Evidence Portfolio – Cardiometabolic Health and Weight Management Subcommittee, Question 1

What is the relationship between physical activity and prevention of weight gain?

a. Is there a dose-response relationship? If yes, what is the shape of the relationship?
b. Does the relationship vary by age, sex, race/ethnicity, socio-economic status, or weight status?
c. Does the relationship vary based on levels of sedentary behavior, light, moderate, or vigorous physical activity?

Source of Evidence: Original Research

Conclusion Statements and Grades

Strong evidence demonstrates a relationship between greater amounts of physical activity and attenuated weight gain in adults, with some evidence to support that this relationship is most pronounced when physical activity exposure is above 150 minutes per week. **PAGAC Grade: Strong.**

Limited evidence suggests a dose-response relationship between physical activity and the risk of weight gain in adults, with greater amounts of physical activity associated with lower risk of weight gain. **PAGAC Grade: Limited.**

Limited evidence suggests that the relationship between greater amounts of physical activity and attenuated weight gain in adults varies by age, with the effect diminishing with increasing age. The evidence from studies of older adults, however, is inconsistent. **PAGAC Grade: Limited.**

Moderate evidence indicates that the relationship between greater amounts of physical activity and attenuated weight gain in adults does not appear to vary by sex. **PAGAC Grade: Moderate.**

Insufficient evidence is available to determine whether the relationship between greater amounts of physical activity and attenuated weight gain in adults varies by race/ethnicity. **PAGAC Grade: Not assignable.**

Insufficient evidence is available to determine whether the relationship between greater amounts of physical activity and attenuated weight gain in adults varies by socioeconomic status. **PAGAC Grade: Not assignable.**

Insufficient evidence is available to determine whether the relationship between greater amounts of physical activity and attenuated weight gain in adults varies by initial weight status. **PAGAC Grade: Not assignable.**

Strong evidence demonstrates that the significant relationship between greater time spent in physical activity and attenuated weight gain in adults is observed with moderate-to-vigorous physical activity. **PAGAC Grade: Strong.**

Insufficient evidence is available to determine an association between light-intensity activity and attenuated weight gain in adults. **PAGAC Grade: Not assignable.**

Description of the Evidence

An initial search for systematic reviews, meta-analyses, pooled analyses, and reports did not identify sufficient literature to answer the research question as determined by the Cardiometabolic Health and Weight Management subcommittee. A complete de novo search of original research was conducted.

Original Research

Overview

Thirty-three original research studies were included as sources of evidence. The studies included 31 prospective cohort studies, 1 randomized trial, and 1 group randomized trial.

Two studies were conducted in the Philippines,[1, 2] 5 studies were conducted in Australia,[3-7] 2 studies were conducted in the United Kingdom,[8, 9] 10 studies were conducted in the United States,[10-19] 1 study was conducted in Spain,[20] 1 study was conducted in Canada,[21] 1 was conducted in Sweden,[22] 1 was conducted in Finland,[23] 1 was conducted in Norway,[24] 1 was conducted in France,[25] 1 was conducted in South Africa,[26] and the remaining locations of studies were not reported.

Exposures

All studies used self-reported data, primarily in the form of questionnaires or surveys, to assess physical activity. Three studies also used a device (accelerometer or pedometer) to measure daily activity. The majority of the studies assessed leisure-time physical activity.[7, 27, 28] Two studies focused on occupational physical activity only.[1, 2] Three studies assessed both physical activity and sedentary behavior as an exposure.[1, 10, 26] Six studies examined specific types of physical activity such as walking[4, 19, 25] and running.[29-31]

Outcomes

The outcomes addressed included self-reported body mass index and waist circumference, total body composition, and changes in weight status.

Populations Analyzed

The table below lists the populations analyzed in each article.

Table 1. Populations Analyzed by All Sources of Evidence

	Sex	Race/ Ethnicity	Age	Socioeconomic Status	Weight Status	Other
Adair, 2011	Female	Filipino	Youth and adults 15–45. Subgroups by age of entry (<20, 20–25, 25–30, 30–35, and >35)			Childbearing women
Basterra-Gortari, 2009	Female, Male	Spanish	Adults	University graduates		
Bea, 2010	Female		Adults 40–65			Post-menopausal
Blanck, 2007	Female		Adults 40–69		Underweight (BMI: below 18.5), normal/ healthy weight (BMI: 18.5–24.9), overweight and obese	Menopause
Botoseneanu, 2012			Older adults			
Brien, 2007	Female, Male		Adults		Overweight (BMI: 25–29.9), obese (BMI: 30 and above)	
Brown, 2016	Female		Baseline: adults 18–23, follow-up 34–39	Education attainment		
Chiriboga, 2008	Female, Male	Black or African American, Asian, Hispanic or Latino	Adults	Education attainment		
Colchero, 2008	Female	Filipino	Youth and adults 14–47			
de Munter, 2015	Male, Female		Adults 18–84	Normal/ healthy weight (BMI: 18.5–24.9), overweight (BMI: 25–29.9), obese (BMI: 30 and above)		
Drenowatz, 2016			Adults 20–35			
Drenowatz, 2017			Adults 20–35			
French, 2012			Children and adults 12–17			

	Sex	Race/ Ethnicity	Age	Socioeconomic Status	Weight Status	Other
Gebel, 2014			Adults ≥45			
Gradidge, 2015	Female	Black or African American	Adults			
Hamer, 2013			Middle-older aged adults			
Hankinson, 2010	Male, Female		Adults 18–30 baseline; 38–50 follow-up			
Hillemeier, 2011	Female		Adults 18–45		Normal/ healthy weight (BMI: 18.5–24.9), overweight (BMI: 25–29.9),	
Kaikkonen, 2015	Male, Female		Adults 24–39			
Kelly, 2015	Female		College-aged adults			
Lee, 2010	Female		Adults <55, 55–64, >65		Normal/ healthy weight (BMI: 18.5–24.9), overweight (BMI: 25–29.9), obese (BMI: 30 and above)	Smoking status, menopausal status
MacInnis, 2014			Adults 40–69; subgroups 40–49, 50–59, 60–69			
Moholdt, 2014	Male, Female		Adults ≥20; subgroups <40, 40–59, >60		Underweight (BMI: below 18.5), normal/ healthy Weight (BMI: 18.5–24.9), overweight (BMI: 25–29.9), obese (BMI: 30 and above)	Smoking status (never, current, former)
Mortensen, 2006			Adults; subgroups 41, 44, 46, 54		Obese (BMI: 30 and above)	
Parsons, 2006	Male, Female		7 (baseline), 45 (final follow-up)			
Rosenberg, 2013	Female	Black or African American	Adults 21–40 at baseline		Normal/ healthy weight (BMI: 18.5–24.9), overweight and obese	
Shibata, 2016		Australian	Adults 25–74			
Sims, 2012	Female		Adults 50–79		Normal/ healthy weight (BMI: 18.5–24.9), overweight (BMI: 25-29.9), obese (BMI: 30 and above)	Post-menopausal

	Sex	Race/ Ethnicity	Age	Socioeconomic Status	Weight Status	Other
Sjosten, 2012	Male, Female	French	Adults 35–50	Employees of national gas and electric company		
Smith, 2017			7–15 years old baseline; 26–36 follow-up; 31–41 follow-up 2			
Williams, 2006a	Male, Female		Adults; females separated by >45 and <45			
Williams, 2006b	Male, Female		Adults 18–75			
Williams, 2007	Male, Female		Adults			

Supporting Evidence

Original Research

Table 2. Original Research Individual Evidence Summary Tables

<table>
<tr><td colspan="2">Original Research
Citation: Adair LS, Gultiano S, Suchindran C. 20-year trends in Filipino women's weight reflect substantial secular and age effects. J Nutr. 2011;141:667-673. doi:10.3945/jn.110.134387.</td></tr>
<tr><td colspan="2">Purpose: To explore age and secular trends in women’s weight and determine how weight is influenced by biological, behavioral, economic, and environmental factors over time.</td></tr>
<tr><td>Study Design: Prospective cohort study</td><td rowspan="5">Abstract: Increasing obesity in low- and middle-income countries is well documented in cross-sectional studies. However, few longitudinal studies identify factors that influence individual weight gain patterns over time in relation to the major social and economic changes that now characterize these settings. This study uses data from adult Filipino women participating in the Cebu Longitudinal Health and Nutrition Survey from 1983 to 2005. A sample of 3005 women contributed 1-8 observations each. Longitudinal mixed effects models identified how age and secular weight trends related to underlying effects of urbanization and changing household socioeconomic status (SES) and to proximate individual effects of reproductive history, diet, and occupational physical activity. The 23-y secular trend in weight amounted to nearly 10 kg. Younger women gained more weight than older women (12.4 kg in those < 20 y old in 1983 vs. 4.9 kg in those > 35 y). Periods of more rapid weight gain corresponded to periods of rapid increase in SES and urbanization. Weight was positively related to energy intake, percentage of calories from protein, and more sedentary occupations, but negatively related to months pregnant and lactating and postmenopausal status. These effects all varied with age and over time. The trends contributed to a 6-fold increase in prevalence of overweight and an increasing number of women who have or are likely to develop obesity-related metabolic diseases. The trends are highly relevant for health policy and preventive health measures in the Philippines and other countries now facing the dual burden of over- and undernutrition.</td></tr>
<tr><td>Location: Phillipines</td></tr>
<tr><td>Sample: 3,005
Attrition Rate: 9.68%
Sample Power: Not Reported</td></tr>
<tr><td>Intervention: No</td></tr>
<tr><td>Exposure Measurement
Self-Reported: Occupational physical activity (PA): Women accounted for usual daily activities, providing a description of each activity and time spent engaged in the activity, including occupational PA. Occupations were categorized according to the level of physical demand and energy expenditure. Sub-groups of activity level (occupation): sedentary (1.44 metabolic equivalents [METS], including jobs with minimal demand, done while sitting); and more demanding (4.1 METS, including jobs such as laundress).
Measures Steps: No
Measures Bouts: No</td></tr>
<tr><td>Refers to Other Materials: No
Examine Cardiorespiratory Fitness as Outcome: No</td><td>Outcomes Examined: Body mass index: Weight was measured at each survey on portable scales and participants wore light clothing. Created subgroups by age of entry (<20, 20–25, 25–30, 30–35, and >35).</td></tr>
<tr><td>Populations Analyzed: Female, other, Filipino, ages 15–45. Subgroups by age of entry (<20, 20–25, 25–30, 30–35, and >35), urban, childbearing women.</td><td>Author-Stated Funding Source: Obesity Development and Cardiovascular Disease Risk Factor Clustering in Filipino Women and Offspring</td></tr>
</table>

<table>
<tr><td colspan="2">Original Research
Citation: Basterra-Gortari FJ, Bes-Rastrollo M, Pardo-Fernandez M, et al. Changes in weight and physical activity over two years in Spanish alumni. Med Sci Sports Exerc. 2009;41:516-522. doi:10.1249/MSS.0b013e318188607c.</td></tr>
<tr><td colspan="2">Purpose: To ascertain the association between baseline leisure-time physical activity (PA) and weight change, and also the association of changes in leisure time PA during follow-up and weight gain.</td></tr>
<tr><td>Study Design: Prospective cohort study</td><td rowspan="4">Abstract: PURPOSE: To investigate the relationship between baseline leisure-time physical activity and changes in leisure activity during follow-up on long-term weight changes. METHODS: We evaluated prospectively 11,974 participants (university graduates) who participated in a dynamic cohort (Seguimiento Universidad de Navarra cohort) with an average follow-up of 27 months. Self-reported data from validated mailed questionnaires were used. Baseline leisure activity was assessed with a previously validated questionnaire. RESULTS: After adjusting for age, hours sitting down, smoking status, snacking, fiber intake, and consumption of sugar-sweetened beverages, fast food, and alcohol, participants who decreased their leisure activity during follow-up experienced a significant increase in body mass index (BMI; relative change): for men, 0.9% (95% confidence interval [CI] = 0.5-1.2%); for women, 1.0% (95% CI = 0.6-1.3%). Participants who increased their leisure activity during follow-up experienced a significant reduction (relative change) in BMI: for men, -0.8% (95% CI = -1.1% to -0.5%); for women, -0.6% (95% CI = -0.9% to -0.4%). This inverse association between changes in leisure activity and weight gain was significantly stronger for participants with a baseline BMI >or=25 kg x m(-2), but the absolute magnitude of this interaction effect was trivial. Baseline physical activity was not significantly associated with weight changes after 2-yr of follow-up. CONCLUSION: Longitudinal changes in leisure activity during follow-up were inversely associated with changes in body weight. The true relationships between leisure activity and body weight are likely to have been larger than observed, owing to attenuation of effects by measurement error in self-reported data.</td></tr>
<tr><td>Location: Spain</td></tr>
<tr><td>Sample: 11,974
Attrition Rate: 14.27%
Sample Power: Yes</td></tr>
<tr><td>Intervention: No</td></tr>
<tr><td>Exposure Measurement
Self-Reported: Answered questions on leisure time activity and time spent in activity; used self report of leisure time PA to calculate average metabolic equivalent hours/week performed; followed up with questionnaire every 2 years about average change in moderate intensity activities; created tertiles for comparison; self-reported number of hours sitting down/week estimated by multiplying by 5 the hours sitting down in a typical weekday and adding twice the average estimate for typical weekend day.
Measures Steps: No
Measures Bouts: No</td></tr>
<tr><td>Refers to Other Materials: No
Examine Cardiorespiratory Fitness as Outcome: No</td><td>Outcomes Examined: Body mass index: self report.</td></tr>
<tr><td>Populations Analyzed: Male, female, other, Spanish, adults, university graduates</td><td>Author-Stated Funding Source: Spanish Ministry of Health and Navarra Regional Government</td></tr>
</table>

