Evidence Portfolio – Physical Activity Promotion Subcommittee, Question 2

What interventions are effective for reducing sedentary behavior?

Sources of Evidence: Existing Systematic Reviews and Meta-Analyses

Conclusion Statements and Grades

ADULTS
Limited evidence suggests that sedentary behavior interventions targeting decreases in overall sedentary time in general adult populations are effective. **PAGAC Grade: Limited.**

YOUTH
Moderate evidence indicates that interventions targeting youth, primarily through reductions in television viewing and other screen-time behaviors in primarily school-based settings, have small but consistent effects on reducing sedentary behavior. **PAGAC Grade: Moderate.**

WORKSITE
Moderate evidence indicates that interventions targeting sedentary behavior in worksites—particularly among workers who perform their job duties primarily while seated—have moderate to large short-term effects in reducing sedentary behavior. **PAGAC Grade: Moderate.**

Description of the Evidence

The Physical Activity Promotion Subcommittee conducted one search for systematic reviews, meta-analyses, pooled analyses, and reports on physical activity and sedentary behavior to address both of its research questions. Additional searches for original research were not conducted based on the a-priori decision to focus on existing reviews.

Existing Systematic Reviews and Meta-Analyses

ADULTS

Overview
A total of 4 existing reviews were included: 3 meta-analyses,[1-3] and 1 systematic review.[4] The reviews were published between 2014 and 2016.

The meta-analyses included a range of 19 to 36 studies. The meta-analyses covered an extensive timeframe: inception to January 2015,[1] inception to January 2014,[2] and inception to November 2013.[3]

The systematic review included 30 studies and covered the timeframe from 2006 to October 2016.

Interventions
The included reviews examined the effects of intervention strategies to reduce sedentary time in adults. Two reviews compared interventions focused only on reducing sedentary behavior with those focused

on increasing physical activity.[2, 3] Two reviews examined the use of mobile-phone-based interventions.[1, 4]

Outcomes

The included reviews addressed changes in sedentary behavior. Changes in sedentary behavior were measured by self-reporting, devices, or a combination of the two.

WORKSITE

Overview

A total of 4 existing reviews were included: 2 meta-analyses[5, 6] and 2 systematic reviews.[7, 8] The reviews were published in 2015 and 2016.

The meta-analyses included 8[6] and 21[5] studies. Both meta-analyses covered a timeframe from inception to 2015.

The systematic reviews included 15[8] and 40[7] studies. The systematic reviews covered a timeframe from 1992 to March 2015[7] and from 2005 to December 2015.[8]

Interventions

The included reviews examined the effects of worksite intervention strategies to reduce sedentary time. Interventions included environmental, educational, behavioral, and/or policy components.

Outcomes

The included reviews addressed changes in sedentary behavior. Both meta-analyses examined the changes in sitting time. Changes in sedentary behavior were measured by self-reporting, objective measures, or a combination of the two.

YOUTH

Overview

A total of 9 existing reviews were included: 5 systematic reviews,[9-13] and 4 meta-analyses.[14-17] The reviews were published between 2011 and 2016.

The systematic reviews included a range of 10 to 22 studies. Reviews covered the following timeframes: inception to 2015,[12] inception to June 2015,[13] inception to February 2013,[9] inception to March 2012,[11] and 1980 to April 2011.[10]

The meta-analyses included a range of 13 to 34 studies. The meta-analyses covered the following timeframes: inception to October 2010,[14] 1948 to April 2011,[17] December 1989 to July 2010,[16] and 1998 to August 2012.[15]

Interventions

The included reviews examined the effects of intervention strategies to reduce sedentary time among children and youth. Friedrich et al[15] and Hynynen et al[9] examined interventions conducted in the school environment, while Norris et al[12] examined the effects of active video game interventions in school, and Sherry et al[13] examined the effects of standing desks within the school classroom. Marsh et al[11] examined family-based interventions.

Outcomes

The included reviews addressed changes in sedentary behavior. Changes in sedentary behavior were measured by self-reporting, objective measures, or a combination of the two. Friedrich et al[15] and Wahi et al[17] examined changes in screen time.

Populations Analyzed

The table below lists the populations analyzed in each article.

Table 1. Populations Analyzed by All Sources of Evidence

	Age
Biddle, 2011	Youth ≤18
Chu, 2016	Adults
Commissaris, 2016	Adults
Direito, 2016	Children and adults 8–72 with 40.1 median age
Friedrich, 2014	Children and youth 4–19
Hutcheson, 2016	Adults
Hynynen, 2016	Youth 15–19
Leung, 2012	Children and youth 6–19
Marsh, 2014	Children and youth 2–18
Martin, 2015	Adults ≥18
Norris, 2016	Children and youth 5–17
Prince, 2014	Adults 18–94
Schoeppe, 2016	Adults 18–71, Children and youth 8–17
Sherry, 2016	Children and youth 5–18
Shrestha, 2015	Adults
van Grieken, 2012	Children and youth 0–18
Wahi, 2011	Children and youth ≤18, Children <6

Supporting Evidence

Existing Systematic Reviews and Meta-Analyses

Table 2. Existing Systematic Reviews and Meta-Analyses Individual Evidence Summary Tables

<table>
<tr><th colspan="2">Adult Interventions</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Direito A, Carraça E, Rawstorn J, Whittaker R, Maddison R. mHealth technologies to influence physical activity and sedentary behaviors: behavior change techniques, systematic review and meta-analysis of randomized controlled trials. Ann Behav Med. Oct 2016. doi:10.1007/s12160-016-9846-0.</td></tr>
<tr><td>Purpose: To determine the effectiveness of mHealth on physical activity and sedentary behavior outcomes in free-living individuals.</td><td rowspan="5">Abstract: BACKGROUND: mHealth programs offer potential for practical and cost-effective delivery of interventions capable of reaching many individuals. PURPOSE: To (1) compare the effectiveness of mHealth interventions to promote physical activity (PA) and reduce sedentary behavior (SB) in free-living young people and adults with a comparator exposed to usual care/minimal intervention; (2) determine whether, and to what extent, such interventions affect PA and SB levels and (3) use the taxonomy of behavior change techniques (BCTs) to describe intervention characteristics. METHODS: A systematic review and meta-analysis following PRISMA guidelines was undertaken to identify randomized controlled trials (RCTs) comparing mHealth interventions with usual or minimal care among individuals free from conditions that could limit PA. Total PA, moderate-to-vigorous intensity physical activity (MVPA), walking and SB outcomes were extracted. Intervention content was independently coded following the 93-item taxonomy of BCTs. RESULTS: Twenty-one RCTs (1701 participants-700 with objectively measured PA) met eligibility criteria. SB decreased more following mHealth interventions than after usual care (standardised mean difference (SMD) -0.26, 95 % confidence interval (CI) -0.53 to -0.00). Summary effects across studies were small to moderate and non-significant for total PA (SMD 0.14, 95 % CI -0.12 to 0.41); MVPA (SMD 0.37, 95 % CI -0.03 to 0.77); and walking (SMD 0.14, 95 % CI -0.01 to 0.29). BCTs were employed more frequently in intervention (mean = 6.9, range 2 to 12) than in comparator conditions (mean = 3.1, range 0 to 10). Of all BCTs, only 31 were employed in intervention conditions. CONCLUSIONS: Current mHealth interventions have small effects on PA/SB. Technological advancements will enable more comprehensive, interactive and responsive intervention delivery. Future mHealth PA studies should ensure that all the active ingredients of the intervention are reported in sufficient detail.</td></tr>
<tr><td>Timeframe: Inception–January 2015</td></tr>
<tr><td>Total # of Studies: 19 in the meta-analysis (21 in the qualitative review)</td></tr>
<tr><td>Description of Intervention(s): Mobile-phone-based interventions related to PA, including those using short message service (SMS) and more complex functions (such as Bluetooth technology and smartphone applications).</td></tr>
<tr><td>Outcomes Addressed: Sedentary behavior outcomes of interest were duration (e.g., total minutes sitting) or an estimate of energy expenditure. Outcomes were either objectively measured (e.g., accelerometers, pedometers) or self-reported.</td></tr>
<tr><td>Examine cost, cost-effectivenesss or ROI: Not reported
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Children and adults 8–72 with 40.1 median age</td><td>Author-Stated Funding Source: Foundation for Science and Technology, Health Research Council, Sir Charles Hercus Fellowship.</td></tr>
</table>

<table>
<tr><th colspan="2">Adult Interventions</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Martin A, Fitzsimons C, Jepson R, et al.; EuroFIT consortium. Interventions with potential to reduce sedentary time in adults: systematic review and meta-analysis. Br J Sports Med. 2015;49(16):1056-1063. doi:10.1136/bjsports-2014-094524.</td></tr>
<tr><td>Purpose: To evaluate the effect of interventions that included sedentary behavior as an outcome measure in adults.</td><td rowspan="5">Abstract: CONTEXT: Time spent in sedentary behaviours (SB) is associated with poor health, irrespective of the level of physical activity. The aim of this study was to evaluate the effect of interventions which included SB as an outcome measure in adults. METHODS: Thirteen databases, including The Cochrane Library, MEDLINE and SPORTDiscus, trial registers and reference lists, were searched for randomised controlled trials until January 2014. Study selection, data extraction and quality assessment were performed independently. Primary outcomes included SB, proxy measures of SB and patterns of accumulation of SB. Secondary outcomes were cardiometabolic health, mental health and body composition. Intervention types were categorised as SB only, physical activity (PA) only, PA and SB or lifestyle interventions (PA/SB and diet). RESULTS: Of 8087 records, 51 studies met the inclusion criteria. Meta-analysis of 34/51 studies showed a reduction of 22 min/day in sedentary time in favour of the intervention group (95% CI -35 to -9 min/day, n=5868). Lifestyle interventions reduced SB by 24 min/day (95% CI -41 to -8 min/day, n=3981, moderate quality) and interventions focusing on SB only by 42 min/day (95% CI -79 to -5 min/day, n=62, low quality). There was no evidence of an effect of PA and combined PA/SB interventions on reducing sedentary time. CONCLUSIONS: There was evidence that it is possible to intervene to reduce SB in adults. Lifestyle and SB only interventions may be promising approaches. More high quality research is needed to determine if SB interventions are sufficient to produce clinically meaningful and sustainable reductions in sedentary time.</td></tr>
<tr><td>Timeframe: Inception–January 2014</td></tr>
<tr><td>Total # of Studies: 36 in meta-analysis (51 in qualitative review)</td></tr>
<tr><td>Description of Intervention(s): Variety of interventions to decrease sitting/sedentary time; subgroup analyses for intervention type (sedentary, PA/sedentary or lifestyle, PA/sedentary plus diet), gender, duration (<3 months, 3–6 months, >6 months), follow-up duration (<3 months, 3–6 months, 7–12 months, >12 months), setting (work place vs. home/community), outcome measure (objective vs. self-report), and study aim (sedentary primary vs. secondary).</td></tr>
<tr><td>Outcomes Addressed: Objectively measured or self-reported total time spent in sedentary behaviors: minutes/day, percentage of assessed time, number of sitting breaks, and number of prolonged sitting events.</td></tr>
<tr><td>Examine cost, cost-effectivenesss or ROI: Not reported
Examine Cardiorespiratory Fitness as Outcome: No</td><td></td></tr>
<tr><td>Populations Analyzed: Adults ≥18</td><td>Author-Stated Funding Source: EuroFIT consortium.</td></tr>
</table>

