 3 RCT included	
Outcomes addressed: Anxiety	

SR/MA	
Citation: Verswijveren SJMM, Lamb KE, Bell LA et al. Associations between activity patterns and cardio-metabolic risk factors in children and adolescents: A systematic review. <i>PLOS One</i> 2018; 13(8): e0201947.	
Purpose: To synthesise the evidence concerning associations between activity patterns and cardio-metabolic risk factors in children and adolescents aged 5±19 years.	Abstract:
Timeframe: 1980 to 2017	Introduction Total volumes of physical activity and sedentary behaviour have been associated with cardio-metabolic risk profiles; however, little research has examined whether patterns of activity (e.g., prolonged bouts, frequency of breaks in sitting) impact cardio-metabolic risk. The aim of this review was to synthesise the evidence concerning associations between activity patterns and cardio-metabolic risk factors in children and adolescents aged 5±19 years.
Total # studies included: 29	Materials and methods A systematic search of seven databases was completed in October 2017. Included studies were required to report associations between objectively-measured activity patterns and cardio-metabolic risk factors in children and/or adolescents, and be published between 1980 and 2017. At least two researchers independently screened each study, extracted data, and undertook risk of bias assessments.
Other details (e.g. definitions used, exclusions etc) Device-measured PA and sedentary patterns. 24 observational (76% x-sectional) and five interventions	Results From the 15,947 articles identified, 29 were included in this review. Twenty-four studies were observational (cross-sectional and/or longitudinal); five were experimental. Ten studies examined physical activity patterns, whilst 19 studies examined sedentary patterns. Only one study examined both physical activity and sedentary time patterns. Considerable variation in definitions of activity patterns made it impossible to identify which activity patterns were most beneficial to children's and adolescents' cardio-metabolic health. However, potential insights and current research gaps were identified.
Outcomes addressed: Cardio-metabolic risk factors (i.e., adiposity, blood lipids, inflammatory biomarkers, endothelial function biomarkers, blood glucose, vascular health, fitness, or summary cardio-metabolic scores)	Discussion and conclusion A consensus on how to define activity patterns is needed in order to determine which activity patterns are associated with children's and adolescents' cardio-metabolic risk. This will inform future research on the impact of activity patterns on children's and adolescents' short- and longer-term health.

Meta-Analysis	
Citation: Xue Y, Yang Y, Huang T. Effects of chronic exercise interventions on executive function among children and adolescents: a systematic review with meta-analysis. <i>Br J Sports Med.</i> 2019 Feb 8;(1):1–9.	
Purpose: To synthesise randomised controlled trials (RCTs) regarding the effects of chronic exercise interventions on different domain-specific executive functions (EFs) among children and adolescents.	Abstract: OBJECTIVE: To synthesise randomised controlled trials (RCTs) regarding the effects of chronic exercise interventions on different domain-specific executive functions (EFs) among children and adolescents. DESIGN: Systematic review with meta-analysis. DATA SOURCES: PsycINFO, PubMed, SPORTDiscus, Academic Search Premier, Embase and Web of Science were searched. ELIGIBILITY CRITERIA FOR SELECTING STUDIES: RCTs or cluster RCT design, which employ chronic exercise interventions and target healthy children (age 6-12 years) and adolescents (age 13-17 years). We defined chronic exercise as physical activity (PA) which consists of multiple exercise sessions per week and lasts for an extended period of time (typically over 6 weeks).
Timeframe: Not reported.	RESULTS: We included 19 studies, with a total of 5038 participants. The results showed that chronic exercise interventions improved overall EFs (standardised mean difference (SMD)=0.20, 95% CI 0.09 to 0.30, p<0.05) and inhibitory control (SMD=0.26, 95% CI 0.08 to 0.45, P<0.05). In meta regression, higher body mass index was associated with greater improvements in overall EFs performance (β =0.03, 95% CI 0.0002 to 0.06, p<0.05), whereas age and exercise duration were not. In subgroup analysis by intervention modality, sports and PA programme (SMD=0.21, 95% CI 0.12 to 0.31, p<0.05) and curricular PA (SMD=0.39, 95% CI 0.08 to 0.69, p<0.05) improved overall EFs performance, but integrated PA did not (SMD=0.02, 95% CI -0.05 to 0.09, p>0.05). Interventions with a session length < 90 minutes improved overall EFs performance (SMD=0.24, 95%CI 0.10 to 0.39, p=0.02), but session length \geq 90 minutes did not (SMD=0.05, 95%CI -0.03 to 0.14). No other moderator was found to have an effect.
Total # studies included: 19	CONCLUSIONS: Despite small effect sizes, chronic exercise interventions, implemented in curricular or sports and PA programme settings, might be a promising way to promote multiple aspects of executive functions, especially inhibitory control.
Author's Definition of chronic exercise: Physical activity which consists of multiple exercise sessions per week and lasts for an extended period of time (typically over 6 weeks).	
Outcomes addressed: Executive function (i.e., cognition flexibility, inhibitory control, working memory and planning)	
Populations analysed: children and adolescents	Author-stated funding source: TH was supported by Shanghai Pujiang Program (16PJC052) and the research project from General Administration of Sport of China (2017B044).