Original Research

Citation: Bea JW, Cussler EC, Going SB, Blew RM, Metcalfe LL, Lohman TG. Resistance training predicts 6-yr body composition change in postmenopausal women. *Med Sci Sports Exerc.* 2010;42:1286-1295. doi:10.1249/MSS.0b013e3181ca8115.

Purpose: To examine the relationship of resistance training exercise to bone mineral density (BMD) in early postmenopausal women.

Study Design: Randomized trial

Location: Not Reported

Sample: 122
Attrition Rate: 61.88%
Sample Power: Not Reported

Intervention: Yes
Intervention Type: Behavioral
Intervention Length: 6 years

Exposure Measurement
Self-Reported: Exercise logs filled out by participants, participants recorded their resistance training ExFreq, weightlifting loads, sets and repetitions, steps with weighted vests, and minutes of progressive weight bearing activity; habitual physical activity measured with 7 day recall.
Measures Steps: No
Measures Bouts: No
Exposure/Intervention
Frequency: 3 days per week
Intensity: 70–80% one rep max (strength)
Time: 60–75 minutes
Type: Cardiorespiratory, jogging, walking, stairs, skipping, hopping, jumping circuit, strength, free weights and machines
Examines HIIT: No

Abstract: PURPOSE: The aim of this study was to examine the association of exercise frequency (ExFreq) and volume (total weight lifted by military press and squats (SQ)) with change in body composition among postmenopausal women participating in a progressive resistance training study. METHODS: Previously, sedentary women (n = 122, age = 56.3 +/- 4.3 yr) were followed for 6 yr. At 6 yr, there were women who had been randomly assigned to resistance training at baseline (n = 65) controls that were permitted to cross over to the exercise program at 1 yr (n = 32) and 25 true controls. Exercisers and crossovers directed to perform eight core exercises for two sets of eight repetitions at 70%-80% of one-repetition maximum, three times weekly, plus progressive weight bearing, stretching, and balance. Body weight and fat were measured at baseline and annually using anthropometry and dual-energy x-ray absorptiometry. RESULTS: Average change in body weight and total body fat were 0.83 +/- 5.39 and 0.64 +/- 4.95 kg at 6 yr, respectively. In multiple linear regression, ExFreq, military press, and SQ were significantly inversely associated with change in body weight (standardized beta coefficient (SBC) = -0.22 to -0.28, $P < 0.01$), fat (SBC = -0.25 to -0.33, $P < 0.01$), and trunk fat (SBC = -0.20 to -0.31, $P < 0.03$) after adjusting for age, years on hormone therapy, change in lean soft tissue, baseline body composition, and baseline habitual exercise. The lowest tertile of SQ (equivalent to 2.5% attendance) demonstrated significant gain in weight, fat, and trunk fat over 6 yr ($P < 0.004$), whereas the highest tertile SQ (equivalent to 64% attendance) was able to maintain their weight, total, and regional fat. CONCLUSIONS: We conclude that resistance training is a viable long-term method to prevent weight gain and deleterious changes in body composition in postmenopausal women.

Refers to Other Materials: Yes
Adverse Events Addressed: No
Examine Cardiorespiratory Fitness as Outcome: No

Outcomes Examined: Total and regional body composition: weight (kg), total body fat (kg), regional fat (kg), and lean soft tissue(kg) were measured by dual energy x-ray absorptiometry using a total-body densitometer.

Populations Analyzed: Female, adults 40–65, post-menopausal

Author-Stated Funding Source: National Institutes of Health, Mission Pharmacal

<table>
<tr><td colspan="2">Original Research
Citation: Blanck HM, McCullough ML, Patel AV, et al. Sedentary behavior, recreational physical activity, and 7-year weight gain among postmenopausal U.S. women. Obesity. 2007;15:1578-1588.</td></tr>
<tr><td colspan="2">Purpose: To assess the relationship among recreational physical activity (PA), non-occupational sedentary behavior, and 7-year weight gain among postmenopausal U.S. women 40 to 69 years old.</td></tr>
<tr><td>Study Design: Prospective cohort study</td><td rowspan="5">Abstract: OBJECTIVE: To assess the relationship among recreational physical activity (PA), non-occupational sedentary behavior, and 7-year weight gain among postmenopausal U.S. women 40 to 69 years old. RESEARCH METHODS AND PROCEDURES: In 1992 and 1999, 18,583 healthy female participants from the Cancer Prevention Study II Nutrition Cohort completed questionnaires on anthropometric characteristics and lifestyle factors. The associations between recreational PA [in metabolic equivalent (MET) hours per week] and non-occupational sedentary behavior (in hours per day) at baseline and risk for 7-year weight gain (5 to 9 or >or =10 vs. +/-4 pounds) were assessed using multivariate logistic regression analysis. RESULTS: Neither PA nor sedentary behavior was associated with a 5- to 9-pound weight gain. Among women who were not overweight at baseline (BMI <25.0), the odds of > or =10-pound weight gain were 12% lower (odds ratio, 0.88; 95% confidence interval, 0.77 to 0.99) for those in the highest category of recreational PA (> or =18 MET h/wk) compared with >0 to <4 MET h/wk; odds were 47% higher (odds ratio, 1.47; 95% confidence interval, 1.21 to 1.79) for non-overweight women who reported > or =6 h/d of non-occupational sedentary behavior compared with <3 h/d. Neither PA nor sedentary behavior were associated with risk of > or =10-pound weight gain weight among women who were overweight at baseline (BMI > or =25.0). DISCUSSION: Both recreational PA and non-occupational sedentary behavior independently predicted risk of > or =10-pound weight gain among postmenopausal women who were not overweight at baseline. Public health messages to prevent weight gain among normal-weight postmenopausal women may need to focus on decreasing time spent in sedentary behaviors and increasing the amount of time spent on PA.</td></tr>
<tr><td>Location: United States</td></tr>
<tr><td>Sample: 18,583
Attrition Rate: 81.00%
Sample Power: Not Reported</td></tr>
<tr><td>Intervention: No</td></tr>
<tr><td>Exposure Measurement
Self-Reported: Questionnaire, recreational PA, non-occupational sedentary time, and non-recreational PA. PA responses were converted to a summary unit of metabolic equivalent (MET) hours per week. Categories compared in MET/hr/week: 0–4, 4–10, 10–18, and >18). Non-occupational sedentary time assessed in hours/day (categories: <3, 3–5, ≥6 hrs/day).
Measures Steps: No
Measures Bouts: No</td></tr>
<tr><td>Refers to Other Materials: Yes
Examine Cardiorespiratory Fitness as Outcome: No</td><td>Outcomes Examined: Self-reported weight change in pounds: stable 0–5 pounds, gained 5–9, and gained >10.</td></tr>
<tr><td>Populations Analyzed: Female; adults 40–69; underweight (BMI: below 18.5); normal/healthy weight (BMI: 18.5–24.9); overweight and obese; menopause</td><td>Author-Stated Funding Source: None</td></tr>
</table>

<table>
<tr><td colspan="2">Original Research
Citation: Botoseneanu A, Liang J. The effect of stability and change in health behaviors on trajectories of body mass index in older Americans: a 14-year longitudinal study. J Gerontol A Biol Sci Med Sci. 2012;67:1075-1084. doi:10.1093/gerona/gls073.</td></tr>
<tr><td colspan="2">Purpose: To estimate the effects of smoking, physical activity , and alcohol use status and variation over time on the long-term trajectory of body mass index (BMI) starting in middle age.</td></tr>
<tr><td>Study Design: Prospective cohort study
Location: United States
Sample: 10,314
Attrition Rate: 23.97%
Sample Power: Not Reported
Intervention: No
Exposure Measurement
Self-Reported: Frequency of vigorous intensity physical activity (PA) at each wave. Coding for PA indicators varied slightly across waves, so they were recoded into binary measures, with a score of 0 for “once per week or less ” and 1 for “more than once per week ” for all time points.
Measures Steps: No
Measures Bouts: No</td><td>Abstract: BACKGROUND: Obesity is increasingly prevalent among older adults, yet little is known about the impact of health behaviors on the trajectories of body weight in this age group. METHODS: We examined the effect of time-varying smoking, physical activity (PA), alcohol use, and changes thereof, on the 14-year (1992-2006) trajectory of body- mass index (BMI) in a cohort of 10,314 older adults from the Health and Retirements Study, aged 51-61 years at baseline. Hierarchical linear modeling (HLM) quantifies the effect of smoking, PA, and alcohol use (user status, initiation and cessation) on intercept and rate-of-change in BMI trajectory, and tests for variations in the strength of association between each behavior and BMI. RESULTS: Over 14 years (82,512 observations), BMI increased approximated by a quadratic function. Smoking and PA (user status and initiation) were associated with significantly lower BMI trajectories over time. Cessation of smoking and PA resulted in higher BMI trajectories over time. The weight-gaining effect of smoking cessation increased, while the strength of association between BMI trajectories and PA or alcohol use were constant over time. Socio-economic and health status differences explained the effects of alcohol use on BMI trajectory. CONCLUSIONS: In older adults, smoking and PA, and changes thereof, vary in their long-term effect on trajectories of BMI. Barring increases in PA levels, older smokers who quit today are expected to gain significantly more weight than two decades ago. This knowledge is essential for the design of smoking cessation, physical activityPA, and weight-control interventions in older adults.</td></tr>
<tr><td>Refers to Other Materials: Yes
Examine Cardiorespiratory Fitness as Outcome: No</td><td>Outcomes Examined: Self reported body weight: body mass index trajectory.</td></tr>
<tr><td>Populations Analyzed: Older adults</td><td>Author-Stated Funding Source: National Institute on Aging at the National Institutes of Health, The Japanese Ministry of Health, Labor and Welfare Longevity Foundation, the Tokyo Metropolitan Institute of Gerontology, and the Michigan Claude D. Pepper Older Americans Independence Center</td></tr>
</table>