<table>
<tr><th colspan="2">Adult Interventions</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Prince SA, Saunders TJ, Gresty K, Reid RD. A comparison of the effectiveness of physical activity and sedentary behaviour interventions in reducing sedentary time in adults: a systematic review and meta-analysis of controlled trials. Obes Rev. 2014;15(11):905-919. doi:10.1111/obr.12215.</td></tr>
<tr><td>Purpose: To systematically review and compare the effectiveness of interventions with a focus on PA and/or sedentary behaviors (PA only vs. PA + sedentary behaviors [SB] vs. SB only) for reducing sedentary time in adults.</td><td rowspan="6">Abstract: The objective of this study was to systematically review the literature and compare the effectiveness of controlled interventions with a focus on physical activity (PA) and/or sedentary behaviours (SBs) for reducing sedentary time in adults. Six electronic databases were searched to identify all studies that examined the effects of interventions that targeted PA and/or SBs and that reported on changes in SBs (sedentary, sitting or television time). A qualitative synthesis was performed for all studies, and meta-analyses conducted among studies with mean differences (min/d) of sedentary time. PROSPERO: CRD42014006535. Sixty-five controlled studies met inclusion criteria; 33 were used in the meta-analyses. Interventions with a focus on PA or that included a PA and SB component produced less consistent findings and generally resulted in modest reductions in sedentary time (PA: standardized mean differences [SMD] = −0.22 [95% confidence interval [18]: −0.35, −0.10], PA + SB: SMD = −0.37 [95% CI: −0.69, −0.05]). Moderate quality evidence from the randomized controlled trial meta-analysis coupled with the qualitative synthesis provides consistent evidence that large and clinically meaningful reductions in sedentary time can be expected from interventions with a focus on reducing SBs (SMD = −1.28 [95% CI: −1.68, −0.87]). There is evidence to support the need for interventions to include a component focused on reducing SBs in order to generate clinically meaningful reductions in sedentary time.</td></tr>
<tr><td>Timeframe: Inception–November 2013</td></tr>
<tr><td>Total # of Studies: 33 in meta-analysis (63 in qualitative review)</td></tr>
<tr><td>Description of Intervention(s):
PA intervention trials including activities-based education, online interventions, and resources interventions. Subgroups: controlled trials and randomized controlled trials. Types of interventions: only PA, PA+SB, and SB only.</td></tr>
<tr><td>Outcomes Addressed: Sedentary behavior (minutes/day): sedentary time, sitting time, TV time.</td></tr>
<tr><td>Examine cost, cost-effectivenesss or ROI: Not reported
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults 18–94</td><td>Author-Stated Funding Source: Gordon E. Allen Post-Doctoral Fellowship in Health Behaviors at the University of Ottawa Heart Institute; Canadian Institutes of Health Research Fellowship; Heart and Stroke Foundation Post-Doctoral Fellowship.</td></tr>
</table>

<table>
<tr><th colspan="2">Adult Interventions</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Schoeppe S, Alley S, Van Lippevelde W, et al. Efficacy of interventions that use apps to improve diet, physical activity and sedentary behaviour: a systematic review. Int J Behav Nutr Phys Act. 2016;13(1):127. doi:10.1186/s12966-016-0454-y.</td></tr>
<tr><td>Purpose: To synthesize evidence for the efficacy of interventions that use apps to improve diet, PA, and sedentary behavior for noncommunicable disease prevention among adults and children.</td><td rowspan="5">Abstract: BACKGROUND: Health and fitness applications (apps) have gained popularity in interventions to improve diet, physical activity and sedentary behaviours but their efficacy is unclear. This systematic review examined the efficacy of interventions that use apps to improve diet, physical activity and sedentary behaviour in children and adults. METHODS: Systematic literature searches were conducted in five databases to identify papers published between 2006 and 2016. Studies were included if they used a smartphone app in an intervention to improve diet, physical activity and/or sedentary behaviour for prevention. Interventions could be stand-alone interventions using an app only, or multi-component interventions including an app as one of several intervention components. Outcomes measured were changes in the health behaviours and related health outcomes (i.e., fitness, body weight, blood pressure, glucose, cholesterol, quality of life). Study inclusion and methodological quality were independently assessed by two reviewers. RESULTS: Twenty-seven studies were included, most were randomised controlled trials (n = 19; 70%). Twenty-three studies targeted adults (17 showed significant health improvements) and four studies targeted children (two demonstrated significant health improvements). Twenty-one studies targeted physical activity (14 showed significant health improvements), 13 studies targeted diet (seven showed significant health improvements) and five studies targeted sedentary behaviour (two showed significant health improvements). More studies (n = 12; 63%) of those reporting significant effects detected between-group improvements in the health behaviour or related health outcomes, whilst fewer studies (n = 8; 42%) reported significant within-group improvements. A larger proportion of multi-component interventions (8 out of 13; 62%) showed significant between-group improvements compared to stand-alone app interventions (5 out of 14; 36%). Eleven studies reported app usage statistics, and three of them demonstrated that higher app usage was associated with improved health outcomes. CONCLUSIONS: This review provided modest evidence that app-based interventions to improve diet, physical activity and sedentary behaviours can be effective. Multi-component interventions appear to be more effective than stand-alone app interventions, however, this remains to be confirmed in controlled trials. Future research is needed on the optimal number and combination of app features, behaviour change techniques, and level of participant contact needed to maximise user engagement and intervention efficacy.</td></tr>
<tr><td>Timeframe: January 2006–October 2016</td></tr>
<tr><td>Total # of Studies: 30</td></tr>
<tr><td>Description of Intervention(s): Used an app in an intervention to influence PA or sedentary behavior: could be a standalone intervention using apps only, or a multicomponent intervention.</td></tr>
<tr><td>Outcomes Addressed: Lifestyle behavior change: PA (e.g., change in daily minutes of PA), sedentary behavior, and other outcomes, including weight status, fitness, blood pressure, and cholesterol.</td></tr>
<tr><td>Examine cost, cost-effectivenesss or ROI: Not reported
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
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Populations Analyzed: Adults (18–71), Children (8–17)	**Author-Stated Funding Source:** Early Career Fellowship from the Australian National Health and Medical Research Council. Future Leader Fellowships from the National Heart Foundation of Australia.

<table>
<tr><th colspan="2">Worksite Interventions</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Chu AH, Ng SH, Tan CS, Win AM, Koh D, Müller-Riemenschneider F. A systematic review and meta-analysis of workplace intervention strategies to reduce sedentary time in white-collar workers. Obes Rev. 2016;17(5):467-481. doi:10.1111/obr.12388.</td></tr>
<tr><td>Purpose: To fill existing gaps in the literature and summarize the evidence regarding the effectiveness of interventions aimed at reducing workplace sitting that focused on white-collar workers using controlled trials.</td><td rowspan="5">Abstract: Prolonged sedentary behaviour has been associated with various detrimental health risks. Workplace sitting is particularly important, providing it occupies majority of total daily sedentary behaviour among desk-based employees. The aim of this systematic review and meta-analysis was to examine the effectiveness of workplace interventions overall, and according to different intervention strategies (educational/behavioural, environmental and multi-component interventions) for reducing sitting among white-collar working adults. Articles published through December 2015 were identified in five online databases and manual searches. Twenty-six controlled intervention studies published between 2003 and 2015 of 4568 working adults were included. All 26 studies were presented qualitatively, and 21 studies with a control group without any intervention were included in the meta-analysis. The pooled intervention effect showed a significant workplace sitting reduction of -39.6 min/8-h workday (95% confidence interval [CI]: -51.7, -27.5), favouring the intervention group. Multi-component interventions reported the greatest workplace sitting reduction (-88.8 min/8-h workday; 95% CI: -132.7, -44.9), followed by environmental (-72.8 min/8-h workday; 95% CI: -104.9, -40.6) and educational/behavioural strategies -15.5 min/8-h workday (95% CI:-22.9,-8.2). Our study found consistent evidence for intervention effectiveness in reducing workplace sitting, particularly for multi-component and environmental strategies. Methodologically rigorous studies using standardized and objectively determined outcomes are warranted. (c) 2016 World Obesity.</td></tr>
<tr><td>Timeframe: Inception–December 2015</td></tr>
<tr><td>Total # of Studies: 21 in meta-analysis (26 in qualitative review)</td></tr>
<tr><td>Description of Intervention(s): Educational/behavioral, environmental, and multicomponent. Subgroups: intervention type (educational/behavioral, environmental, and multicomponent), study design (randomized control trial vs. not randomized control trial), assessment measure (self-report vs. objective), and outcome measure (minutes/8-hour day and minutes/day).</td></tr>
<tr><td>Outcomes Addressed: Self-report of objectively measured sitting time per day (minutes/8-hour workday or minutes/waking hours) and sitting-based energy expenditure.

Examine cost, cost-effectivenesss or ROI: Not reported
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults</td><td>Author-Stated Funding Source: National University of Singapore Research Scholarship.</td></tr>
</table>

<table>
<tr><th colspan="2">Worksite Interventions</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Commissaris DA, Huysmans MA, Mathiassen SE, Srinivasan D, Koppes LLj, Hendriksen IJ. Interventions to reduce sedentary behavior and increase physical activity during productive work: a systematic review. Scand J Work Environ Health. 2016;42(3):181-191. doi:10.5271/sjweh.3544.</td></tr>
<tr><td>Purpose: To address the effectiveness of workplace interventions that are implemented during productive work and are intended to change worker's sedentary behavior and/or physical activity.</td><td rowspan="5">Abstract: OBJECTIVE: This review addresses the effectiveness of workplace interventions that are implemented during productive work and are intended to change workers` SB and/or PA. METHODS: We searched Scopus for articles published from 1992 until 12 March 2015. Relevant studies were evaluated using the Quality Assessment Tool for Quantitative Studies and summarized in a best-evidence synthesis. Primary outcomes were SB and PA, both at work and overall (ie, during the whole day); work performance and health-related parameters were secondary outcomes. RESULTS: The review included 40 studies describing 41 interventions organized into three categories: alternative workstations (20), interventions promoting stair use (11), and personalized behavioral interventions (10). Alternative workstations were found to decrease overall SB (strong evidence; even for treadmills separately); interventions promoting stair use were found to increase PA at work while personalized behavioral interventions increased overall PA (both with moderate evidence). There was moderate evidence to show alternative workstations influenced neither hemodynamics nor cardiorespiratory fitness and personalized behavioral interventions did not influence anthropometric measures. Evidence was either insufficient or conflicting for intervention effects on work performance and lipid and metabolic profiles. CONCLUSIONS: Current evidence suggests that some of the reviewed workplace interventions that are compatible with productive work indeed have positive effects on SB or PA at work. In addition, some of the interventions were found to influence overall SB or PA positively. Putative long-term effects remain to be established.</td></tr>
<tr><td>Timeframe: 1992–March 2015</td></tr>
<tr><td>Total # of Studies: 40</td></tr>
<tr><td>Description of Intervention(s): Workstations interventions, promoting stair use, and personalized behavioral interventions.</td></tr>
<tr><td>Outcomes Addressed: Primary outcomes were changes in sedentary behavior and physical activity; also metabolic and physiologic, hemodynamic measures, cardiorespiratory fitness, anthropometric measures. Subgroup analyses for sit-stand stations and treadmills.</td></tr>
<tr><td>Examine cost, cost-effectivenesss or ROI: Not reported
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults</td><td>Author-Stated Funding Source: Dutch Ministry of Economic Affairs, and the manufacturer Markant Office Furniture contributed with in-kind resources, the Swedish Research Council for Health, and Working Life and Welfare.</td></tr>
</table>