<table>
<tr><td colspan="2">Original Research
Citation: Brien SE, Katzmarzyk PT, Craig CL, Gauvin L. Physical activity, cardiorespiratory fitness and body mass index as predictors of substantial weight gain and obesity: the Canadian physical activity longitudinal study. Can J Public Health. 2007;98:121-124.</td></tr>
<tr><td colspan="2">Purpose: To determine the relationships between physical activity, cardiorespiratory fitness, and the development of overweight and obesity over 20 years in a prospective cohort of Canadians.</td></tr>
<tr><td>Study Design: Prospective cohort study</td><td rowspan="4">Abstract: BACKGROUND: Obesity is a growing health issue in Canada and the identification of the determinants of obesity is important for the development of prevention strategies. The purpose of this investigation was to determine the relationships between physical activity, cardiorespiratory fitness, body mass index (BMI), and the development of future obesity. METHODS: The sample included 459 adults (18+ y; 223 men, 236 women) from the Canadian Physical Activity Longitudinal Study (PALS; 2002-04). Data on physical activity, smoking, alcohol consumption, BMI, and cardiorespiratory fitness (VO2max) were collected in 1981 and 1988. The mean BMI, physical activity, and VO2max were calculated across the 1981 and 1988 measures. Self-reported height and weight were collected in the 2002-04 survey, and participants were classified as overweight (BMI 25 to 29.9 kg/m2) or obese (BMI 230 kg/m2). Logistic regression was used to predict overweight, obesity or substantial weight gain (10 kg or more) in 2002-04, controlling for age, sex, smoking and alcohol use. RESULTS: Higher VO2max in 1981-88 was associated with lower odds of obesity in 2002-04 (OR = 0.87; 95% Cl: 0.76-0.99, p < 0.05), and higher BMI in 1981-88 was associated with higher odds of obesity in 2002-04 (1.84; 1.52-2.20, p < 0.0001). In women, higher VO2max (0.82; 0.72-0.93) resulted in lower odds of a 10 kg weight gain. CONCLUSIONS: The results indicate that cardiorespiratory fitness and previous BMI are important predictors of future weight gain and obesity, and should be incorporated in strategies to identify individuals at increased risk of obesity.</td></tr>
<tr><td>Location: Canada</td></tr>
<tr><td>Sample: 459
Attrition Rate: 90.63%
Sample Power: Not Reported</td></tr>
<tr><td>Intervention: No</td></tr>
<tr><td>Exposure Measurement
Self-Reported: A questionnaire modeled after the Minnesota Leisure Time Physical Activity Questionnaire. Physical activity over the past 12 months and average daily leisure time activity energy expenditure were calculated.
Other: VO2 max using a modification of the Canadian Aerobic fitness test
Measures Steps: No
Measures Bouts: No</td></tr>
<tr><td>Refers to Other Materials: No
Examine Cardiorespiratory Fitness as Outcome: No</td><td>Outcomes Examined: Change in weight status: body mass index categories and those who gained more than 10 kg. Self reported height and weight.</td></tr>
<tr><td>Populations Analyzed: Male, female; adults; overweight (BMI: 25–29.9), obese (BMI: 30 and above)</td><td>Author-Stated Funding Source: Social Sciences and Humanities Research Council of Canada and the Canadian Institutes of Health Research</td></tr>
</table>

<table>
<tr><td colspan="2">Original Research
Citation: Brown WJ, Kabir E, Clark BK, Gomersall SR. Maintaining a healthy BMI: data from a 16-year study of young Australian women. Am J Prev Med. 2016;51:e165-e178. doi:10.1016/j.amepre.2016.09.007.</td></tr>
<tr><td colspan="2">Purpose: To examine the 16-year trajectories of weight and body mass index (BMI) in young adult women who had a healthy BMI and to examine determinants of remaining in the healthy BMI category.</td></tr>
<tr><td>Study Design: Prospective cohort study
Location: Australia
Sample: 4,881
Attrition Rate: 0%
Sample Power: Not Reported
Intervention: No
Exposure Measurement
Self-Reported: A weekly physical activity score was based on frequency of vigorous and less vigorous exercise lasting for >20 minutes. Generic metabolic equivalent (MET) values of 3.33 (walking/moderate) and 6.66 (vigorous) were used to create a MET minutes/week score.
Measures Steps: No
Measures Bouts: No</td><td>Abstract: INTRODUCTION: The aims of this prospective cohort study were to examine 16-year trajectories of weight and BMI in young adult women who had a healthy BMI in 1996 and determinants of remaining in the healthy BMI category. METHODS: A total of 4,881 women with healthy BMI at baseline and either healthy, overweight, or obese BMI at 16-year follow-up reported their weight, height, health, and health behaviors in six surveys of the Australian Longitudinal Study on Women's Health between 1996 (aged 18-23 years) and 2012 (aged 34-39 years). Determinants of BMI maintenance were estimated using binary logistic regression and generalized estimating equations in 2015. RESULTS: Almost 60% remained in the healthy BMI category from 1996 to 2012, (mean weight gain, 0.19 kg/year), 29% transitioned to overweight BMI (0.83 kg/year), and 11.6% transitioned to obese (1.73 kg/year). The mean rates of annual weight gain in each group were consistent over time. Only three factors (low alcohol, moderate/high physical activity, having a university degree) were positively associated with maintaining a healthy BMI. Additional behavioral factors (smoking, high sitting time, energy intake, dieting, takeaway food, and use of oral contraceptives), as well as blue collar occupation, separation/divorce/widowhood, and major illness were negatively associated with BMI maintenance. CONCLUSIONS: To prevent the transition from healthy to overweight/obese BMI, weight gain must be limited to <0.5 kg/year. Women with healthy BMI, but with higher rates of weight gain in their early 20s, could be identified by health professionals for assistance with prevention of becoming overweight/obese.</td></tr>
<tr><td>Refers to Other Materials: Yes
Examine Cardiorespiratory Fitness as Outcome: No</td><td>Outcomes Examined: Self-reported change in weight: kilograms, BMI.</td></tr>
<tr><td>Populations Analyzed: Female, 18–23 at baseline, 34–39 at follow-up; education attainment; urban, rural, other, remote</td><td>Author-Stated Funding Source: Australian Government Department of Health and Ageing; Australian National Health and Medical Research Council (NHMRC) Program Grant; NHMRC Centre of Research Excellence Grant</td></tr>
</table>

<table>
<tr><td colspan="2">Original Research
Citation: Chiriboga DE, Ma Y, Li W, et al. Gender differences in predictors of body weight and body weight change in healthy adults. Obesity. 2008;16:137-145. doi:10.1038/oby.2007.38.</td></tr>
<tr><td colspan="2">Purpose: To identify gender-specific predictors of body weight using cross-sectional and longitudinal analyses.</td></tr>
<tr><td>Study Design: Prospective cohort study</td><td rowspan="5">Abstract: BACKGROUND: Overweight and obesity are important predictors of a wide variety of health problems. Analysis of naturally occurring changes in body weight can provide valuable insights in improving our understanding of the influence of demographic, lifestyle, and psychosocial factors on weight gain in middle-age adults. OBJECTIVE: To identify gender-specific predictors of body weight using cross-sectional and longitudinal analyses. METHODS AND PROCEDURES: Anthropometric, lifestyle and psychosocial factors were measured at baseline and then quarterly for 1 year in 572 healthy adult volunteers from Central Massachusetts who were recruited between 1994 and 1998. Linear mixed models were used to analyze the relationship between body weight and potential predictors, including demographic (e.g., age, educational level), lifestyle (e.g., diet, physical activity, smoking), and psychosocial (e.g., anxiety, depression) factors. RESULTS: Over the 1-year study period, on average, men gained 0.3 kg and women lost 0.2 kg. Predictors of lower body weight at baseline in both men and women included current cigarette smoking, greater leisure-time physical activity, and lower depression and anxiety scores. Lower body weights were associated with a lower percentage of caloric intake from protein and greater occupational physical activity levels only among men; and with higher education level only among women. Longitudinal predictors of 1-year weight gain among women included increased total caloric intake and decreased leisure-time physical activity, and among men, greater anxiety scores. DISCUSSION: Demographic, lifestyle and psychosocial factors are independently related to naturally occurring changes in body weight and have marked differential gender effects. These effects should be taken into consideration when designing interventions for weight-loss and maintenance at the individual and population levels.</td></tr>
<tr><td>Location: United States</td></tr>
<tr><td>Sample: 572
Attrition Rate: 10.76%
Sample Power: Not Reported</td></tr>
<tr><td>Intervention: No</td></tr>
<tr><td>Exposure Measurement
Self-Reported: A series of fifteen 24-hour physical activity recalls, number of hours spent in four intensities of activity on the previous day: light (1.5–2.9 metabolic equivalents [METs]), moderate (3.0– 5.9 METs), vigorous (6.0–7.9 METs), and very vigorous (≥8.0 METs), in each of three activity domains (household, occupational, leisure time).
Measures Steps: No
Measures Bouts: No</td></tr>
<tr><td>Refers to Other Materials: Yes
Examine Cardiorespiratory Fitness as Outcome: No</td><td>Outcomes Examined: Weight change: kilograms.</td></tr>
<tr><td>Populations Analyzed: Male, female; Black or African American, Asian, Hispanic or Latino, Adults; education attainment</td><td>Author-Stated Funding Source: National Heart, Lung, and Blood Institute</td></tr>
</table>

<table>
<tr><td colspan="2">Original Research
Citation: Colchero MA, Caballero B, Bishai D. The effect of income and occupation on body mass index among women in the Cebu Longitudinal Health and Nutrition Surveys (1983-2002). Soc Sci Med. 2008;66(9):1967-1978. doi:10.1016/j.socscimed.2008.01.008.</td></tr>
<tr><td colspan="2">Purpose: To estimate the effect of past occupational activity and past income on changes in weight among women enrolled in Cebu Longitudinal Health and Nutrition Surveys (CLHNS) between 1983 and 2002.</td></tr>
<tr><td>Study Design: Prospective cohort study</td><td rowspan="4">Abstract: We assessed the effects of changes in income and occupational activities on changes in body weight among 2952 non-pregnant women enrolled in the Cebu Longitudinal Health and Nutrition Surveys between 1983 and 2002. On average, body mass index (BMI) among women occupied in low activities was 0.29 kg/m(2) (standard error 0.11) larger compared to women occupied in heavy activities. BMI among women involved in medium activities was on average 0.12 kg/m(2) (standard error 0.05) larger compared to women occupied in heavy activities. A one-unit increase in log household income in the previous survey was associated with a small and positive change in BMI of 0.006 kg/m(2) (standard error 0.02) but the effect was not significant. The trend of increasing body mass was higher in the late 1980s than during the 1990s. These period effects were stronger for the women who were younger at baseline and for women with low or medium activity levels. Our analysis suggests a trend in the environment over the last 20 years that has increased the susceptibility of Filipino women to larger body mass.</td></tr>
<tr><td>Location: Phillipines</td></tr>
<tr><td>Sample: 2,952
Attrition Rate: 11.27%
Sample Power: Not Reported</td></tr>
<tr><td>Intervention: No</td></tr>
<tr><td>Exposure Measurement
Self-Reported: Questionnaire, assessment of main occupation. Investigators assigned intensity to the reported occupation as low, medium, or heavy.
Measures Steps: No
Measures Bouts: No</td><td></td></tr>
<tr><td>Refers to Other Materials: No
Examine Cardiorespiratory Fitness as Outcome: No</td><td>Outcomes Examined: Body mass index: objectively measured height and weight. Subgroups: age (<25, 25–35, ≥35) and year of measure.</td></tr>
<tr><td>Populations Analyzed: Female, other, Filipino, ages 14–47</td><td>Author-Stated Funding Source: National Institutes of Health</td></tr>
</table>

<table>
<tr><td colspan="2">Original Research
Citation: de Munter JS, Tynelius P, Magnusson C, Rasmussen F. Longitudinal analysis of lifestyle habits in relation to body mass index, onset of overweight and obesity: results from a large population-based cohort in Sweden. Scand J Public Health. 2015;43:236-245. doi:10.1177/1403494815569865.</td></tr>
<tr><td colspan="2">Purpose: To explore associations of longitudinal changes in lifestyle habits with changes in body mass index (BMI), and the onset of overweight and obesity.</td></tr>
<tr><td>Study Design: Prospective cohort study</td><td rowspan="4">Abstract: AIMS: It is currently unknown whether the prevalence of obesity is increasing or has levelled off in Sweden and other Westernised countries. Given the major importance of lifestyle habits on weight status, we aimed to explore associations of longitudinal changes in lifestyle habits with changes in body mass index (BMI), and the onset of overweight and obesity. METHODS: Participants (aged 18-84 years at baseline) were included from the Stockholm Public Health Cohort 2002-2010 (n=23,108). Weight status was from self-reported height and weight. Investigated lifestyle habits were leisure-time physical activity, and fruit, alcohol and smoking habits. We estimated associations of stable, improving or worsening lifestyle habits with longitudinal changes in BMI and onset of overweight or obesity between 2002 and 2010. RESULTS: Both men and women increased in weight during the eight years of follow-up. Incidence of obesity was lower in men who increased their leisure-time physical activity (Relative Risk [RR]=0.58, 95% confidence interval 0.42-0.81) than in inactive individuals; the same applied to women (RR=0.37, 0.25-0.54), and similar patterns were identified for overweight and BMI in both genders. Smoking cessation was associated with onset of obesity for men (RR=1.69, 1.15-2.50) and women (RR=1.99, 1.39-2.85). Stable low alcohol intake or decreasing alcohol intake and daily fruit intake was associated with less weight gain, but only in men. CONCLUSIONS: Improving physical activity in both men and women, and alcohol habits and fruit intake in men, prevents excess weight gain among adult people in Sweden. Such an improvement might diminish weight gain after smoking cessation.</td></tr>
<tr><td>Location: Sweden</td></tr>
<tr><td>Sample: 23,108
Attrition Rate: 25.89%
Sample Power: Not Reported</td></tr>
<tr><td>Intervention: No</td></tr>
<tr><td>Exposure Measurement
Self-Reported: Leisure time physical activity assessed in four categories: “inactive” (mostly sitting, or walking and cycling less than two hours per week), “walking/cycling” (walking and cycling at least two hours per week or more, no exercise), “exercise” (30 minutes per week or more), and “more exercise” (90 minutes per week or more).
Measures Steps: No
Measures Bouts: No</td><td></td></tr>
<tr><td>Refers to Other Materials: No
Examine Cardiorespiratory Fitness as Outcome: No</td><td>Outcomes Examined: BMI: self reported height and weight.</td></tr>
<tr><td>Populations Analyzed: Male, female; adults 18–84; normal/healthy weight (BMI: 18.5–24.9), overweight (BMI: 25-29.9), obese (BMI: 30 and above)</td><td>Author-Stated Funding Source: Swedish Council for Working Life and Social Research to Finn Rasmussen</td></tr>
</table>

Original Research

Citation: Drenowatz C, Gribben N, Wirth MD, et al. The association of physical activity during weekdays and weekend with body composition in young adults. *J Obes.* 2016;8236439. http://dx.doi.org/10.1155/2016/8236439.

Purpose: To examine the prospective association between weekly physical activity (PA) patterns and weight change in generally healthy young adults.

Study Design: Prospective cohort study

Location: Not Reported

Sample: 338
Attrition Rate: 21.40%
Sample Power: Not Reported

Intervention: No

Exposure Measurement
Self-Reported: Reported activities during non-wear time of sensor.
Device-Measured: Accelerometer, physical activity (PA): arm band for 7 days (entire 24 hr/day). PA assessment: total daily energy expenditure and time per day spent in: sedentary (excluding sleep), light PA, moderate, and vigorous PA (intensities in metabolic equivalents). Week days compared with weekends.
Measures Steps: No
Measures Bouts: No

Abstract: Physical activity (PA) is a key contributor in long-term weight management but there remains limited research on the association between weekly PA patterns and weight change. The purpose of the present study was to examine the prospective association between weekly PA patterns and weight change in generally healthy young adults. Anthropometric measurements, including dual X-ray absorptiometry, were obtained every 3 months over a period of one year in 338 adults (53% male). At each measurement time, participants wore a multisensor device for a minimum of 10 days to determine total daily energy expenditure and time spent sleeping, sedentary, in light PA (LPA), in moderate PA (MPA), and in vigorous PA (VPA). PA did not differ between weekdays and the weekend at baseline. Twenty-four-hour sleep time, however, was significantly longer during weekends compared to weekdays, which was associated with less time spent sedentary. Weight loss was associated with a significant increase in LPA at the expense of sedentary time during the weekend but not during weekdays. Regression analyses further revealed an inverse association between change in VPA during the weekend and body composition at 12-month follow-up. Taken together, these results suggest that weekend PA plays an important role in long-term weight management.

Refers to Other Materials: No
Examine Cardiorespiratory Fitness as Outcome: No

Outcomes Examined: Height and weight: objectively measured with participants in surgical scrubs and bare feet. Total fat mass and fat free mass: dual-energy x-ray absorptiometry. Subgroups: weight loss, weight maintenance, and weight gain.

Populations Analyzed: Adults 20–35

Author-Stated Funding Source: The Coca-Cola Company

<table>
<tr><td colspan="2">Original Research
Citation: Drenowatz C, Hill JO, Peters JC, Soriano-Maldonado A, Blair SN. The association of change in physical activity and body weight in the regulation of total energy expenditure. Eur J Clin Nutr. 2017;71(3):377-382. doi:10.1038/ejcn.2016.228.</td></tr>
<tr><td colspan="2">Purpose: To examine the longitudinal association of body weight with physical activity (PA), total daily energy expenditure, and total daily energy intake.</td></tr>
<tr><td>Study Design: Prospective cohort study</td><td rowspan="4">Abstract: BACKGROUND/OBJECTIVES: The limited success in addressing the current obesity epidemic reflects the insufficient understanding of the regulation of energy balance. The present study examines the longitudinal association of body weight with physical activity (PA), total daily energy expenditure (TDEE) and total daily energy intake (TDEI). SUBJECTS/METHODS: A total of 195 adults (52% male) between 21 and 35 years of age with no intention for weight loss were followed over a 2-year period. Body weight, fat mass and fat-free mass were measured every 3 months. Participants were stratified into three groups based on change in body weight using a 5% cutpoint. TDEE and time spent in different PA intensities were determined via a multisensor device at each measurement time. TDEI was calculated based on change in body composition and TDEE. RESULTS: At 2-year follow-up, 57% of the participants maintained weight, 14% lost weight and 29% gained weight. Average weight change was -6.9+/-3.4 and 7.1+/-3.6 kg in the weight-loss and weight-gain groups, respectively. Average TDEE and TDEI did not change significantly in any weight change group (P>0.16). Moderate-to-vigorous PA, however, increased significantly in the weight-loss group (35+/-49 min/day; P<0.01) and decreased in the weight-gain group (-35+/-46 min/day; P<0.01). CONCLUSIONS: Results of this observational study indicate an inverse association between body weight and PA to maintain a stable TDEE and allow for a stable TDEI over time. Sufficient PA levels, therefore, are an important contributor to weight loss maintenance.</td></tr>
<tr><td>Location: Not Reported</td></tr>
<tr><td>Sample: 195
Attrition Rate: 54.65%
Sample Power: Not Reported</td></tr>
<tr><td>Intervention: No</td></tr>
<tr><td>Exposure Measurement
Device-Measured: SenseWear Mini Armband, total daily energy expenditure and time spent in different intensities: sedentary (excluding sleep), light PA, moderate-to-vigorous PA (MVPA), and time spent in 10 min bouts of MVPA (a minimum of 10 consecutive minutes with at least 8 minutes spent in MVPA).
Measures Steps: No
Measures Bouts: Yes</td></tr>
<tr><td>Refers to Other Materials: No
Examine Cardiorespiratory Fitness as Outcome: No</td><td>Outcomes Examined: Fat mass and fat free mass: dual-energy x-ray absorptiometry; body mass index. Height and weight were objectively measured by trained staff, with participants wearing surgical scrubs and bare feet. Total daily energy expenditure: measured via multisensory armband. Subgroups: Weight loss, weight maintenance, weight gain.</td></tr>
<tr><td>Populations Analyzed: Adults 20–35</td><td>Author-Stated Funding Source: The Coca-Cola Company</td></tr>
</table>

Original Research

Citation: French SA, Mitchell NR, Hannan PJ. Decrease in television viewing predicts lower body mass index at 1-year follow-up in adolescents, but not adults. *J Nutr Educ Behav.* 2012;44(5):415-422. doi:10.1016/j.jneb.2011.12.008.

Purpose: To examine the cross-sectional and prospective associations between energy balance behaviors and body weight change in adolescents and adults recruited from the same households.

Study Design: Group randomized trial

Location: Not Reported

Sample: 86
Attrition Rate: 4.44%
Sample Power: Yes

Intervention: Yes
Intervention Type: Provision of information/education, behavioral
Intervention Length: Not applicable, not physical activity

Exposure Measurement
Self-Reported: Modified International Physical Activity Questionnaire; total minutes score for walking and for moderate and vigorous activity. Three-Day Physical Activity Recall (3DPAR) used for children to measure 30-minute time block for 3 days. Scores computed based on the number of blocks of time in which physical activities of different intensities are engaged. TV viewing (hours/day) included video/DVD viewing on the television but not time spent using small screens, computers, or other video devices.
Measures Steps: No
Measures Bouts: No
Exposure/Intervention
Frequency: Not applicable, not physical activity
Intensity: Not applicable, not physical activity
Time: Not applicable, not physical activity
Type: Other type, sedentary behavior
Examines HIIT: No
Sedentary Behavior Intervention: TV-limiting devices on all household televisions for the 1-year intervention (i.e., turned TV off after weekly TV allowance had been used)

Abstract: OBJECTIVE: To examine associations between television viewing, sugar-sweetened beverage consumption, eating out, physical activity, and body weight change over 1 year. DESIGN: Secondary data analysis from randomized intervention trial. SETTING: Households in the community. PARTICIPANTS: Adults (n = 153) and adolescents (n = 72) from the same households. INTERVENTION: Households were randomized to a home-based obesity prevention intervention or to a no-intervention control group for a 1-year period. MAIN OUTCOME MEASURES: Self-reported television viewing (TV) hours, diet, and physical activity. Body mass index (BMI) computed from measured weight and height (primary outcome measure). ANALYSIS: Mixed-model regression. RESULTS: Among adolescents, a significant prospective association was observed between decreases in television viewing hours and lower BMI z score at 1-year follow-up (decreased TV hours: BMI z score mean = 0.65; no change or increase TV hours: BMI z score = 0.92; P < .02). No significant prospective associations were observed among adults. CONCLUSIONS AND IMPLICATIONS: Reducing television viewing may be an effective strategy to prevent excess weight gain among adolescents.

Refers to Other Materials: Yes
Adverse Events Addressed: No
Examine Cardiorespiratory Fitness as Outcome: No

Outcomes Examined: Body mass index: calculated from height and weight. Weight: street clothing without shoes using a calibrated electronic scale. Height: measured using a wall-mounted stadiometer. Subgroups: adults, children.

Populations Analyzed: Adults; children 12–17

Author-Stated Funding Source: National Institutes of Health/National Cancer Institute

<table>
<tr><td colspan="2">Original Research
Citation: Gebel K, Ding D, Bauman AE. Volume and intensity of physical activity in a large population-based cohort of middle-aged and older Australians: prospective relationships with weight gain, and physical function. Prev Med. 2014;60:131-133. doi:10.1016/j.ypmed.2013.12.030.</td></tr>
<tr><td colspan="2">Purpose: To examine prospectively whether higher proportions of vigorous physical activity (VPA), independent of total activity volume, are associated with better outcomes in weight maintenance and physical function.</td></tr>
<tr><td>Study Design: Prospective cohort study</td><td rowspan="5">Abstract: OBJECTIVES: To examine prospectively whether higher proportions of vigorous physical activity (VPA), independent of total activity volume, are associated with better outcomes in weight maintenance and physical function. METHODS: We used three-year longitudinal data (2006/07-2009/10) of adults 45 and older (n=32,087; 59.5+/-9.3years) from New South Wales, Australia. Logistic regression models examined odds of weight gain and functional decline by volume and intensity of physical activity. RESULTS: On average, body weight increased by 0.66kg (SD=5.83, p<0.001); a validated physical function score (MOS-PF) decreased by 4.79 (SD=12.56, p<0.001). There was a 10% reduction in the odds of weight gain for participants who reported 300min/week or more of moderate to vigorous physical activity (MVPA) compared to less than 150min of MVPA. The proportion of MVPA that was vigorous was not associated with weight change. With the physical functioning outcome, there were independent protective effects from volume and intensity of physical activity. Independent of total MVPA, each 1% increase in the proportion of total activity that was vigorous was associated with a 0.3% decrease in the odds of decline in physical function. CONCLUSION: These prospective findings indicate that VPA per se plays an important role in the prevention of functional decline.</td></tr>
<tr><td>Location: Australia</td></tr>
<tr><td>Sample: 32,087
Attrition Rate: 46.87%
Sample Power: Not Reported</td></tr>
<tr><td>Intervention: No</td></tr>
<tr><td>Exposure Measurement
Self-Reported: Active Australia Survey assessed sessions, hours, and minutes of walking, moderate and vigorous physical activity in past week, divided into tertiles (<150 minutes, 150–299 minutes, 300 or more minutes of moderate to vigorous physical activity).
Measures Steps: No
Measures Bouts: No</td></tr>
<tr><td>Refers to Other Materials: Yes
Examine Cardiorespiratory Fitness as Outcome: No</td><td>Outcomes Examined: Weight: self report. Physical functioning: Medical Outcomes Study Physical Functioning Scale.</td></tr>
<tr><td>Populations Analyzed: Adults ≥45</td><td>Author-Stated Funding Source: Not Reported</td></tr>
</table>