<table>
<tr><th colspan="2">Worksite Interventions</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Hutcheson AK, Piazza AJ, Knowlden AP. Work site-based environmental interventions to reduce sedentary behavior: a systematic review. Am J Health Promot. Oct 2016. pii: 0890117116674681.</td></tr>
<tr><td>Purpose: To determine the effectiveness of environmental, worksite-based interventions to reduce sedentary behavior and to provide recommendations to enhance future intervention efforts.</td><td rowspan="6">Abstract: OBJECTIVE: The purpose of this investigation was to systematically review work site-based, environmental interventions to reduce sedentary behavior following preferred reporting items for systematic reviews and meta-analyses guidelines. DATA SOURCE: Data were extracted from Medical Literature Analysis and Retrieval System Online, Cochrane Central Register of Controlled Trials, and Web of Science between January 2005 and December 2015. STUDY INCLUSION AND EXCLUSION CRITERIA: Inclusion criteria were work site interventions, published in peer-reviewed journals, employing environmental modalities, targeting sedentary behavior, and using any quantitative design. Exclusion criteria were noninterventions and non-English publications. DATA EXTRACTION: Data extracted included study design, population, intervention dosage, intervention activities, evaluation measures, and intervention effects. DATA SYNTHESIS: Data were tabulated quantitatively and synthesized qualitatively. RESULTS: A total of 15 articles were identified for review and 14 reported statistically significant decreases in sedentary behavior. The majority of studies employed a randomized controlled trial design (n = 7), used inclinometers to measure sedentary behavior (n = 9), recruited predominantly female samples (n = 15), and utilized sit-to-stand desks as the primary intervention modality (n = 10). The mean methodological quality score was 6.2 out of 10. CONCLUSION: Environmental work site interventions to reduce sedentary behavior show promise because work sites often have more control over environmental factors. Limitations of this intervention stream include inconsistent measurement of sedentary behavior, absence of theoretical frameworks to guide program development, and absence of long-term evaluation. Future studies should include clear reporting of intervention strategies and explicit operationalization of theoretical constructs.</td></tr>
<tr><td>Timeframe: 2005–December 2015</td></tr>
<tr><td>Total # of Studies: 15</td></tr>
<tr><td>Description of Intervention(s): Worksite interventions. Most studies incorporated one of the following: sit-to-stand desks, treadmill desks, portable pedal machines, or prompting technology.</td></tr>
<tr><td>Outcomes Addressed: Sedentary behavior: measured by accelerometers or inclinometers, experience sampling methodology via text message, or self-report via questionnaire.</td></tr>
<tr><td>Examine cost, cost-effectivenesss or ROI: Not reported
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults</td><td>Author-Stated Funding Source: None.</td></tr>
</table>

<table>
<tr><th colspan="2">Worksite Interventions</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Shrestha N, Ijaz S, Kukkonen-Harjula KT, Kumar S, Nwankwo CP. Workplace interventions for reducing sitting at work. Cochrane Database Syst Rev. 2015;1:Cd010912. doi:10.1002/14651858.CD010912.pub2.</td></tr>
<tr><td>Purpose: To evaluate the effects of workplace interventions to reduce sitting at work compared to no intervention or alternative interventions.</td><td rowspan="4">Abstract: BACKGROUND: The number of people working whilst seated at a desk keeps increasing worldwide. As sitting increases, occupational physical strain declines at the same time. This has contributed to increases in cardiovascular disease, obesity and diabetes. Therefore, reducing and breaking up the time that people spend sitting while at work is important for health. OBJECTIVES: To evaluate the effects of workplace interventions to reduce sitting at work compared to no intervention or alternative interventions. SEARCH METHODS: We searched the Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE, EMBASE, CINAHL, OSH UPDATE, PsycINFO, Clinical trials.gov and the World Health Organization (WHO) search trial portal up to 14 February, 2014. We also searched reference lists of articles and contacted authors. SELECTION CRITERIA: We included randomised controlled trials (RCT), cluster-randomised controlled trials (cRCTs), and quasi-randomised controlled trials of interventions to reduce sitting at work. For changes of workplace arrangements, we also included controlled before-and-after studies (CBAs) with a concurrent control group. The primary outcome was time spent sitting at work per day, either self-reported or objectively measured by means of an accelerometer coupled with an inclinometer. We considered energy expenditure, duration and number of sitting episodes lasting 30 minutes or more, work productivity and adverse events as secondary outcomes. DATA COLLECTION AND ANALYSIS: Two review authors independently screened titles, abstracts and full-text articles for study eligibility. Two review authors independently extracted data and assessed risk of bias. We contacted authors for additional data where required. MAIN RESULTS: We included eight studies, four RCTs, three CBAs and one cRCT, with a total of 1125 participants. The studies evaluated physical workplace changes (three studies), policy changes (one study) and information and counselling (four studies). No studies investigated the effect of treadmill desks, stepping devices, periodic breaks or standing or walking meetings. All the studies were at high risk of bias. The quality of the evidence was very low to low. Half of the studies were from</td></tr>
<tr><td>Timeframe: Inception–June 2015</td></tr>
<tr><td>Total # of Studies: 8 in the meta-analysis (20 in the qualitative review)</td></tr>
<tr><td>Description of Intervention(s): Interventions included changing features of the workplace (use of a sit-stand desk, use of inflated balloon chairs or therapy balls, printer location), policy changes (walking meetings, frequent breaks, sitting diaries), and information/counseling to encourage workers to sit less (individual counseling, e-health intervention, and signs to prompt walking).</td></tr>
<tr><td>Outcomes Addressed: Time spent seated at work, either self-reported (by questionnaires) or objectively measured sitting by accelerometer-inclinometer to assess PA intensity and body posture; self-reported or objectively measured episodes of prolonged sitting (30 minutes or more) at work and number of episodes.</td></tr>
</table>

Examine cost, cost-effectivenesss or ROI: Not reported **Examine Cardiorespiratory Fitness as Outcome:** No	Australia and the other half from Europe, with none from low- or middle-income countries. Physical workplace changesWe found very low quality evidence that sit-stand desks with or without additional counselling reduced sitting time at work per workday at one week follow-up (MD -143 minutes (95% CI -184 to -102, one study, 31 participants) and at three months' follow-up (MD - 113 minutes, 95% CI -143 to -84, two studies, 61 participants) compared to no intervention. Total sitting time during the whole day decreased also with sit-stand desks compared to no intervention (MD -78 minutes, 95% CI -125 to -30, one study, 31 participants) as did the duration of sitting episodes lasting 30 minutes or more (MD -52 minutes, 95% CI -79 to -26, two studies, 74 participants). Sit-stand desks did not have a considerable effect on work performance and had an inconsistent effect on musculoskeletal symptoms and sick leave. Policy changesWalking strategies had no considerable effect on sitting at work (MD -16 minutes, 95% CI -54 to 23, one study, 179 participants, low quality evidence). Information and counsellingGuideline-based counselling by occupational physicians reduced sitting time at work (MD -28 minutes, 95% CI -54 to -2, one study, 396 participants, low quality evidence). There was no considerable effect on reduction in total sitting time during the whole day.Mindfulness training induced a non-significant reduction in workplace sitting time (MD -2 minutes, 95% CI -22 to 18) at six months' follow-up and at 12 months' follow-up (MD -16 minutes, 95% CI -45 to 12, one study, 257 participants, low quality evidence).There was an inconsistent effect of computer prompting on sitting time at work. One study found no considerable effect on sitting at work (MD -18 minutes, 95% CI -53 to 17, 28 participants, low quality evidence) at 10 days' follow-up, while another study reported a significant reduction in sitting at work (MD -55 minutes, 95% CI -96 to -14, 34 participants, low quality evidence) at 13 weeks' follow-up. Computer prompting software also led to a non-significant increase in energy expenditure at work (MD 278 calories/workday, 95% CI 0 to 556, one study, 34 participants, low quality evidence) at 13 weeks' follow-up. AUTHORS' CONCLUSIONS: At present there is very low quality evidence that sit-stand desks can reduce sitting time at work, but the effects of policy changes and information and counselling are inconsistent. There is a need for high quality cluster-randomised trials to assess the effects of different types of interventions on objectively measured sitting time. There are many ongoing trials that might change these conclusions in the near future.
Populations Analyzed: Adults	**Author-Stated Funding Source:** Cochrane Work Review Group, Finland and UK. Mesenaatti.me, Finland.

<table>
<tr><th colspan="2">Youth Interventions</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Biddle SJ, O'Connell S, Braithwaite RE. Sedentary behaviour interventions in young people: a meta-analysis. Br J Sports Med. 2011;45(11):937-942. doi: 10.1136/bjsports-2011-090205.</td></tr>
<tr><td>Purpose: To identify the interventions targeted at reducing sedentary behavior in children and adolescents.</td><td rowspan="5">Abstract: BACKGROUND:
There is increasing concern about the time young people spend in sedentary behaviour ('sitting time'), especially with the development of attractive home-based electronic entertainment. This may have deleterious health effects.
PURPOSE:
To ascertain, through a meta-analytic review, whether interventions targeted at reducing sedentary behaviours in young people are successful.
METHOD:
ERIC, MedLine, PsychInfo, SportDiscus and the Cochrane Library databases were searched up to 2010. Titles and abstracts of identified papers were examined against inclusion criteria. Included papers were coded by three researchers.
RESULTS:
17 papers, including 17 independent samples (N=4976), met the inclusion criteria and were analysed. There was a small but significant effect in favour of sedentary behaviour reduction for intervention groups (Hedges' g = - 0.192; SE = 0.056; 95% CI = -0.303 to -0.082; p = 0.001). Moderator analyses produced no significant between-moderator results for any of the intervention or study characteristics, although trends were evident.
CONCLUSION:
Behaviour change interventions targeting reductions in sedentary behaviour have been shown to be successful, although effects are small. More needs to be known about how best to optimise intervention effects.</td></tr>
<tr><td>Timeframe: Inception–2010</td></tr>
<tr><td>Total # of Studies: 17</td></tr>
<tr><td>Description of Intervention(s): Interventions focused on sedentary or combination PA and sedentary behaviors. Clinical, community-based, counseling, education, and laboratory interventions compared.</td></tr>
<tr><td>Outcomes Addressed: Change in sedentary behavior: self-reported, objective measures, or a combination. Differences between experimental and control groups examined.</td></tr>
<tr><td>Examine cost, cost-effectivenesss or ROI: Not reported.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Youth ≤18</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

<table>
<tr><th colspan="2">Youth Interventions</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Friedrich RR, Polet JP, Schuch I, Wagner MB. Effect of intervention programs in schools to reduce screen time: a meta-analysis. J Pediatr (Rio J). 2014;90(3):232-241. doi:10.1016/j.jped.2014.01.003.</td></tr>
<tr><td>Purpose: To evaluate the effects of interventions, conducted in the school environment, on the time dedicated to activities such as watching television, playing video games, and using a computer.</td><td rowspan="6">Abstract: OBJECTIVE:
to evaluate the effects of intervention program strategies on the time spent on activities such as watching television, playing videogames, and using the computer among schoolchildren.
SOURCES:
a search for randomized controlled trials available in the literature was performed in the following electronic databases: PubMed, Lilacs, Embase, Scopus, Web of Science, and Cochrane Library using the following Keywords randomized controlled trial, intervention studies, sedentary lifestyle, screen time, and school. A summary measure based on the standardized mean difference was used with a 95% confidence interval.
DATA SYNTHESIS:
a total of 1,552 studies were identified, of which 16 were included in the meta-analysis. The interventions in the randomized controlled trials (n=8,785) showed a significant effect in reducing screen time, with a standardized mean difference (random effect) of: -0.25 (-0.37, -0.13), p<0.01.
CONCLUSION:
interventions have demonstrated the positive effects of the decrease of screen time among schoolchildren.</td></tr>
<tr><td>Timeframe: 1998–August 2012</td></tr>
<tr><td>Total # of Studies: 16</td></tr>
<tr><td>Description of Intervention(s): Randomized controlled trials that aimed to reduce screen time, with a minimum duration of 3 months, conducted in the school environment. Some included nutrition and physical activities.</td></tr>
<tr><td>Outcomes Addressed: Time spent watching television, playing video games, or using a computer (hours/day).</td></tr>
<tr><td>Examine cost, cost-effectivenesss or ROI: Not reported
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Children and youth ages 4–19</td><td>Author-Stated Funding Source: National Council for Scientific and Technological Development.</td></tr>
</table>