<table>
<tr><td colspan="2">Original Research
Citation: Gradidge PJ, Norris SA, Micklesfield LK, et al. The role of lifestyle and psycho-social factors in predicting changes in body composition in black South African women. PloS One. 2015;10:e0132914.</td></tr>
<tr><td colspan="2">Purpose: To describe the change in body composition over a 10-year period in a cohort of urban black South African women; to determine whether baseline measurements of body size dissatisfaction and body size discrepancy are associated with baseline body composition measures.</td></tr>
<tr><td>Study Design: Prospective cohort study</td><td rowspan="5">Abstract: BACKGROUND: This study aimed to determine whether lifestyle and psycho-social factors determine changes in body composition over 10 years in a population of black African females with a high prevalence of obesity. MATERIALS AND METHODS: Data were collected from 430 women at baseline and 10-year follow-up. Dual energy x-ray absorptiometry-derived body fat mass and fat free soft tissue mass, and simple anthropometric measures were taken at both time points. Data on physical activity (PA), diet, smoking, and alcohol intake were collected at baseline. Body size dissatisfaction and body size discrepancy were determined at baseline using the feel minus ideal (FID) index and the perceived minus actual weight status discrepancy score (PAD), respectively. RESULTS: All body composition measurements increased over 10 years ($p<0.0005$). Two distinct groups of overweight/obese females were identified using PAD and FID: one that was content with their body size and one that wished to be leaner. Vigorous PA at baseline was inversely associated with absolute changes in all measures of adiposity. In subjects who underestimated their body size at baseline (74.0% of the study population) changes in total and peripheral levels of body fat were less than in subjects who correctly identified their body size. In the group that underestimated body size, more women wanted to be leaner than in the group who knew their body size (60.1% vs 47.5%, $p<0.05$). CONCLUSIONS: Underestimation of body size is common and is associated with a lower gain in total body adiposity and a prevalent desire to lose weight.</td></tr>
<tr><td>Location: South Africa</td></tr>
<tr><td>Sample: 428
Attrition Rate: 65.79%
Sample Power: Not Reported</td></tr>
<tr><td>Intervention: No</td></tr>
<tr><td>Exposure Measurement
Self-Reported: Global Physical Activity Questionnaire: Total moderate-vigorous physical activity (MVPA) in minutes per week (mins/wk), was calculated from the sum of occupation, travel-related (walking) and leisure time MVPA. Sitting time (measured in mins/wk) was used as a proxy for sedentary behaviour.
Measures Steps: No
Measures Bouts: No</td></tr>
<tr><td>Refers to Other Materials: No
Examine Cardiorespiratory Fitness as Outcome: No</td><td>Outcomes Examined: Body composition: weight (electronic scale, kg), waist and hip circumference with measuring tape. Dual-energy x-ray absorptiometry used to assess total body fat mass, central, and peripheral adiposity, and free soft tissue mass (all in kg).</td></tr>
<tr><td>Populations Analyzed: Female, Black or African American, adults, urban</td><td>Author-Stated Funding Source: Wellcome Trust (UK)</td></tr>
</table>

<table>
<tr><td colspan="2">Original Research
Citation: Hamer M, Brunner EJ, Bell J, et al. Physical activity patterns over 10 years in relation to body mass index and waist circumference: the Whitehall II cohort study. Obesity. 2013;21: E755-E761. doi:10.1002/oby.20446.</td></tr>
<tr><td colspan="2">Purpose: To examine the association between physical activity (PA) patterns over 10 years in relation to body mass index (BMI) and waist circumference (WC).</td></tr>
<tr><td>Study Design: Prospective cohort study
Location: United Kingdom
Sample: 4,880
Attrition Rate: 38.22%
Sample Power: Not Reported
Intervention: No
Exposure Measurement
Self-Reported: Phase 3 was a three-question survey and phases 5 and 7 of the study used a 20-item survey to assess PA. Each activity was assigned a metabolic equivalent (MET) value by using a compendium of activity energy costs. Three groups were analyzed based on activity. The “none” group did not meet PA guidelines. The moderate group met guidelines through moderate intensity activity, and the vigorous group met the PA guidelines through vigorous activity. An additional grouping was made based on ‘‘rarely’’ meeting guideline (once or less through follow-up); ‘‘sometimes’’ (on two phases); and ‘‘always’’ (on all three follow-up phases).
Measures Steps: No
Measures Bouts: No</td><td>Abstract: OBJECTIVE: Physical activity patterns over 10-years in relation to changes in body mass index (BMI) and waist circumference (WC) were examined. DESIGN AND METHODS: Participants (4,880, mean age 49.3 years at baseline) from the Whitehall II cohort study were included. Self-reported physical activity and anthropometric data were collected at baseline (1991) and twice during follow-up (1997 and 2002). RESULTS: At baseline, meeting established guidelines for physical activity, particularly through vigorous activity, was associated with lower WC (multivariable adjusted B compared to not meeting the guidelines -2.08 cm, 95% CI, -1.39, -0.75) and BMI (-0.34 kg/m(2) , -0.10, -0.59). Based on repeat data, "high adherence" to the guidelines compared to "rare adherence" over follow-up was associated with lower BMI (adjusted difference, -0.43 kg/m(2) , 95% CI, -0.79, -0.08) and WC (-2.50 cm, 95% CI, -3.46, -1.54) at follow-up. Compared to participants that remained stable between 1997 and 2002 (change of <2.5 h/week), those that reported an increase in moderate-vigorous physical activity of at least 2.5 h/week displayed lower BMI (-0.40 kg/m(2) , 95% CI, -0.71, -0.08) and WC (-1.10 cm, 95% CI, -1.95, -0.75). CONCLUSION: Regular physical activity, confirmed by repeated assessments, is associated with relatively favorable levels of adiposity markers after 10 years follow-up.</td></tr>
<tr><td>Refers to Other Materials: No
Examine Cardiorespiratory Fitness as Outcome: No</td><td>Outcomes Examined: BMI and waist circumference (cm).</td></tr>
<tr><td>Populations Analyzed: Middle-older aged adults</td><td>Author-Stated Funding Source: Medical Research Council; British Heart Foundation; Health and Safety Executive; Department of Health; National Heart, Lung, and Blood Institute; National Institute on Aging; Agency for Health Care Policy Research; John D. and Catherine T. MacArthur Foundation Research Networks on Successful Midlife Development and Socio-economic Status and Health</td></tr>
</table>

<table>
<tr><td colspan="2">Original Research
Citation: Hankinson AL, Daviglus ML, Bouchard C, et al. Maintaining a high physical activity level over 20 years and weight gain. JAMA. 2010;304:2603-2610. doi: 10.1001/jama.2010.1843.</td></tr>
<tr><td colspan="2">Purpose: To evaluate the relationship between maintaining higher activity levels, including Department of Health and Human Services-recommended levels, and changes in body mass index (BMI) and waist circumference over 20 years in young adults.</td></tr>
<tr><td>Study Design: Prospective cohort study
Location: United States
Sample: 3,554
Attrition Rate: 30.52%
Sample Power: Not Reported
Intervention: No
Exposure Measurement
Self-Reported: CARDIA Physical Activity History questionnaire, physical activity. The questionnaire asks about participation in 13 specific moderate- and vigorous-intensity activities over the previous year, including sports, exercise, home maintenance, and occupational activities. Habitual high, moderate, or low activity levels were defined as maintaining activity scores greater than the baseline upper tertile, middle tertile, or below the lowest tertile, respectively, at two-thirds of follow-up CARDIA examinations.
Measures Steps: No
Measures Bouts: No</td><td>Abstract: CONTEXT: Data supporting physical activity guidelines to prevent long-term weight gain are sparse, particularly during the period when the highest risk of weight gain occurs. OBJECTIVE: To evaluate the relationship between habitual activity levels and changes in body mass index (BMI) and waist circumference over 20 years. DESIGN, SETTING, AND PARTICIPANTS: The Coronary Artery Risk Development in Young Adults (CARDIA) study is a prospective longitudinal study with 20 years of follow-up, 1985-1986 to 2005-2006. Habitual activity was defined as maintaining high, moderate, and low activity levels based on sex-specific tertiles of activity scores at baseline. Participants comprised a population-based multicenter cohort (Chicago, Illinois; Birmingham, Alabama; Minneapolis, Minnesota; and Oakland, California) of 3554 men and women aged 18 to 30 years at baseline. MAIN OUTCOME MEASURES: Average annual changes in BMI and waist circumference. RESULTS: Over 20 years, maintaining high levels of activity was associated with smaller gains in BMI and waist circumference compared with low activity levels after adjustment for race, baseline BMI, age, education, cigarette smoking status, alcohol use, and energy intake. Men maintaining high activity gained 2.6 fewer kilograms (0.15 BMI units per year; 95% confidence interval [CI], 0.11-0.18 vs 0.20 in the lower activity group; 95% CI, 0.17-0.23), and women maintaining higher activity gained 6.1 fewer kilograms (0.17 BMI units per year; 95% CI, 0.12-0.21 vs 0.30 in the lower activity group; 95% CI, 0.25-0.34). Men maintaining high activity gained 3.1 fewer centimeters in waist circumference (0.52 cm per year; 95% CI, 0.43-0.61 cm vs 0.67 cm in the lower activity group; 95% CI,0.60-0.75 cm) and women maintaining higher activity gained 3.8 fewer centimeters(0.49 cm per year; 95% CI, 0.39-0.58 cm vs 0.67 cm in the lower activity group; 95% CI, 0.60-0.75 cm) [corrected]. CONCLUSION: Maintaining high activity levels through young adulthood may lessen weight gain as young adults transition to middle age, particularly in women.</td></tr>
<tr><td>Refers to Other Materials: Yes
Examine Cardiorespiratory Fitness as Outcome: No</td><td>Outcomes Examined: BMI, weight (kg), and waist circumference (cm).</td></tr>
<tr><td>Populations Analyzed: Male, female; adults 18–30 at baseline and 38–50 at follow-up</td><td>Author-Stated Funding Source: National Heart, Lung, and Blood Institute</td></tr>
</table>

<table>
<tr><td colspan="2">Original Research
Citation: Hillemeier MM, Weisman CS, Chuang C, Downs DS, McCall-Hosenfeld J, Camacho F. Transition to overweight or obesity among women of reproductive age. J Womens Health. 2011;20:703-710. doi:10.1089/jwh.2010.2397.</td></tr>
<tr><td colspan="2">Purpose: To identify factors associated with transition in body mass index (BMI) category to overweight or obesity status over a 2-year period among women of reproductive age.</td></tr>
<tr><td>Study Design: Prospective cohort study
Location: United States
Sample: 689
Attrition Rate: 32.65%
Sample Power: Not Reported
Intervention: No
Exposure Measurement
Self-Reported: Physical activity was categorized as either meeting or not meeting exercise recommendations of 30 minutes of moderate to strenuous physical activity on most, if not all, days of the week.
Measures Steps: No
Measures Bouts: No</td><td>Abstract: BACKGROUND: Nearly two thirds of reproductive-aged women in the United States are currently overweight or obese, placing them at elevated risk for adverse health outcomes. This study identifies factors associated with transition in body mass index (BMI) category to overweight or obesity status over a 2-year period among women of reproductive age. METHODS: Data were collected in the Central Pennsylvania Women's Health Study (CePAWHS), a longitudinal cohort study of reproductive-aged women. Participants were 689 women with normal or overweight BMI at baseline who were not pregnant at either baseline or 2-year follow-up. Separate multiple logistic regression analyses were estimated to model adverse change in weight category for women who were normal weight at baseline and to model transition to obesity among women who were overweight at baseline. RESULTS: Among women of normal weight at baseline, 18% became overweight or obese by follow-up; 25% of women overweight at baseline became obese. In multiple regression analyses, low physical activity at baseline was significantly associated with a 2-fold elevation in the odds of transitioning from normal BMI to overweight/obesity (odds ratio [OR] 2.11, 95% confidence interval [CI] 1.06-4.20), as was having an interim live birth (OR 2.75, 95%CI 1.27-5.95). In contrast, demographics (lower education, younger age) were the only significant predictors of transition from overweight to obesity. CONCLUSIONS: Meeting physical activity guidelines should be encouraged among normal weight women of reproductive age as well as those who are overweight or obese, as low physical activity is a risk for transitioning from normal to overweight status. Younger overweight women are particularly at risk for transition to obesity.</td></tr>
<tr><td>Refers to Other Materials: No
Examine Cardiorespiratory Fitness as Outcome: No</td><td>Outcomes Examined: Change in BMI and change in BMI category.</td></tr>
<tr><td>Populations Analyzed: Female; adults 18–45; normal/healthy weight (BMI: 18.5–24.9), overweight (BMI: 25–29.9)</td><td>Author-Stated Funding Source: Pennsylvania Department of Health, Eunice Kennedy Shriver National Institute of Child Health and Human Development, National Institutes of Health Office of Research on Women’s Health’s Building Interdisciplinary Research Careers in Women’s Health</td></tr>
</table>

<table>
<tr><td colspan="2">Original Research
Citation: Kaikkonen JE, Mikkila V, Juonala M, et al. Factors associated with six-year weight change in young and middle-aged adults in the Young Finns Study. Scand J Clin Lab Invest. 2015;75:133-144. doi:10.3109/00365513.2014.992945.</td></tr>
<tr><td colspan="2">Purpose: To examine factors associated with weight change and obesity risk in young and middle-aged adults.</td></tr>
<tr><td>Study Design: Prospective cohort study
Location: Finland
Sample: 1,715
Attrition Rate: 24.65%
Sample Power: Not Reported
Intervention: No
Exposure Measurement
Self-Reported: Leisure-time physical activity index was categorized into score values from 5 to 15, and exercise intensity from 1 to 3 (1 = usually not becoming out of breath or sweating; 2 = becoming out of breath and sweating slightly; 3 = becoming out of breath and sweating considerably).
Measures Steps: No
Measures Bouts: No</td><td>Abstract: OBJECTIVE: To examine factors associated with weight change and obesity risk in young and middle-aged adults. SUBJECTS/METHODS: The Young Finns Study with its 923 women and 792 men aged 24-39 years at baseline were followed for six years. Variables associated with the weight change were investigated with regression models. RESULTS: The average weight change was 0.45 kg/year in women and 0.58 kg/year in men. In women, weight change was steady across all ages. In men, weight changes were more pronounced in younger age groups. In women (weight gain > 2 kg, n = 490), medication for anxiety, low occupational status, high baseline BMI (body mass index), high intake of sweet beverages, high childhood BMI, high salt (NaCl and/or KCl) use, low number of children, low childhood family income, high stature and low level of dependence (a temperament subscale) were associated with increased weight gain (in the order of importance). In men (weight gain > 2 kg, n = 455), high stature, high intake of french fries, low intake of sweet cookies, young age, recent divorce, low intake of cereals, high intake of milk, depressive symptoms, rural childhood origin, high baseline BMI and unemployment were associated with more pronounced weight gain. Sedentarity (screen-time) was associated with weight gain only in young men. Physical activity and genetic risk for high BMI (score of 31 known variants) were not consistently associated with weight change. CONCLUSIONS: Socio-economic factors, temperamental and physical characteristics, and some dietary factors are related with weight change in young/middle-aged adults. The weight change occurring in adulthood is also determined by childhood factors, such as high BMI and low family income.</td></tr>
<tr><td>Refers to Other Materials: No
Examine Cardiorespiratory Fitness as Outcome: No</td><td>Outcomes Examined: Odds ratios for incident obesity.</td></tr>
<tr><td>Populations Analyzed: Male, female, adults 24–39</td><td>Author-Stated Funding Source: Academy of Finland; the Social Insurance Institution of Finland; Kuopio, Tampere and Turku University Hospital Medical Funds; the Yrj öJahnsson Foundation (JEK); Juho Vainio Foundation (TL, OTR, MH, LP-R); Paavo Nurmi Foundation, Finnish Foundation of Cardiovascular Research (TL, OTR, JEK); Finnish Cultural Foundation, Sigrid Juselius Foundation, Tampere Tuberculosis Foundation (TL); Emil Aaltonen Foundation (TL, MH); and Signe and Ane Gyllenberg Foundation (MH, LP-R); The Bothnia Welfare Coalition for Research and Knowledge through grants from the University of Vaasa and the Vaasa Hospital District (LP-R).</td></tr>
</table>

<table>
<tr><td colspan="2">Original Research
Citation: Kelly MC, Latner JD. Evaluating patterns of weight and body composition change among college women. Eat Behav. 2015;17:157-162.</td></tr>
<tr><td colspan="2">Purpose: To identify patterns of weight change and associated demographic and psychological features among college women at all levels of undergraduate study.</td></tr>
<tr><td>Study Design: Prospective cohort study</td><td rowspan="4">Abstract: The prevalence of obesity increases as women move from adolescence to young adulthood, and college women have been identified as a population at risk for unhealthy weight gain. Studies of weight gain in college populations have revealed that significant, variable weight change occurs in as few as eight weeks, but few have included participants beyond their freshman year of college or assessed body composition. The aims of the study were to use a repeated measures design to identify patterns of weight change among college women at all grade levels and to evaluate factors that may predict weight change over a one-year period. Undergraduate college women (N=131) completed measures of physical activity, dietary restraint, living conditions, and body dissatisfaction at baseline, 6-months, and 12-months. Height, weight, and body composition were collected at all assessment periods. Forty-four percent of participants gained at least 3lb, 23% lost at least 3lb, and 33% maintained weight over one year. Weight change was associated with changes in body fat and was not related to baseline BMI or age. There were no significant differences between grade levels, suggesting that future studies should include women at all grade levels. Baseline physical activity, dietary restraint, living conditions, and body dissatisfaction did not predict weight change at one year, nor did they differentiate between individuals in the three weight change categories. Further research is needed to identify the factors associated with weight gain in young adult women, and such studies should not be limited to college freshmen.</td></tr>
<tr><td>Location: United States</td></tr>
<tr><td>Sample: 86
Attrition Rate: 34.35%
Sample Power: Not Reported</td></tr>
<tr><td>Intervention: No</td></tr>
<tr><td>Exposure Measurement
Self-Reported: Godin Leisure Time Activity Questionnaire, physical activity. It assesses the amount of mild, moderate, and strenuous exercise that participants engage in during their free time per week.
Measures Steps: No
Measures Bouts: No</td><td></td></tr>
<tr><td>Refers to Other Materials: No
Examine Cardiorespiratory Fitness as Outcome: No</td><td>Outcomes Examined: Weight (kg) and body composition (body fat percentage).</td></tr>
<tr><td>Populations Analyzed: Female, college-aged adults</td><td>Author-Stated Funding Source: Department of Psychology at the University of Hawai'i at Mānoa</td></tr>
</table>

<table>
<tr><td colspan="2">Original Research
Citation: Lee IM, Djousse L, Sesso HD, Wang L, Buring JE. Physical activity and weight gain prevention. JAMA. 2010;303:1173-1179. doi: 10.1001/jama.2010.312.</td></tr>
<tr><td colspan="2">Purpose: To examine weight changes associated with different physical activity levels, focusing on the 150 versus 420 minutes/week recommendations, in a large cohort of women followed for 13 years.</td></tr>
<tr><td>Study Design: Prospective cohort study
Location: United States
Sample: 34,079
Attrition Rate: 0
Sample Power: Yes
Intervention: No
Exposure Measurement
Self-Reported: Adapted College Alumni Health Study, average time per week (over the past year) spent in walking, jogging, running, bicycling, yoga/stretching, tennis/squash, and swimming; estimated metabolic equivalent (MET) hours/week from activities reported. Classified <7.5 MET hrs/week, 7.5–21 MET hr/week, 21+MET hrs/week.
Measures Steps: No
Measures Bouts: No</td><td>Abstract: CONTEXT: The amount of physical activity needed to prevent long-term weight gain is unclear. In 2008, federal guidelines recommended at least 150 minutes per week (7.5 metabolic equivalent [MET] hours per week) of moderate-intensity activity for "substantial health benefits." OBJECTIVE: To examine the association of different amounts of physical activity with long-term weight changes among women consuming a usual diet. DESIGN, SETTING, AND PARTICIPANTS: A prospective cohort study involving 34,079 healthy US women (mean age, 54.2 years) from 1992-2007. At baseline and months 36, 72, 96, 120, 144, and 156, women reported their physical activity and body weight. Women were classified as expending less than 7.5, 7.5 to less than 21, and 21 or more MET hours per week of activity at each time. Repeated-measures regression prospectively examined physical activity and weight change over intervals averaging 3 years. MAIN OUTCOME MEASURE: Change in weight. RESULTS: Women gained a mean of 2.6 kg throughout the study. A multivariate analysis comparing women expending 21 or more MET hours per week with those expending from 7.5 to less than 21 MET hours per week showed that the latter group gained a mean (SD) 0.11 kg (0.04 kg; P = .003) over a mean interval of 3 years, and those expending less than 7.5 MET hours per week gained 0.12 kg (0.04; P = .002). There was a significant interaction with body mass index (BMI), such that there was an inverse dose-response relation between activity levels and weight gain among women with a BMI of less than 25 (P for trend < .001) but no relation among women with a BMI from 25 to 29.9 (P for trend = .56) or with a BMI of 30.0 or higher (P for trend = .50). A total of 4540 women (13.3%) with a BMI lower than 25 at study start successfully maintained their weight by gaining less than 2.3 kg throughout. Their mean activity level over the study was 21.5 MET hours per week (approximately 60 minutes a day of moderate-intensity activity). CONCLUSIONS: Among women consuming a usual diet, physical activity was associated with less weight gain only among women whose BMI was lower than 25. Women successful in maintaining normal weight and gaining fewer than 2.3 kg over 13 years averaged approximately 60 minutes a day of moderate-intensity activity throughout the study.</td></tr>
<tr><td>Refers to Other Materials: No
Examine Cardiorespiratory Fitness as Outcome: No</td><td>Outcomes Examined: Weight (kg) and height: self report.</td></tr>
<tr><td>Populations Analyzed: Female; adults <55, 55–64,</td><td>Author-Stated Funding Source: National Institutes of Health</td></tr>
</table>

>65; normal/healthy weight (BMI: 18.5–24.9), overweight (BMI: 25–29.9), obese (BMI: 30 and above); smoking status, menopausal status	