<table>
<tr><th colspan="2">Youth Interventions</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Hynynen ST, van Stralen MM, Sniehotta FF, et al. A systematic review of school-based interventions targeting physical activity and sedentary behaviour among older adolescents. Int Rev Sport Exerc Psychol. 2016;9(1):22-44. doi:10.1080/1750984X.2015.1081706.</td></tr>
<tr><td>Purpose: To evaluate the effectiveness of school-based interventions to increase PA and decrease sedentary behavior among 15- to 19-year-old adolescents, and examine whether intervention characteristics (intervention length, delivery mode, and intervention provider) and intervention content (e.g., behavior change techniques) are related to intervention effectiveness.</td><td rowspan="5">Abstract: Lack of physical activity (PA) and high levels of sedentary behaviour (SB) have been associated with health problems. This systematic review evaluates the effectiveness of school-based interventions to increase PA and decrease SB among 15-19-year-old adolescents, and examines whether intervention characteristics (intervention length, delivery mode and intervention provider) and intervention content (i.e. behaviour change techniques, BCTs) are related to intervention effectiveness. A systematic search of randomised or cluster randomised controlled trials with outcome measures of PA and/or SB rendered 10 results. Risk of bias was assessed using the Cochrane risk of bias tool. Intervention content was coded using Behaviour Change Technique Taxonomy v1. Seven out of 10 studies reported significant increases in PA. Effects were generally small and short-term (Cohen's d ranged from 0.132 to 0.659). Two out of four studies that measured SB reported significant reductions in SB. Interventions that increased PA included a higher number of BCTs, specific BCTs (e.g., goal setting, action planning and self-monitoring), and were delivered by research staff. Intervention length and mode of delivery were unrelated to effectiveness. More studies are needed that evaluate long-term intervention effectiveness and target SBs among older adolescents.</td></tr>
<tr><td>Timeframe: Inception–February 2013</td></tr>
<tr><td>Total # of Studies: 10</td></tr>
<tr><td>Description of Intervention(s): School-based interventions that targeted PA or sedentary behavior in adolescents, randomized control trials, and cluster randomised control trials.</td></tr>
<tr><td>Outcomes Addressed: Self-reported and objectively measured PA, including step counts (pedometer) and accelerometers, varying in length from 1 session to 9 months.</td></tr>
<tr><td>Examine cost, cost-effectivenesss or ROI: Not reported
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Youth ages 15–19</td><td>Author-Stated Funding Source: Ministry of Education and Culture, Ministry of Social Affairs and Health, Fuse, UK Clinical Research Collaboration Centre of Excellence for Translational Research in Public Health, British Heart Foundation, Cancer Research UK, Economic and Social Research Council, Medical Research Council, and the National Institute for Health Research under the UK Clinical Research Collaboration.</td></tr>
</table>

<table>
<tr><th colspan="2">Youth Interventions</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Leung MM, Agaronov A, Grytsenko K, Yeh MC. Intervening to reduce sedentary behaviors and childhood obesity among school-age youth: a systematic review of randomized trials. J Obes. 2012;2012:685430. doi:10.1155/2012/685430.</td></tr>
<tr><td>Purpose: To assess the effectiveness of interventions that focus on reducing sedentary behavior among school-age youth.</td><td rowspan="6">Abstract: Objective. To assess the effectiveness of interventions that focus on reducing sedentary behavior (SB) among school-age youth and to identify elements associated with interventions' potential for translation into practice settings. Methods. A comprehensive literature search was conducted using 4 databases for peer-reviewed studies published between 1980 and April 2011. Randomized trials, which lasted at least 12 weeks, aimed at decreasing SB among children aged 6 to 19 years were identified. Results. Twelve studies were included; 3 focused only on SB, 1 focused on physical activity (PA), 6 were combined SB and PA interventions, and 2 studies targeted SB, PA, and diet. The majority of the studies were conducted in a school setting, while others were conducted in such settings as clinics, community centers, and libraries. Conclusions. Overall, interventions that focused on decreasing SB were associated with reduction in time spent on SB and/or improvements in anthropometric measurements related to childhood obesity. Several of the studies did consider elements related to the intervention's potential for translation into practice settings.</td></tr>
<tr><td>Timeframe: 1980–April 2011</td></tr>
<tr><td>Total # of Studies: 12</td></tr>
<tr><td>Description of Intervention(s): Interventions aimed at decreasing sedentary behavior (SB). Included interventions were single component (addressing only SB) or multiple component (addressing also PA and diet). Most interventions were delivered in school settings followed by other community venues such as clinics and community centers. Common intervention components included family involvement (e.g., parents receiving newsletters or attending workshops) and provision of tangible ideas and alternatives to SB to children.</td></tr>
<tr><td>Outcomes Addressed: Sedentary behavior: defined as media-related behavior (time spent watching TV/videotapes, playing video games). Studies addressing PA were also included if SB was measured independently.</td></tr>
<tr><td>Examine cost, cost-effectivenesss or ROI: Data on cost of interventions identified for this paper were very limited.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Children and youth ages 6–19</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

<table>
<tr><th colspan="2">Youth Interventions</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Marsh S, Foley LS, Wilks DC, Maddison R. Family-based interventions for reducing sedentary time in youth: a systematic review of randomized controlled trials. Obes Rev. 2014;15(2):117-133. doi:10.1111/obr.12105.</td></tr>
<tr><td>Purpose: To examine the effectiveness of these interventions with respect to decreasing sedentary time, and investigate whether level of family involvement/engagement affects this outcome.</td><td rowspan="5">Abstract: Family involvement in interventions to reduce sedentary time may help foster appropriate long-term screen-based habits in children. This review systematically synthesized evidence from randomized controlled trials of interventions with a family component that targeted reduction of sedentary time, including TV viewing, video games and computer use, in children. MEDLINE, PubMed, PsycInfo, CINAHL and Embase were searched from inception through March 2012. Seventeen articles were considered eligible and included in the review. Studies were judged to be at low-to-moderate risk of bias. Despite inconsistent study results, level of parental involvement, rather than the setting itself, appeared an important determinant of intervention success. Studies including a parental component of medium-to-high intensity were consistently associated with statistically significant changes in sedentary behaviours. Participant age was also identified as a determinant of intervention outcomes; all three studies conducted in pre-school children demonstrated significant decreases in sedentary time. Finally, TV exposure appeared to be related to changes in energy intake rather than physical activity. Future studies should assess the effects of greater parental involvement and child age on success of sedentary behaviour interventions. More research is required to better understand the relationship between screen time and health behaviours, particularly energy intake.</td></tr>
<tr><td>Timeframe: Inception–March 2012</td></tr>
<tr><td>Total # of Studies: 17</td></tr>
<tr><td>Description of Intervention(s): Family-based interventions: including at least one parent and the child with active involvement for the parent. Subgroups: home-based, community-based, primary-care-based, school-based, and mixed setting.</td></tr>
<tr><td>Outcomes Addressed: Sedentary time (minutes/day): sedentary screen time, targeted and non-targeted sedentary time, sedentary time or video/TV use.</td></tr>
<tr><td>Examine cost, cost-effectivenesss or ROI: Not reported
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Children and youth ages 2–18</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

<table>
<tr><th colspan="2">Youth Interventions</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Norris E, Hamer M, Stamatakis E. Active video games in schools and effects on physical activity and health: a systematic review. J Pediatr. 2016;172:40-46.e5. doi:10.1016/j.jpeds.2016.02.001.</td></tr>
<tr><td>Purpose: To present current evidence on school-based active video games and their relationship with health and PA outcomes, including motor skills in children and youth ages 5 and older.</td><td rowspan="5">Abstract: OBJECTIVE: To assess the quality of evidence for the effects of school active video game (AVG) use on physical activity and health outcomes. STUDY DESIGN: Online databases (ERIC, PsycINFO, PubMed, SPORTDiscus, and Web of Science) and gray literature were searched. Inclusion criteria were the use of AVGs in school settings as an intervention; assessment of at least 1 health or physical activity outcome; and comparison of outcomes with either a control group or comparison phase. Studies featuring AVGs within complex interventions were excluded. Study quality was assessed using the Effective Public Health Practice Project tool. RESULTS: Twenty-two reports were identified: 11 assessed physical activity outcomes only, 5 assessed motor skill outcomes only, and 6 assessed both physical activity and health outcomes. Nine out of 14 studies found greater physical activity in AVG sessions compared with controls; mostly assessed by objective measures in school time only. Motor skills were found to improve with AVGs vs controls in all studies but not compared with other motor skill interventions. Effects of AVGs on body composition were mixed. Study quality was low in 16 studies and moderate in the remaining 6, with insufficient detail given on blinding, participation rates, and confounding variables. CONCLUSIONS: There is currently insufficient evidence to recommend AVGs as efficacious health interventions within schools. Higher quality AVG research utilizing randomized controlled trial designs, larger sample sizes, and validated activity measurements beyond the school day is needed.</td></tr>
<tr><td>Timeframe: Inception–2015</td></tr>
<tr><td>Total # of Studies: 22</td></tr>
<tr><td>Description of Intervention(s): Interventions featured active video game exposure in school: within a lesson, during break time, or before or after the school day.</td></tr>
<tr><td>Outcomes Addressed: Changes in PA: self-report or accelerometer. Body mass index and body composition.
Sedentary Behavior an Outcome: Yes</td></tr>
<tr><td>Examine cost, cost-effectivenesss or ROI: Not reported
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Children and youth ages 5–17</td><td>Author-Stated Funding Source: University College London Crucible doctoral studentship; National Health and Medical Research Council Senior Research Fellowship</td></tr>
</table>

<table>
<tr><th colspan="2">Youth Interventions</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Sherry AP, Pearson N, Clemes SA. The effects of standing desks within the school classroom: a systematic review. Prev Med Rep. 2016;3:338-347. doi:10.1016/j.pmedr.2016.03.016.</td></tr>
<tr><td>Purpose: To examine the effects of interventions that have implemented standing desks within the classroom.</td><td rowspan="4">Abstract: BACKGROUND: The school classroom environment often dictates that pupils sit for prolonged periods which may be detrimental for children's health. Replacing traditional school desks with standing desks may reduce sitting time and provide other benefits. The aim of this systematic review was to assess the impact of standing desks within the school classroom. METHOD: Studies published in English up to and including June 2015 were located from online databases and manual searches. Studies implementing standing desks within the school classroom, including children and/or adolescents (aged 5-18 years) which assessed the impact of the intervention using a comparison group or pre-post design were included. RESULTS: Eleven studies were eligible for inclusion; all were set in primary/elementary schools, and most were conducted in the USA (n = 6). Most were non-randomised controlled trials (n = 7), with durations ranging from a single time point to five months. Energy expenditure (measured over 2 h during school day mornings) was the only outcome that consistently demonstrated positive results (three out of three studies). Evidence for the impact of standing desks on sitting, standing, and step counts was mixed. Evidence suggested that implementing standing desks in the classroom environment appears to be feasible, and not detrimental to learning. CONCLUSIONS: Interventions utilising standing desks in classrooms demonstrate positive effects in some key outcomes but the evidence lacks sufficient quality and depth to make strong conclusions. Future studies using randomised control trial designs with larger samples, longer durations, with sitting, standing time and academic achievement as primary outcomes, are warranted.</td></tr>
<tr><td>Timeframe: Inception–June 2015</td></tr>
<tr><td>Total # of Studies: 11</td></tr>
<tr><td>Description of Intervention(s): Standing desks, including sit-to-stand desks, standing desks, standing workstations, stand-sit workstations, stand-biased desk, and adjustable furniture.</td></tr>
<tr><td>Outcomes Addressed: Steps, sitting time, and energy expenditure.</td><td rowspan="2"></td></tr>
<tr><td>Examine cost, cost-effectivenesss or ROI: Not reported
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Children and youth ages 5–18</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