<table>
<tr><td colspan="2">Original Research
Citation: MacInnis RJ, Hodge AM, Dixon HG, et al. Predictors of increased body weight and waist circumference for middle-aged adults. Public Health Nutr. 2014;17:1087-1097. doi:10.1017/S1368980013001031.</td></tr>
<tr><td colspan="2">Purpose: To identify potential predictors of stable and increased weight and waist circumference using a prospective cohort study in which all participants were directly measured at baseline and followup.</td></tr>
<tr><td>Study Design: Prospective cohort study
Location: Australia
Sample: 5,879
Attrition Rate: 35.15%
Sample Power: Not Reported
Intervention: No
Exposure Measurement
Self-Reported: Questionnaire, frequency of walking: recreation or exercise (0, 1-2, 3+ times per week), vigorous exercise (0, 1-2, 3+ times per week), and less vigorous exercise (0, 1-2, 3+ times per week) over the last 6 months. Physical activity (PA) score quartiles from total walk, less vigorous and vigorous PA performed. Two additional questions on moderate to heavy physical exertion at work and at home (yes/no).
Measures Steps: No
Measures Bouts: No</td><td>Abstract: OBJECTIVE: To identify predictors of increased adiposity for different measures of adiposity. DESIGN: Prospective cohort study, the Melbourne Collaborative Cohort Study (MCCS), with data at baseline (1990-1994) and wave 2 (2003-2007). SETTING: Participants recruited from the community. SUBJECTS: Australian-born participants (n 5879) aged 40 to 69 years who were not current smokers and who were free from common chronic diseases at recruitment. At baseline and at wave 2, weight and waist circumference were measured; while demographic and lifestyle variables were obtained at baseline via structured interviews. RESULTS: Participants who reported any recreational physical activity at baseline had lower weight and smaller waist circumference at wave 2 than those who did not, particularly for younger participants and for vigorous physical activity. Walking for leisure was not associated, and greater physical activity at work was associated, with greater adiposity measures at wave 2. A diet low in carbohydrates and fibre, but high in fat and protein, predicted greater weight and waist circumference at wave 2. Participants were less likely to have elevated weight or waist circumference at wave 2 if they consumed low to moderate amounts of alcohol. CONCLUSIONS: Our findings indicate that promoting vigorous physical activity, encouraging a diet high in carbohydrate and fibre but low in fat and protein, and limiting alcohol intake could be promising approaches for preventing obesity in middle-aged adults. Similar interventions should successfully address the management of both weight and waist circumference, as they were predicted by similar factors.</td></tr>
<tr><td>Refers to Other Materials: Yes
Examine Cardiorespiratory Fitness as Outcome: No</td><td>Outcomes Examined: Measured blood pressure (mm/Hg), height (cm), weight (kg), and waist circumference (cm).</td></tr>
<tr><td>Populations Analyzed: Adults 40–69, subgroups 40–49, 50–59, 60–69</td><td>Author-Stated Funding Source: Cancer Council Victoria, Vichealth and the National Health and Medical Research Council</td></tr>
</table>

Original Research
Citation: Moholdt T, Wisloff U, Lydersen S, Nauman J. Current physical activity guidelines for health are insufficient to mitigate long-term weight gain: more data in the fitness versus fatness debate (The HUNT study, Norway). *Br J Sports Med*. 2014;48:1489-1496. doi: 10.1136/bjsports-2014-093416.

Purpose: To examine the associations of physical activity (PA) with weight gain in men and women throughout their adult lifespan, and to investigate potential interactions with age and body mass index (BMI).

Study Design: Prospective cohort study

Location: Norway

Sample: 19,127
Attrition Rate: 16.91%
Sample Power: Not Reported

Intervention: No

Exposure Measurement
Self-Reported: Questionnaire: exercise frequency (never, less than once per week, once per week, 2-3 times per week, or 4+ times per week) duration (<15, 15-30, 31-60, 61+ min), and intensity (no sweat, sweat, or exhausted) in baseline; follow-up 1: asked about light and hard PA; follow-up 2: similar to baseline. Created four leisure time PA variables from current recommendations (inactive, below, met, or above); occupational PA: sedentary, walk, and lift or heavy manual work).
Measures Steps: No
Measures Bouts: No

Abstract: BACKGROUND: To promote and maintain health, all adults are recommended to do moderate-intensity aerobic activity a minimum of 30 min on 5 days, or vigorous-intensity activity of 20 min on 3 days, each week. Whether these levels prevent long-term weight gain is uncertain. OBJECTIVE: To assess the relationship between physical activity and long-term weight gain. STUDY DESIGN: An observational prospective cohort study. METHODS: Weight and physical activity were measured in the Nord-Trondelag Health Study in 1984-1986, 1995-1997 and 2006-2008. Participants (n=19 127) were classified based on physical activity into inactive, below recommended level, recommended level or above recommended level. We carried out adjusted mixed model regression analyses with weight as outcome. RESULTS: Men maintaining physical activity above the recommendations for 33 years increased 5.6 kg, while inactive men increased 9.1 kg. For women, corresponding numbers were 3.8 kg in those above recommended physical activity levels, and 9.5 kg in inactive. In adjusted analyses, physical activity above the recommendations was associated with 2.1 kg (95% CI 1.8 to 2.4) less weight gain in men over any 11-year period, compared with inactive. Women exceeding the recommendations gained 1.8 kg (CI 1.5 to 2.2) less than inactive. Compared with inactive, the Ors of gaining meaningful weight of >/=2.3 kg were 0.79 (CI 0.69 to 0.91) and 0.70 (CI 0.60 to 0.81) if exceeding the recommendations in men and women, respectively. CONCLUSIONS: Physical activity above the current recommendations for health benefits was associated with significantly lower risk of weight gain.

Refers to Other Materials: Yes
Examine Cardiorespiratory Fitness as Outcome: No

Outcomes Examined: Height (cm) and weight (kg): direct measurements.

Populations Analyzed: Male, female; adults 20 and older, subgroups <40, 40–59, >60; underweight (BMI: below 18.5), normal/healthy weight (BMI: 18.5–24.9), overweight (BMI: 25–29.9), obese (BMI: 30 and above); smoking status (never, current, former)

Author-Stated Funding Source: K.G. Jebsen Foundation and Norwegian Fund for Postgraduate Training in Physiotherapy

<table>
<tr><td colspan="2">Original Research
Citation: Mortensen LH, Siegler IC, Barefoot JC, Gronbaek M, Sorensen TI. Prospective associations between sedentary lifestyle and BMI in midlife. Obesity. 2006;14:1462-1471. doi:10.1038/oby.2006.166.</td></tr>
<tr><td colspan="2">Purpose: To examine the prospective associations between body mass index and a sedentary lifestyle over fairly close follow-up waves in a cohort of middle-aged adults, and to examine to what extent controlling for preceeding and concurrent changes in physical activity (PA) and body mass index influences the results.</td></tr>
<tr><td>Study Design: Prospective cohort study</td><td rowspan="4">Abstract: OBJECTIVE: A strong positive cross-sectional relationship between BMI and a sedentary lifestyle has been consistently observed in numerous studies. However, it has been questioned whether high BMI is a determinant or a consequence of a sedentary lifestyle. RESEARCH METHODS AND PROCEDURES: Using data from four follow-ups of the University of North Carolina Alumni Heart Study, we examined the prospective associations between BMI and sedentary lifestyle in a cohort of 4595 middle-aged men and women who had responded to questionnaires at the ages of 41 (standard deviation 2.3), 44 (2.3), 46 (2.0), and 54 (2.0). RESULTS: BMI was consistently related to increased risk of becoming sedentary in both men and women. The odds ratios of becoming sedentary as predicted by BMI were 1.04 (95% confidence limits, 1.00, 1.07) per 1 kg/m(2) from ages 41 to 44, 1.10 (1.07, 1.14) from ages 44 to 46, and 1.12 (1.08, 1.17) from ages 46 to 54. Controlling for concurrent changes in BMI marginally attenuated the effects. Sedentary lifestyle did not predict changes in BMI, except when concurrent changes in physical activity were taken into account ($p < 0.001$). The findings were not confounded by preceding changes in BMI or physical activity, age, smoking habits, or sex. DISCUSSION: Our findings suggest that a high BMI is a determinant of a sedentary lifestyle but did not provide unambiguous evidence for an effect of sedentary lifestyle on weight gain.</td></tr>
<tr><td>Location: United States</td></tr>
<tr><td>Sample: 4,595
Attrition Rate: 0%
Sample Power: Not Reported</td></tr>
<tr><td>Intervention: No</td></tr>
<tr><td>Exposure Measurement
Self-Reported: Questionnaire: Baseline: "How many hours a week, on average, do you exercise or play sports for fun or to keep in shape, not counting job or housework activities?", follow up 1: "On average, how many hours of exercise do you get a week?"; follow-up 2 and 3: scale for rating PA (eight categories) and Houston Non-Exercise VO2 test; Sedentary: 0 hours leisure time PA or did not participate regularly in recreation sport or heavy PA. All variables recoded into binary variable to reflect sedentary lifestyle.
Measures Steps: No
Measures Bouts: No</td></tr>
<tr><td>Refers to Other Materials: Yes
Examine Cardiorespiratory Fitness as Outcome: No</td><td>Outcomes Examined: Weight (kg) and height (cm): self report.</td></tr>
<tr><td>Populations Analyzed: Adults; subgroups 41, 44, 46, 54; obese (BMI: 30 and above)</td><td>Author-Stated Funding Source: The Danish National Institute of Public Health and the National Institutes of Health</td></tr>
</table>

<table>
<tr><td colspan="2">Original Research
Citation: Parsons TJ, Manor O, Power C. Physical activity and change in body mass index from adolescence to mid-adulthood in the 1958 British cohort. Int J Epidemiol. 2006;35:197-204.</td></tr>
<tr><td colspan="2">Purpose: To investigate whether adolescent physical activity (PA) influences subsequent changes in body mass index through to mid-adulthood life.</td></tr>
<tr><td>Study Design: Prospective cohort study
Location: United Kingdom
Sample: 9,377
Attrition Rate: 47.12%
Sample Power: Not Reported
Intervention: No
Exposure Measurement
Self-Reported: Questionnaire, PA frequency. At 11 years, the mother reported how often the child used recreational facilities, and the child reported frequency of sport outside school hours; At 16 years, participants reported frequency of outdoor and indoor games and sports. In adulthood, participants responded to a single question about frequency of sports participation at 23 years, and of regular PA at 33 and 42 years. Four activity categories ranging from the least active to the more active were compared.
Measures Steps: No
Measures Bouts: No</td><td rowspan="2">Abstract: BACKGROUND: Prevention of obesity has focused on childhood as a target period. Our aim was to assess whether frequency of adolescent physical activity affected subsequent body mass index (BMI) gain through to mid-adulthood. METHODS: The British birth cohort of all births in 1 week in March 1958, includes information on physical activity frequency and BMI for several ages, 11-45 years. We examined relationships between activity in adolescence and trajectories of BMI between 16 years (or 23 years) and 45 years using multi-level models. Effects of change in activity on BMI and on change in BMI were tested using ANOVA. RESULTS: Physical activity at 11 years had no effect on the BMI trajectories, in males or females. More active females at 16 years gained BMI more slowly than others, by 0.007 kg/m2/year per activity category over the period 16-45 years, whereas the most active males gained BMI faster than others, by 0.005 kg/m2/year per activity category. This effect in males was not evident on the BMI trajectory from 23 to 45 years. Consistent with these analyses, change in activity was associated with change in BMI in females, e.g. females active at 16 and 42 years gained less BMI than inactive females (2.1 vs 2.5 kg/m2/10 years). Results for males were inconsistent over the time periods examined. CONCLUSIONS: Physical activity may lessen the gains in BMI from adolescence onwards, but relationships vary with age, and in later adolescence show opposite effects for males and females. Decreasing activity between adolescence and mid-adulthood in males, and inactivity in both life stages in females may increase BMI gain.</td></tr>
<tr><td>Refers to Other Materials: No
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Male, female, 7 (baseline), 45 (final follow-up)</td><td>Outcomes Examined: Change in body mass index.