<table>
<tr><th colspan="2">Youth Interventions</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: van Grieken A, Ezendam NP, Paulis WD, Wouden JC, Raat H. Primary prevention of overweight in children and adolescents: a meta-analysis of the effectiveness of interventions aiming to decrease sedentary behaviour. Int J Behav Nutr Phys Act. 2012;9(2):61. doi:10.1186/1479-5868-9-61.</td></tr>
<tr><td>Purpose: To examine the effects of interventions aiming to prevent high levels of time spent in sedentary behaviors, implemented in school and general population settings, targeting children and adolescents, on the amount of sedentary behavior and body mass index.</td><td rowspan="5">Abstract: The objectives of this meta-analysis were to provide an overview of the evidence regarding the effects of interventions, implemented in the school- and general population setting, aiming to prevent excessive sedentary behaviour in children and adolescents on (1) the amount of sedentary behaviour and (2) BMI. Differences in effects on sedentary behaviour and BMI between single health behaviour interventions (sedentary behaviour only) and multiple health behaviour interventions were explored. A literature search was conducted in PubMed, EMBASE, Web of Science, PsycINFO and Cochrane Database of Systematic Reviews. Thirty-four (R)CT studies evaluating 33 general population interventions, published between 1990 and April 2011, aiming to decrease sedentary behaviour in normal weight children or adolescents (0-18 years) were included. Intervention duration ranged from 7 days to 4 years. Mean change in sedentary behaviour and BMI from baseline to post-intervention was calculated using a random effects model. Results showed significant decreases for the amount of sedentary behaviour and BMI. For sedentary behaviour the post-intervention mean difference was -17.95 min/day (95%CI:-26.61;-9.28); the change-from-baseline mean difference was -20.44 min/day (95%CI:-30.69;-10.20). For BMI the post-intervention mean difference was -0.25 kg/m² (95%CI:-0.40;-0.09); the change-from-baseline mean difference was -0.14 kg/m² (95%CI:-0.23;-0.05). No differences were found between single and multiple health behaviour interventions. Interventions in the school- and general population setting aiming to reduce only sedentary behaviour and interventions targeting multiple health behaviours can result in significant decreases in sedentary behaviour. Studies need to increase follow-up time to estimate the sustainability of the intervention effects found.</td></tr>
<tr><td>Timeframe: December 1989–July 2010</td></tr>
<tr><td>Total # of Studies: 34</td></tr>
<tr><td>Description of Intervention(s): Interventions of any duration that aimed to reduce the level of sedentary behavior. The majority of the interventions were performed in the school setting. Sedentary behavior was generally targeted with individual-level interventions such as counseling or tailored feedback. Parents were often involved. Another approach, although used less frequently, was the home-based intervention.</td></tr>
<tr><td>Outcomes Addressed: Sedentary behavior (minutes per day) included screen time activities (watching television, DVD/video/HDD viewing, electronic gaming, computer activities, and small screen activities) and behaviors (listening to music, “sitting around doing nothing,” or talking on the phone). BMI.</td></tr>
<tr><td>Examine cost, cost-effectivenesss or ROI: Not reported
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Children and youth ages 0–18</td><td>Author-Stated Funding Source: ZonMw, the Netherlands Organisation for Health Research and Development, the Netherlands Organisation for Scientific Research.</td></tr>
</table>

<table>
<tr><th colspan="2">Youth Interventions</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Wahi G, Parkin PC, Beyene J, Uleryk EM, Birken CS. Effectiveness of interventions aimed at reducing screen time in children: a systematic review and meta-analysis of randomized controlled trials. Arch Pediatr Adolesc Med. 2011;165(11):979-986. doi:10.1001/archpediatrics.2011.122.</td></tr>
<tr><td>Purpose: To evaluate the impact on children of interventions aimed at reducing screen time on the outcome of body mass index.</td><td rowspan="5">Abstract: OBJECTIVE: To evaluate the impact of interventions focused on reducing screen time.
DATA SOURCES: Medline, Embase, Cochrane Central Register of Controlled Trials, PsycINFO, ERIC, and CINAHL through April 21, 2011.
STUDY SELECTION: Included studies were randomized controlled trials of children aged 18 years or younger with interventions that focused on reducing screen time.
INTERVENTION: Efforts to reduce screen time.
MAIN OUTCOME MEASURES:
The primary outcome was body mass index (BMI); the secondary outcome was screen time (hours per week).
RESULTS: A total of 1120 citations were screened, and 13 studies were included in the systematic review. Study samples ranged in age (3.9-11.7 years) and size (21-1295 participants). Interventions ranged in length (1-24 months) and recruitment location (5 in schools, 2 in medical clinics, 1 in a community center, and 5 from the community). For the primary outcome, the meta-analysis included 6 studies, and the difference in mean change in BMI in the intervention group compared with the control group was -0.10 (95% confidence interval [CI], -0.28 to 0.09) (P = .32). The secondary outcome included 9 studies, and the difference in mean change from baseline in the intervention group compared with the control group was -0.90 h/wk (95% CI, -3.47 to 1.66 h/wk) (P = .49). A subgroup analysis of preschool children showed a difference in mean change in screen time of -3.72 h/wk (95% CI, -7.23 to -0.20 h/wk) (P = .04).
CONCLUSIONS: Our systematic review and meta-analysis did not demonstrate evidence of effectiveness of interventions aimed at reducing screen time in children for reducing BMI and screen time. However, interventions in the preschool age group hold promise.</td></tr>
<tr><td>Timeframe: 1948–April 2011</td></tr>
<tr><td>Total # of Studies: 13</td></tr>
<tr><td>Description of Intervention(s): Interventions to reduce screen time in the included trials for the most part involved multiple sessions over a prolonged time period, integrated into the school curriculum, clinic settings, or the home.</td></tr>
<tr><td>Outcomes Addressed: Reduction in screen time (e.g., television, video games, and/or computer use). Included studies assessed either screen time or television viewing only. All units of measure were converted to hours per week. The difference in mean change in screen time in the intervention compared to the control group was reported.</td></tr>
<tr><td>Examine cost, cost-effectivenesss or ROI: Not reported.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Youth ≤18; Children <6</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

Table 3. Existing Systematic Reviews and Meta-Analyses Quality Assessment Chart

AMSTARExBP: SR/MA						
	Biddle, 2011	Chu, 2016	Commissaris, 2016	Direito, 2016	Friedrich, 2014	Grieken, 2012
Review questions and inclusion/exclusion criteria delineated prior to executing search strategy.	Yes	Yes	Yes	Yes	Yes	Yes
Population variables defined and considered in methods.	No	No	No	No	No	No
Was a comprehensive literature search performed?	Yes	Yes	Partially Yes	Yes	Yes	Yes
Duplicate study selection and data extraction performed.	No	Yes	Yes	Yes	No	Yes
Search strategy clearly described.	Yes	Yes	Yes	Yes	Yes	Yes
Relevant grey literature included in review.	No	No	No	No	No	No
List of studies (included and excluded) provided.	No	No	Yes	No	No	No
Characteristics of included studies provided.	Yes	Yes	Yes	Yes	Yes	No
FITT defined and examined in relation to outcome effect sizes.	N/A	No	N/A	No	No	N/A
Scientific quality (risk of bias) of included studies assessed and documented.	No	Yes	Yes	Yes	Yes	Yes
Results depended on study quality, either overall, or in interaction with moderators.	N/A	No	No	Yes	No	Yes
Scientific quality used appropriately in formulating conclusions.	N/A	Yes	Yes	Yes	Yes	Yes
Data appropriately synthesized and if applicable, heterogeneity assessed.	Yes	Yes	N/A	Yes	Yes	Yes
Effect size index chosen justified, statistically.	Yes	Yes	N/A	Yes	Yes	Yes
Individual-level meta-analysis used.	No	No	N/A	No	No	No
Practical recommendations clearly addressed.	Yes	Yes	Yes	Yes	Yes	Yes
Likelihood of publication bias assessed.	Yes	Yes	No	Yes	No	No
Conflict of interest disclosed.	No	Yes	Yes	Yes	Yes	Yes

AMSTARExBP: SR/MA						
	Hutcheson, 2016	Hynynen, 2016	Leung, 2012	Marsh, 2014	Martin, 2015	Norris, 2016
Review questions and inclusion/exclusion criteria delineated prior to executing search strategy.	Yes	Yes	Yes	Yes	Yes	Yes
Population variables defined and considered in methods.	No	No	Yes	No	Yes	Yes
Was a comprehensive literature search performed?	Yes	Yes	Yes	Yes	Yes	Yes
Duplicate study selection and data extraction performed.	Yes	Yes	No	Yes	Yes	No
Search strategy clearly described.	Yes	Yes	Yes	Yes	Yes	Yes
Relevant grey literature included in review.	No	Yes	No	No	Yes	Yes
List of studies (included and excluded) provided.	No	No	No	No	No	No
Characteristics of included studies provided.	Yes	Yes	Yes	Yes	Yes	Yes
FITT defined and examined in relation to outcome effect sizes.	N/A	N/A	N/A	N/A	No	N/A
Scientific quality (risk of bias) of included studies assessed and documented.	Yes	Yes	No	Yes	Yes	Yes
Results depended on study quality, either overall, or in interaction with moderators.	Yes	No	N/A	No	No	Yes
Scientific quality used appropriately in formulating conclusions.	Yes	Yes	N/A	Yes	Yes	Yes
Data appropriately synthesized and if applicable, heterogeneity assessed.	N/A	N/A	N/A	N/A	Yes	N/A
Effect size index chosen justified, statistically.	N/A	N/A	N/A	N/A	Yes	Yes
Individual-level meta-analysis used.	N/A	N/A	N/A	N/A	No	N/A
Practical recommendations clearly addressed.	Yes	Yes	Yes	Yes	Yes	Yes
Likelihood of publication bias assessed.	No	No	No	No	Yes	No
Conflict of interest disclosed.	Yes	Yes	No	No	Yes	Yes

AMSTARExBP: SR/MA					
	Prince, 2014	Schoeppe, 2016	Sherry, 2016	Shrestha, 2015	Wahi, 2011
Review questions and inclusion/exclusion criteria delineated prior to executing search strategy.	Yes	Yes	Yes	Yes	Yes
Population variables defined and considered in methods.	No	Yes	No	Yes	Yes
Was a comprehensive literature search performed?	Yes	Yes	Yes	Yes	Yes
Duplicate study selection and data extraction performed.	Yes	Yes	No	Yes	Yes
Search strategy clearly described.	Yes	Yes	Yes	Yes	Yes
Relevant grey literature included in review.	Yes	No	No	Yes	Yes
List of studies (included and excluded) provided.	No	No	No	Yes	No
Characteristics of included studies provided.	Yes	Yes	Yes	Yes	Yes
FITT defined and examined in relation to outcome effect sizes.	No	N/A	N/A	No	N/A
Scientific quality (risk of bias) of included studies assessed and documented.	Yes	Yes	Yes	Yes	Yes
Results depended on study quality, either overall, or in interaction with moderators.	No	Yes	No	No	Yes
Scientific quality used appropriately in formulating conclusions.	Yes	Yes	Yes	Yes	Yes
Data appropriately synthesized and if applicable, heterogeneity assessed.	Yes	N/A	N/A	Yes	Yes
Effect size index chosen justified, statistically.	Yes	N/A	N/A	Yes	Yes
Individual-level meta-analysis used.	No	N/A	N/A	No	No
Practical recommendations clearly addressed.	Yes	Yes	Yes	Yes	Yes
Likelihood of publication bias assessed.	Yes	No	No	No	Yes
Conflict of interest disclosed.	Yes	Yes	No	Yes	No

Appendices

Appendix A: Analytical Framework

Topic Area
Physical Activity Promotion

Systematic Review Question
What interventions are effective for reducing sedentary behavior?

Population
People of all ages

Intervention
Sedentary behavior reduction intervention(s)

Endpoint Health Outcomes
Sedentary behavior change

Key Definition:
Sedentary (SED) Behavior Interventions: Strategies that seek to reduce sedentary behavior outcomes, which may include self-reported or context-specific forms of sedentary behavior (e.g., television viewing), accelerometer- or movement-based outcomes, or posture-based outcomes (e.g., lying or seated behaviors at <1.5 METs).

Appendix B: Final Search Strategy[1]

Search Strategy: PubMed (Systematic Reviews, Meta-Analyses, Pooled Analyses, and High-Quality Reports)

Database: PubMed; Date of Search: 12/29/2016; 1,669 results

Set	Search Strategy
Limit: Language	(English[lang])
Limit: Exclude animal only	NOT ("Animals"[Mesh] NOT ("Animals"[Mesh] AND "Humans"[Mesh]))
Limit: Exclude child only	NOT (("infant"[Mesh] OR "child"[mesh] OR "adolescent"[mh]) NOT (("infant"[Mesh] OR "child"[mesh] OR "adolescent"[mh]) AND "adult"[Mesh]))
Limit: Exclude subheadings	NOT (ad[sh] OR aa[sh] OR ci[sh] OR cn[sh] OR dh[sh] OR de[sh] OR dt[sh] OR em[sh] OR en[sh] OR es[sh] OR eh[sh] OR ge[sh] OR hi[sh] OR is[sh] OR ip[sh] OR lj[sh] OR ma[sh] OR mi[sh] OR og[sh] OR ps[sh] OR py[sh] OR pk[sh] OR pd[sh] OR po[sh] OR re[sh] OR rt[sh] OR rh[sh] OR st[sh] OR sd[sh] OR tu[sh] OR th[sh] OR tm[sh] OR tr[sh] OR ut[sh] OR ve[sh] OR vi[sh])
Limit: Publication Date (Systematic Reviews/Meta-Analyses)	AND ("2000/01/01"[PDAT] : "3000/12/31"[PDAT])
Limit: Publication Type Include (Systematic Reviews/Meta-Analyses)	AND (systematic[sb] OR meta-analysis[pt] OR “systematic review”[tiab] OR “systematic literature review”[tiab] OR metaanalysis[tiab] OR "meta analysis"[tiab] OR metanalyses[tiab] OR "meta analyses"[tiab] OR "pooled analysis"[tiab] OR “pooled analyses”[tiab] OR "pooled data"[tiab])
Limit: Publication Type Exclude (Systematic Reviews/Meta-Analyses)	NOT (“comment”[Publication Type] OR “editorial”[Publication Type])
Physical activity	(("Exercise"[mh] OR "Exercise"[tiab] OR "Leisure activities"[mh] OR "Physical activity"[tiab] OR "Physical inactivity"[tiab] OR "Sedentary lifestyle"[mh] OR "Computer time"[tiab] OR "Computer use"[tiab] OR "Inactivity"[tiab] OR "Physically inactive"[tiab] OR "Screen time"[tiab] OR "Television"[tiab] OR "TV viewing"[tiab] OR "TV watching"[tiab] OR "Video game"[tiab] OR "Video gaming"[tiab]) OR (("Aerobic activities"[tiab] OR "Aerobic activity"[tiab] OR "Cardiovascular activities"[tiab] OR "Cardiovascular activity"[tiab] OR "Endurance activities"[tiab]

[1] As determined by the Physical Activity Subcommittee the results from the research question 1 search for systematic reviews, meta-analyses, pooled analyses, and reports were used to identify relevant literature for research question 2.

Set	Search Strategy
	OR "Endurance activity"[tiab] OR "Energy expenditure"[tiab] OR "Leisure activities"[tiab] OR "Resistance training"[tiab] OR "strength training"[tiab] OR "Sitting"[tiab] OR “Sedentarism”[tiab] OR “Sedentary”[tiab] OR "physical conditioning"[tiab] OR "walking"[tiab]) NOT medline[sb]))
Intervention	AND (("Intervention"[tiab] OR "Interventions"[tiab] OR "Trial"[tiab] OR "Trials"[tiab] OR "Initiative"[tiab] OR "Initiatives"[tiab] OR "behavior change"[tiab] OR "Behavioral change"[tiab] OR "strategies"[tiab] OR "program"[tiab] OR "programs"[tiab] OR "programme"[tiab] OR “programmes”[tiab] OR "Behaviour modification"[tiab] OR "Behaviour modification"[tiab] OR "Behaviour change"[tiab] OR "behavioural change"[tiab]) OR (("health education"[tiab] OR "health promotion"[tiab]) NOT medline[sb]))
Levels of Impact	AND ("technology"[tiab] OR "Technologies"[tiab] OR "social media"[tiab] OR "twitter"[tiab] OR "facebook"[tiab] OR "cell phone"[tiab] OR "smartphone"[tiab] OR "mobile phone"[tiab] OR "mobile applications"[tiab] OR "apps"[tiab] OR "text messaging"[tiab] OR "mobile health"[tiab] OR "telemedicine"[tiab] OR "web-based"[tiab] OR "electronic mail"[tiab] OR "e-mail"[tiab] OR "internet"[tiab] OR "wearable"[tiab] OR "monitoring sensors"[tiab] OR "GPS"[tiab] OR "interactive voice response"[tiab] OR "embodied conversational agent"[tiab] OR "virtual"[tiab] OR "electronic tablet"[tiab] OR "tablet-based"[tiab] OR "computers"[tiab] OR "handheld"[tiab] OR "digital health"[tiab] OR "eHealth"[tiab] OR "on-line systems"[tiab] OR "online systems"[tiab] OR "software"[tiab] OR "multimedia"[tiab] OR "activity monitor"[tiab] OR "accelerometer"[tiab] OR "actigraphy"[tiab] OR "pedometer"[tiab] OR "fitness monitor"[tiab] OR "pedometery"[tiab] OR "step counter"[tiab] OR "artificial intelligence"[tiab] OR "telehealth"[tiab] OR "mHealth"[tiab]) OR ("Individual"[tiab] OR "Individuals"[tiab] OR "Person centered"[tiab] OR "self management"[tiab] OR "home-based"[tiab] OR "lifestyle"[tiab] OR "family based"[tiab] OR "self monitoring"[tiab] OR "life style"[mh] OR "life style"[tiab] OR "quantified self"[tiab]) OR ("Built environment"[tiab] OR neighborhood*[tiab] OR neighbourhood*[tiab] OR "land use"[tiab] OR "urban form"[tiab] OR "pedestrian"[tiab] OR "health community design"[tiab] OR "mix use"[tiab] OR "environmental enhancement"[tiab] OR "objective environment"[tiab] OR "spatial"[tiab] OR "physical environment"[tiab] OR "streetscape"[tiab] OR "urban planning"[tiab] OR "walkability"[tiab] OR "pedestrian-friendly"[tiab] OR "urban renewal"[tiab] OR "active transport"[tiab] OR "active commute"[tiab] OR "Active commuting"[tiab] OR "geospatial"[tiab] OR “environment design”[tiab] OR "sidewalk"[tiab] OR "bike lane"[tiab]) OR("Community Settings"[tiab] OR "community based"[tiab] OR "community wide"[tiab] OR "state wide"[tiab] OR "nationwide"[tiab] OR "community group"[tiab] OR "organization-based"[tiab] OR "school"[tiab] OR "place of worship"[tiab] OR "church"[tiab] OR "faith-based"[tiab] OR "worksite"[tiab] OR "workplace"[tiab] OR "recreational setting"[tiab] OR "YMCA"[tiab] OR "childcare"[tiab] OR "education setting"[tiab] OR "early care"[tiab] OR "Schools"[tiab])

Set	Search Strategy
	OR ("policy"[tiab] OR "policies"[tiab] OR "legislative"[tiab] OR "legislation"[tiab] OR "law"[tiab] OR "population-level"[tiab] OR "statute"[tiab] OR "statutes"[tiab] OR "Regulation"[tiab] OR "Regulations"[tiab] OR "Ordinance"[tiab])

Search Strategy: CINAHL (Systematic Reviews, Meta-Analyses, Pooled Analyses, and High-Quality Reports)

Database: CINAHL; Date of Search: 12/29/16; 81 results
Terms searched in title or abstract

Set	Search Terms
Physical Activity	("Exercise" OR "Physical activity" OR "Physical inactivity" OR "Computer time" OR "Computer use" OR "Inactivity" OR "Physically inactive" OR "Screen time" OR "Television" OR "TV viewing" OR "TV watching" OR "Video game" OR "Video gaming" OR "Aerobic activities" OR "Aerobic activity" OR "Cardiovascular activities" OR "Cardiovascular activity" OR "Endurance activities" OR "Endurance activity" OR "Energy expenditure" OR "Leisure activities" OR "Resistance training" OR "strength training" OR "Sitting" OR "Sedentarism" OR "Sedentary" OR "physical conditioning" OR "walking")
Intervention	AND ("Intervention" OR "Interventions" OR "Trial" OR "Trials" OR "Initiative" OR "Initiatives" OR "behavior change" OR "Behavioral change" OR "strategies" OR "program" OR "programs" OR "programme" OR "programmes" OR "Behaviour modification" OR "Behaviour modification" OR "Behaviour change" OR "behavioural change" OR "health education" OR "health promotion")
Levels of Impact	AND ("technology" OR "Technologies" OR "social media" OR "twitter" OR "facebook" OR "cell phone" OR "smartphone" OR "mobile phone" OR "mobile applications" OR "apps" OR "text messaging" OR "mobile health" OR "telemedicine" OR "web-based" OR "electronic mail" OR "e-mail" OR "internet" OR "wearable" OR "monitoring sensors" OR "GPS" OR "interactive voice response" OR "embodied conversational agent" OR "virtual" OR "electronic tablet" OR "tablet-based" OR "computers" OR "handheld" OR "digital health" OR "eHealth" OR "on-line systems" OR "online systems" OR "software" OR "multimedia" OR "activity monitor" OR "accelerometer" OR "actigraphy" OR "pedometer" OR "fitness monitor" OR "pedometery" OR "step counter" OR "artificial intelligence" OR "telehealth" OR "mHealth") OR ("Individual" OR "Individuals" OR "Person centered" OR "self management" OR "home-based" OR "lifestyle" OR "family based" OR "self monitoring" OR "life style" OR "quantified self") OR ("Built environment" OR neighborhood*OR neighbourhood*OR "land use" OR "urban form" OR "pedestrian" OR "health community design" OR "mix use" OR "environmental enhancement" OR "objective environment" OR "spatial" OR "physical environment" OR "streetscape" OR "urban planning" OR "walkability" OR "pedestrian-friendly" OR "urban renewal" OR "active transport" OR "active commute" OR "Active commuting" OR "geospatial" OR "environment design" OR "sidewalk" OR "bike lane") OR ("Community Settings" OR "community based" OR "community wide" OR "state wide" OR "nationwide" OR "community group" OR "organization-based" OR

Set	Search Terms
	"school" OR "place of worship" OR "church" OR "faith-based" OR "worksite" OR "workplace" OR "recreational setting" OR "YMCA" OR "childcare" OR "education setting" OR "early care" OR "Schools") OR ("policy" OR "policies" OR "legislative" OR "legislation" OR "law" OR "population-level" OR "statute" OR "statutes" OR "Regulation" OR "Regulations" OR "Ordinance")
Systematic Reviews/Meta-Analyses	AND ("systematic review" OR "systematic literature review" OR metaanalysis OR "meta analysis" OR "metanalyses" OR "meta analyses"" OR "pooled analysis" OR "pooled analyses" OR "pooled data")
Limits	2000-present English language Peer reviewed Exclude Medline records Human

Search Strategy: Cochrane (Systematic Reviews, Meta-Analyses, Pooled Analyses, and High-Quality Reports)

Database: Cochrane, Date of Search: 12/29/16; 580 results
Terms searched in title, abstract, or keywords

Set	Search Terms
Physical Activity	("Exercise" OR "Physical activity" OR "Physical inactivity" OR "Computer time" OR "Computer use" OR "Inactivity" OR "Physically inactive" OR "Screen time" OR "Television" OR "TV viewing" OR "TV watching" OR "Video game" OR "Video gaming" OR "Aerobic activities" OR "Aerobic activity" OR "Cardiovascular activities" OR "Cardiovascular activity" OR "Endurance activities" OR "Endurance activity" OR "Energy expenditure" OR "Leisure activities" OR "Resistance training" OR "strength training" OR "Sitting" OR "Sedentarism" OR "Sedentary" OR "physical conditioning" OR "walking")
Intervention	AND ("Intervention" OR "Interventions" OR "Trial" OR "Trials" OR "Initiative" OR "Initiatives" OR "behavior change" OR "Behavioral change" OR "strategies" OR "program" OR "programs" OR "programme" OR "programmes" OR "Behaviour modification" OR "Behaviour modification" OR "Behaviour change" OR "behavioural change" OR "health education" OR "health promotion")
Technology	AND ("technology" OR "Technologies" OR "social media" OR "twitter" OR "facebook" OR "cell phone" OR "smartphone" OR "mobile phone" OR "mobile applications" OR "apps" OR "text messaging" OR "mobile health" OR "telemedicine" OR "web-based" OR "electronic mail" OR "e-mail" OR "internet" OR "wearable" OR "monitoring sensors" OR "GPS" OR "interactive voice response" OR "embodied conversational agent" OR "virtual" OR "electronic tablet" OR "tablet-based" OR "computers" OR "handheld" OR "digital health" OR "eHealth" OR "on-line systems" OR "online systems" OR "software" OR "multimedia" OR "activity monitor" OR "accelerometer" OR "actigraphy" OR "pedometer" OR "fitness monitor" OR "pedometery" OR "step counter" OR "artificial intelligence" OR "telehealth" OR "mHealth") OR ("Individual" OR "Individuals" OR "Person centered" OR "self management" OR "home-based" OR "lifestyle" OR "family based" OR "self monitoring" OR "life style" OR "quantified self") OR ("Built environment" OR neighborhood*OR neighbourhood*OR "land use" OR "urban form" OR "pedestrian" OR "health community design" OR "mix use" OR "environmental enhancement" OR "objective environment" OR "spatial" OR "physical environment" OR "streetscape" OR "urban planning" OR "walkability" OR "pedestrian-friendly" OR "urban renewal" OR "active transport" OR "active commute" OR "Active commuting" OR "geospatial" OR "environment design" OR "sidewalk" OR "bike lane") OR ("Community Settings" OR "community based" OR "community wide" OR "state wide" OR "nationwide" OR "community group" OR "organization-based" OR "school" OR "place of worship" OR "church" OR "faith-based" OR "worksite" OR "workplace" OR "recreational setting" OR "YMCA" OR "childcare" OR "education setting" OR "early care" OR "Schools")

Set	Search Terms
	OR (“policy” OR “policies” OR “legislative” OR “legislation” OR “law” OR “population-level” OR “statute” OR “statutes” OR “Regulation” OR “Regulations” OR “Ordinance”)
Limits	Title, abstract, keyword 2000-present Cochrane Reviews and Other Reviews Word variations not be searched

Search Strategy: PubMed (Systematic Reviews, Meta-Analyses, Pooled Analyses, and High-Quality Reports related to Primary Care)[2]

Database: PubMed; Date of Search: 5/31/2017; 65 results

Set	Search Strategy
Limit: Language	(English[lang])
Limit: Exclude animal only	NOT ("Animals"[Mesh] NOT ("Animals"[Mesh] AND "Humans"[Mesh]))
Limit: Exclude child only	NOT (("infant"[Mesh] OR "child"[mesh] OR "adolescent"[mh]) NOT (("infant"[Mesh] OR "child"[mesh] OR "adolescent"[mh]) AND "adult"[Mesh]))
Limit: Exclude subheadings	NOT (ad[sh] OR aa[sh] OR ci[sh] OR cn[sh] OR dh[sh] OR de[sh] OR dt[sh] OR em[sh] OR en[sh] OR es[sh] OR eh[sh] OR ge[sh] OR hi[sh] OR is[sh] OR ip[sh] OR lj[sh] OR ma[sh] OR mi[sh] OR og[sh] OR ps[sh] OR py[sh] OR pk[sh] OR pd[sh] OR po[sh] OR re[sh] OR rt[sh] OR rh[sh] OR st[sh] OR sd[sh] OR tu[sh] OR th[sh] OR tm[sh] OR tr[sh] OR ut[sh] OR ve[sh] OR vi[sh])
Limit: Publication Date (Systematic Reviews/Meta-Analyses)	AND ("2011/01/01"[PDAT] : "3000/12/31"[PDAT])
Limit: Publication Type Include (Systematic Reviews/Meta-Analyses)	AND (systematic[sb] OR meta-analysis[pt] OR “systematic review”[tiab] OR “systematic literature review”[tiab] OR metaanalysis[tiab] OR "meta analysis"[tiab] OR metanalyses[tiab] OR "meta analyses"[tiab] OR "pooled analysis"[tiab] OR “pooled analyses”[tiab] OR "pooled data"[tiab])
Limit: Publication Type Exclude (Systematic Reviews/Meta-Analyses)	NOT (“comment”[Publication Type] OR “editorial”[Publication Type])
Physical activity	AND (("Exercise"[mh] OR "Exercise"[tiab] OR "Leisure activities"[mh] OR "Physical activity"[tiab] OR "Physical inactivity"[tiab] OR "Sedentary lifestyle"[mh] OR "Computer time"[tiab] OR "Computer use"[tiab] OR "Inactivity"[tiab] OR "Physically inactive"[tiab] OR "Screen time"[tiab] OR "Television"[tiab] OR "TV viewing"[tiab] OR "TV watching"[tiab] OR "Video game"[tiab] OR "Video gaming"[tiab]) OR (("Aerobic activities"[tiab] OR "Aerobic activity"[tiab] OR "Cardiovascular activities"[tiab] OR "Cardiovascular activity"[tiab] OR "Endurance activities"[tiab] OR "Endurance activity"[tiab] OR "Energy expenditure"[tiab] OR "Leisure activities"[tiab] OR "Resistance training"[tiab] OR "strength training"[tiab] OR

[2] A supplemental search was conducted on May 31, 2017, to capture relevant systematic reviews, meta-analyses, and pooled analyses related to primary care interventions because relevant literature was not captured in the original search.

Set	Search Strategy
	"Sitting"[tiab] OR “Sedentarism”[tiab] OR “Sedentary”[tiab] OR "physical conditioning"[tiab] OR "walking"[tiab]) NOT medline[sb]))
Intervention	AND (("Intervention"[tiab] OR "Interventions"[tiab] OR "Trial"[tiab] OR "Trials"[tiab] OR "Initiative"[tiab] OR "Initiatives"[tiab] OR "behavior change"[tiab] OR "Behavioral change"[tiab] OR "strategies"[tiab] OR "program"[tiab] OR "programs"[tiab] OR "programme"[tiab] OR “programmes”[tiab] OR "Behaviour modification"[tiab] OR "Behaviour modification"[tiab] OR "Behaviour change"[tiab] OR "behavioural change"[tiab]) OR (("health education"[tiab] OR "health promotion"[tiab]) NOT medline[sb]))
Primary Care	AND ((“Primary Health Care”[mh] OR “Physicians, Family”[mh] OR “Family Practice”[mh] OR “primary care”[tiab] OR “family physician”[tiab] OR “family doctor”[tiab]))

Search Strategy: CINAHL (Systematic Reviews, Meta-Analyses, Pooled Analyses, and High-Quality Reports related to Primary Care)

Database: CINAHL; Date of Search: 5/31/2017; 8 results
Terms searched in title or abstract

Set	Search Terms
Physical Activity	("Exercise" OR "Physical activity" OR "Physical inactivity" OR "Computer time" OR "Computer use" OR "Inactivity" OR "Physically inactive" OR "Screen time" OR "Television" OR "TV viewing" OR "TV watching" OR "Video game" OR "Video gaming" OR "Aerobic activities" OR "Aerobic activity" OR "Cardiovascular activities" OR "Cardiovascular activity" OR "Endurance activities" OR "Endurance activity" OR "Energy expenditure" OR "Leisure activities" OR "Resistance training" OR "strength training" OR "Sitting" OR "Sedentarism" OR "Sedentary" OR "physical conditioning" OR "walking")
Intervention	AND ("Intervention" OR "Interventions" OR "Trial" OR "Trials" OR "Initiative" OR "Initiatives" OR "behavior change" OR "Behavioral change" OR "strategies" OR "program" OR "programs" OR "programme" OR "programmes" OR "Behaviour modification" OR "Behaviour modification" OR "Behaviour change" OR "behavioural change" OR "health education" OR "health promotion")
Primary Care	AND ("Primary Health Care" OR "Family Practice" OR "primary care" OR "family doctor" OR "family physician")
Systematic Reviews/Meta-Analyses	AND ("systematic review" OR "systematic literature review" OR metaanalysis OR "meta analysis" OR "metanalyses" OR "meta analyses"" OR "pooled analysis" OR "pooled analyses" OR "pooled data")
Limits	2011-present English language Peer reviewed Exclude Medline records Human

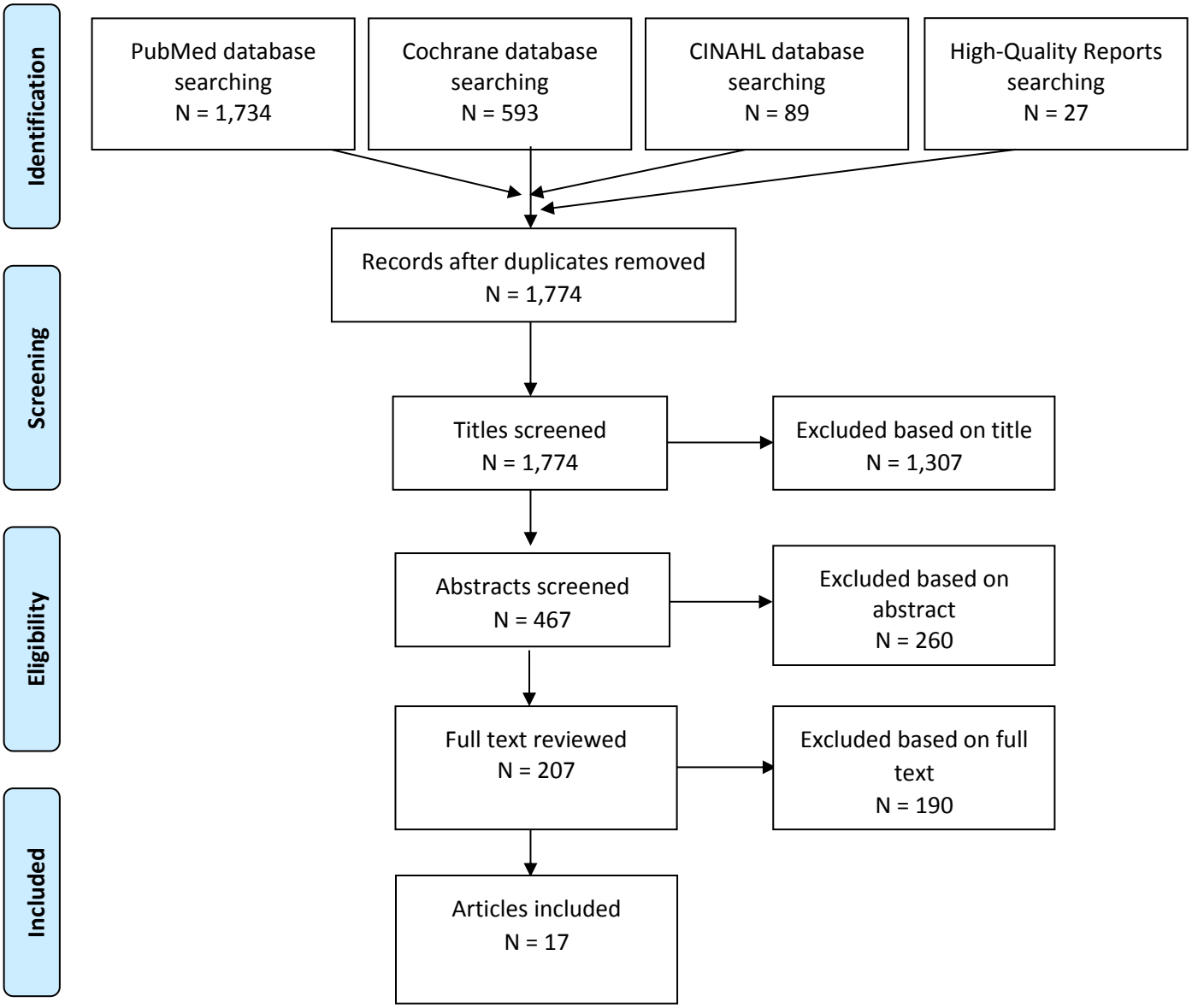
Search Strategy: Cochrane (Systematic Reviews, Meta-Analyses, Pooled Analyses, and High-Quality Reports related to Primary Care)

Database: Cochrane; Date of Search: 5/31/2017; 13 results
Terms searched in title, abstract, or keywords

Set	Search Terms
Physical Activity	("Exercise" OR "Physical activity" OR "Physical inactivity" OR "Computer time" OR "Computer use" OR "Inactivity" OR "Physically inactive" OR "Screen time" OR "Television" OR "TV viewing" OR "TV watching" OR "Video game" OR "Video gaming" OR "Aerobic activities" OR "Aerobic activity" OR "Cardiovascular activities" OR "Cardiovascular activity" OR "Endurance activities" OR "Endurance activity" OR "Energy expenditure" OR "Leisure activities" OR "Resistance training" OR "strength training" OR "Sitting" OR "Sedentarism" OR "Sedentary" OR "physical conditioning" OR "walking")
Intervention	AND ("Intervention" OR "Interventions" OR "Trial" OR "Trials" OR "Initiative" OR "Initiatives" OR "behavior change" OR "Behavioral change" OR "strategies" OR "program" OR "programs" OR "programme" OR "programmes" OR "Behaviour modification" OR "Behaviour modification" OR "Behaviour change" OR "behavioural change" OR "health education" OR "health promotion")
Primary Care	AND ("Primary Health Care" OR "Family Practice" OR "primary care" OR "family doctor" OR "family physician")
Limits	Title, abstract, keyword 2011-present Cochrane Reviews and Other Reviews Word variations not be searched

Appendix C: Literature Tree

Existing Systematic Reviews, Meta-Analyses, Pooled Analyses, and Reports Literature Tree



Appendix D: Inclusion/Exclusion Criteria

Physical Activity Promotion Subcommittee
Q2. What interventions are effective for reducing sedentary behavior?

Category	Inclusion/Exclusion Criteria	Notes/Rationale
Publication Language	**Include:** • Studies published with full text in English	
Publication Status	**Include:** • Studies published in peer-reviewed journals • Reports determined to have appropriate suitability and quality by PAGAC **Exclude:** • Grey literature, including unpublished data, manuscripts, abstracts, conference proceedings	
Research Type	**Include:** • Original research* • Systematic reviews • Meta-analyses • Pooled analyses • Reports determined to have appropriate suitability and quality by PAGAC	*The initial search conducted with systematic reviews, meta-analyses, and reports. If needed, *de novo* reviews will be conducted only to supplement the reviews.
Study Subjects	**Include:** • Human subjects	
Age of Study Subjects	**Include:** • People of all ages	
Health Status of Study Subjects	**Exclude:** • Hospitalized patients • Non-ambulatory individuals	
Comparison	**Exclude:** • Studies comparing athletes to non-athletes • Studies comparing athlete types (e.g., comparing runners to soccer players)	
Date of Publication	**Include:** • Systematic reviews, meta-analyses, and reports published from 2011 to 2016 • Original research (included to supplement systematic review categories) published from 2011 to 2016	The SC revised inclusion dates from 2000–2016 to 2011–2016 after the search strategy was implemented due to substantial amount of relevant recent literature.

Study Design	**Include:** • Systematic reviews • Meta-analyses • Reports determined to have appropriate suitability and quality by PAGAC • Randomized controlled trials* • Non-randomized controlled trials* • Prospective cohort studies* • Retrospective cohort studies* • Case-control studies* • Before-and-after studies* • Time series studies* • Cross-sectional studies **Exclude:** • Case studies • Narrative reviews • Commentaries • Editorials	*Original research with these study designs will be secondary to the systematic review categories, and will be used to capture the latest evidence not reflected in the systematic reviews.
Intervention/ Exposure	**Include studies in which the exposure is:** All types of sedentary behavior reduction interventions or programs **Exclude:** • Studies that do not include a physical activity intervention or program • Studies that do not include physical activity change as a reported outcome variable • Activity studies missing physical activity (mental games such as Sudoku instead of physical activities) • Studies of a single, acute bout of exercise • Studies of a specific therapeutic exercise delivered by a medical professional (e.g., physical therapist) • Studies where the outcome is/are measures of physical fitness (e.g., cardiovascular fitness, strength, flexibility) rather than physical activity • Sedentary behavior only • Sedentary interventions or programs only	Studies will include single behavior (PA intervention alone) and multiple behavior interventions (e.g., when PA intervention is delivered along with dietary interventions).
Comparison	**Exclude:** • Studies comparing athletes to non-athletes • Studies comparing athlete types (e.g., comparing runners to soccer players)	
Outcome	**Include studies in which the outcome is:** • Sedentary behavior change	

Appendix E: Rationale for Exclusion at Abstract or Full-Text Triage for Existing Systematic Reviews, Meta-Analyses, Pooled Analyses, and Reports

The table below lists the excluded articles with at least one reason for exclusion, but may not reflect all possible reasons.

Citation	Outcome	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
Adams J, White M. Are activity promotion interventions based on the transtheoretical model effective? A critical review. *Br J Sports Med*. 2003;37(2):106-114. doi:10.1136/bjsm.37.2.106.		X			
Allender S, Hutchinson L, Foster C. Life-change events and participation in physical activity: a systematic review. *Health Promot Int*. 2008;23(2):160-172. doi:10.1093/heapro/dan012.			X		
Amiri Farahani L, Asadi-Lari M, Mohammadi E, Parvizy S, Haghdoost AA, Taghizadeh Z. Community-based physical activity interventions among women: a systematic review. *BMJ Open*. 2015;5(4):e007210. doi:10.1136/bmjopen-2014-007210.			X		
An JY, Hayman LL, Park YS, Dusaj TK, Ayres CG. Web-based weight management programs for children and adolescents: a systematic review of randomized controlled trial studies. *Adv Nurs Sci.* 2009;32(3):222-240. doi:10.1097/ANS.0b013e3181b0d6ef.	X				
Anderson LM, Quinn TA, Glanz K, et al.; Task Force on Community Preventive Services. The effectiveness of worksite nutrition and physical activity interventions for controlling employee overweight and obesity: a systematic review. *Am J Prev Med.* 2009;37(4):340-357. doi:10.1016/j.amepre.2009.07.003.	X				
Appelhans BM, Moss OA, Cerwinske LA. Systematic review of paediatric weight management interventions delivered in the home setting. *Obes Rev*. 2016;17(10):977-988. doi:10.1111/obr.12427.	X				
Arango CM, Paez DC, Reis RS, Brownson RC, Parra DC. Association between the perceived environment and physical activity among adults in Latin America: a systematic review. *Int J Behav Nutr Phys Act*. 2013;10(122):1479-5868. doi:10.1186/1479-5868-10-122.			X		
Arbesman M, Mosley LJ. Systematic review of occupation- and activity-based health management and maintenance interventions for community-dwelling older adults. *Am J Occup Ther*. 2012;66(3):277-283. doi:10.5014/ajot.2012.003327.				X	
Arsenijevic J, Groot W. Physical activity on prescription schemes (PARS): do programme characteristics influence effectiveness? Results of a systematic review and meta-analyses. *BMJ Open*. 2017;7(2):1-14.e012156. doi:10.1136/bmjopen-2016- 012156.			X		
Ashford S, Edmunds J, French DP. What is the best way to change self-efficacy to promote lifestyle and recreational physical activity? A systematic review					X

Citation	Outcome	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
with meta-analysis. *Br J Health Psycho*l. 2010;15(Pt 2):265-288. doi:10.1348/135910709X461752.					
Ashworth NL, Chad KE, Harrison EL, Reeder BA, Marshall SC. Home versus center based physical activity programs in older adults. *Cochrane Database Syst Rev.* 2005;25(1):CD004017. doi:10.1002/14651858.CD004017.pub2.	X				
Attwood S, van Sluijs E, Sutton S. Exploring equity in primary-care-based physical activity interventions using PROGRESS-Plus: a systematic review and evidence synthesis. *Int J Behav Nutr Phys Act*. 2016;13:60. doi:10.1186/s12966-016-0384-8.			X		
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Citation	Outcome	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
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Citation	Outcome	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
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Citation	Outcome	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
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Citation	Outcome	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
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Citation	Outcome	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
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