Author-Stated Funding Source: National Health Service Executive and Medical Research Council</td></tr>
</table>

<table>
<tr><td colspan="2">Original Research
Citation: Rosenberg L, Kipping-Ruane KL, Boggs DA, Palmer JR. Physical activity and the incidence of obesity in young African-American women. Am J Prev Med. 2013;45:262-268. doi:10.1016/j.amepre.2013.04.016.</td></tr>
<tr><td colspan="2">Purpose: To prospectively investigate the relationship of vigorous exercise and brisk walking to the incidence of obesity (body mass index ≥30) among African-American women aged <40 years.</td></tr>
<tr><td>Study Design: Prospective cohort study
Location: United States
Sample: 20,259
Attrition Rate: 11.43%
Sample Power: Not Reported
Intervention: No
Exposure Measurement
Self-Reported: Average number of hours per week spent in vigorous exercise (1 hr categorical choices); walking for exercise; and walk to and from store, school, and work; assessed pace of walking into categories of intensity (casual, normal, fairly brisk, and brisk/striding); reported number of hours per day watching TV (categories of 1 hr).
Measures Steps: No
Measures Bouts: No</td><td>Abstract: BACKGROUND: Obesity occurs more commonly among African-American women than among other racial/ethnic groups, and most weight gain occurs before middle age. PURPOSE: The study prospectively investigated the relationship of vigorous exercise and brisk walking to the incidence of obesity (BMI >/= 30) among African-American women aged <40 years. METHODS: During 1995-2009 in the Black Women's Health Study, the current authors followed 20,259 African-American women who were aged <40 years and not obese at baseline. BMI, exercise, and walking were assessed at baseline and on biennial follow-up questionnaires. Data for BMI were collected through 2009. Data for exercise and walking were collected through 2007. Validation and reproducibility data indicated that reporting was more accurate for vigorous exercise than for brisk walking. Cox proportional hazards models estimated incidence rate ratios (IRRs) and 95% Cis of incident obesity for hours/week of vigorous exercise and walking relative to "little or no exercise" (<1 hour/week of vigorous exercise and <1 hour/week of brisk walking). The analyses were conducted in 2012. RESULTS: The incidence of obesity decreased with increasing vigorous exercise; the IRR was 0.77 (95% CI=0.69, 0.85) for >/= 7 hours/week relative to little or no exercise; the IRRs were reduced both among women with a healthy weight (BMI <25) at baseline and among women who were overweight (BMI 25-<30) at baseline. The IRRs for brisk walking for exercise and walking for transport were <1.0 for most levels of walking, but without clear trends of decreasing risk with increasing time spent walking. CONCLUSIONS: The results suggest that vigorous exercise may reduce the incidence of obesity among young African-American women. Results for brisk walking were inconclusive.</td></tr>
<tr><td>Refers to Other Materials: No
Examine Cardiorespiratory Fitness as Outcome: No</td><td>Outcomes Examined: Body mass index: reported height and weight. Updated weight at every follow-up questionnaire.</td></tr>
<tr><td>Populations Analyzed: Female; Black or African American; adults 21–40 at baseline; normal/healthy weight (BMI: 18.5–24.9), overweight and obese</td><td>Author-Stated Funding Source: Aetna Foundation, R01 National Cancer Institute</td></tr>
</table>

Original Research

Citation: Shibata AI, Oka K, Sugiyama T, Salmon JO, Dunstan DW, Owen N. Physical activity, television viewing time, and 12-year changes in waist circumference. *Med Sci Sports Exerc.* 2016;48:633-640. doi: 10.1249/MSS.0000000000000803.

Purpose: To examine prospective changes in adults' waist circumference in relation to changes in moderate-to-vigorous physical activity (MVPA) ad television viewing time, using data from three observation points over 12 years.

Study Design: Prospective cohort study

Location: Australia

Sample: 3,261
Attrition Rate: 71.01%
Sample Power: Not Reported

Intervention: No

Exposure Measurement
Self-Reported: Active Australia Survey, questionnaire that measures participation in predominantly leisure time physical activity (and walking for transport) during the past week. Moderate-to-vigorous physical activity (MVPA): sum of time walking, performing moderate intensity physical activity plus double the time spent in vigorous physical activity. Created three categories of change of MVPA from baseline (decrease, no change, and increase); Reported time spent watching TV or video/DVD on weekdays for past week.Created three categories of TV (decrease, no change, increase).
Measures Steps: No
Measures Bouts: No

Abstract: PURPOSE: Both moderate-to-vigorous physical activity (MVPA) and sedentary behavior can be associated with adult adiposity. Much of the relevant evidence is from cross-sectional studies or from prospective studies with relevant exposure measures at a single time point before weight gain or incident obesity. This study examined whether changes in MVPA and television (TV) viewing time are associated with subsequent changes in waist circumference, using data from three separate observation points in a large population-based prospective study of Australian adults. METHODS: Data were obtained from the Australian Diabetes, Obesity, and Lifestyle study collected in 1999-2000 (baseline), 2004-2005 (wave 2), and 2011-2012 (wave 3). The study sample consisted of adults age 25 to 74 yr at baseline who also attended site measurement at three time points (n = 3261). Multilevel linear regression analysis examined associations of initial 5-yr changes in MVPA and TV viewing time (from baseline to wave 2) with 12-yr change in waist circumference (from baseline to wave 3), adjusting for well-known confounders. RESULTS: As categorical predictors, increases in MVPA significantly attenuated increases in waist circumference (P for trend < 0.001). TV viewing time change was not significantly associated with changes in waist circumference (P for trend = 0.06). Combined categories of MVPA and TV viewing time changes were predictive of waist circumference increases; compared with those who increased MVPA and reduced TV viewing time, those who reduced MVPA and increased TV viewing time had a 2-cm greater increase in waist circumference (P = 0.001). CONCLUSION: Decreasing MVPA emerged as a significant predictor of increases in waist circumference. Increasing TV viewing time was also influential, but its impact was much weaker than MVPA.

Refers to Other Materials: Yes **Examine Cardiorespiratory Fitness as Outcome:** No	**Outcomes Examined:** Waist circumference: trained field staff. Body mass index: Height and weight were measured with participants wearing light clothing and no shoes at each wave.
Populations Analyzed: Other, Australian, adults 25–74	**Author-Stated Funding Source:** National Health and Medical Research Council, Australian Government Department of Health and Ageing, Abbott Australasia Pty Ltd, Alphapharm Pty Ltd, Amgen Australia, AstraZeneca, Bristol-Myers Squibb, City Health Centre-Diabetes Service-Canberra, Department of Health and Community Services – Northern Territory, Department of Health and Human Services – Tasmania, Department of Health – New South Wales, Department of Health – Western Australia, Department of Health – South Australia, Department of Human Services – Victoria, Diabetes Australia, Diabetes Australia Northern Territory, Eli Lilly Australia, Estate of the Late Edward Wilson, GlaxoSmithKline, Jack Brockhoff Foundation, Janssen-Cilag, Kidney Health Australia, Marian & FH Flack Trust, Menzies Research Institute, Merck Sharp & Dohme, Novartis Pharmaceuticals, Novo Nordisk Pharmaceuticals, Pfizer Pty Ltd, Pratt Foundation, Queensland Health, Roche Diagnostics Australia, Royal Prince Alfred Hospital, Sydney, Sanofi Aventis, sanofi-synthelabo, the Victorian Government's OIS Program, and 2015-2019 MEXT-Supported Program for the Strategic Research Foundation at Private Universities.

<table>
<tr><td colspan="2">Original Research
Citation: Sims ST, Larson JC, Lamonte MJ, et al. Physical activity and body mass: changes in younger versus older postmenopausal women. Med Sci Sports Exerc. 2012 Jan;44(1):89-97. Doi: 10.1249/MSS.0b013e318227f906.</td></tr>
<tr><td colspan="2">Purpose: To examine the possible role of physical activity (PA) on changes in body weight and fat distribution in a large multi-ethnic cohort of post menopausal women to understand potential differences by age.</td></tr>
<tr><td>Study Design: Prospective cohort study
Location: United States
Sample: 57,735
Attrition Rate: 15.26%
Sample Power: Not Reported
Intervention: No
Exposure Measurement
Self-Reported: Asked how often participants currently walked outside the home for more than 10 minutes (continuous), and the usual duration and speed of their walks. Created four speed metabolic equivalent (MET) categories from walking. Recreational PA: asked how often and for how long they currently exercised at a strenuous level (7+ METs via increased sweating and heart rate). Created MET min/week by the summed product of frequency, duration, and intensity of activities. Created four groups of PA: sedentary, low, moderate, and high for analysis.
Measures Steps: No
Measures Bouts: No</td><td>Abstract: PURPOSE: The study’s purpose was to investigate the relationship of sedentary (? 100 MET · min · wk(-1)), low (>100-500 MET · min · wk(-1)), moderate (>500-1200 MET · min · wk(-1)), and high (>1200 MET · min · wk(-1)) habitual physical activity with body weight, body mass index, and measures of fat distribution (waist-to-hip ratio) in postmenopausal women by age decades. METHODS: A prospective cohort study of 58,610 postmenopausal women age 50-79 yr weighed annually during 8 yr at one of 40 US clinical centers was analyzed to determine the relationship of high versus low habitual physical activity with changes in body weight and fat distribution by age group. RESULTS: Among women age 50-59 yr, there was significant weight loss in those expending >500-1200 MET · min · wk(-1) (coefficient = -0.30, 95% confidence interval = -0.53 to -0.07) compared with the group expending ? 100 MET · min · wk(-1). Among women age 70-79 yr, higher physical activity was associated with less weight loss (coefficient = 0.34, 95% confidence interval = 0.04-0.63). Age at baseline significantly modified the association between physical activity and total weight change, whereas baseline body mass index did not. CONCLUSIONS: High habitual physical activity is associated with less weight gain in younger postmenopausal women and less weight loss in older postmenopausal women. These findings suggest that promoting physical activity among postmenopausal women may be important for managing body weight changes that accompany aging.</td></tr>
<tr><td>Refers to Other Materials: Yes
Examine Cardiorespiratory Fitness as Outcome: No</td><td>Outcomes Examined: Objectively measured height and weight to calculate body mass index (kg/m2), measured waist circumference and hip girth to calculate waist-to-hip ratio.</td></tr>
<tr><td>Populations Analyzed: Female; adults 50–79; normal/healthy weight (BMI: 18.5–24.9), overweight (BMI: 25–29.9), obese (BMI: 30 and above); post menopausal</td><td>Author-Stated Funding Source: National Heart, Lung, and Blood Institute, National Institutes of Health, U.S. Department of Health and Human Services</td></tr>
</table>

<table>
<tr><td colspan="2">Original Research
Citation: Sjosten N, Kivimaki M, Singh-Manoux A, et al. Change in physical activity and weight in relation to retirement: the French GAZEL Cohort Study. BMJ Open. 2012;2:e000522. doi: 10.1136/bmjopen-2011-000522.</td></tr>
<tr><td colspan="2">Purpose: To examine long-term trajectories of physical activity over a 9-year follow-up covering preretirement, periretirement, and postretirement phases and the extent to which these changes were associated with weight change.</td></tr>
<tr><td>Study Design: Prospective cohort study</td><td rowspan="4">Abstract: OBJECTIVES: To examine the trajectories of physical activity from preretirement to postretirement and to further clarify whether the changes in physical activity are associated with changes in body weight. DESIGN: Prospective. SETTING: French national gas and electricity company (GAZEL cohort). PARTICIPANTS: From the original sample of 20 625 employees, only those retiring between 2001 and 2008 on a statutory basis were selected for the analyses (analysis 1: n=2711, 63% men; analysis 2: n=3812, 75% men). Persons with data on at least one preretirement and postretirement measurement of the outcome were selected. PRIMARY AND SECONDARY OUTCOME MEASURES: All outcome data were gathered by questionnaires. In analysis 1, the annual prevalence of higher physical activity (walking >/=5 km/week) 4 years before and after retirement was analysed. In analysis 2, changes in leisure-time sport activities (engagement, frequency and manner) from preretirement to postretirement were analysed with simultaneous changes in body weight (kilogram). RESULTS: In analysis 1 (n=2711), prevalence estimates for 4 years before and 4 years after retirement showed that higher leisure-time physical activity (walking at least 5 km/week) increased by 36% in men and 61% in women during the transition to retirement. This increase was also observed among people at a higher risk of physical inactivity, such as smokers and those with elevated depressive symptoms. In a separate sample (analysis 2, n=3812), change in weight as a function of preretirement and postretirement physical activity was analysed. Weight gain preretirement to postretirement was 0.85 (95% CI 0.48 to 1.21) to 1.35 (0.79 to 1.90) kg greater among physically inactive persons (decrease in activity or inactive) compared with those physically active (p<0.001). CONCLUSIONS: Retirement transition may be associated with beneficial changes in lifestyle and may thus be a good starting point to preventive interventions in various groups of individuals in order to maintain long-term changes.</td></tr>
<tr><td>Location: France</td></tr>
<tr><td>Sample: 3812
Attrition Rate: 0%
Sample Power: Not Reported</td></tr>
<tr><td>Intervention: No</td></tr>
<tr><td>Exposure Measurement
Self-Reported: Questionnaire, walking distance dichotomized into higher activity (≥5 km/week) and lower activity (<5 km/week). Leisure time sport: based on three questions about engaging in leisure time sport, frequency, and manner. Categorized in: inactive, increasingly active, decreasingly active, and active.
Measures Steps: No
Measures Bouts: No</td><td></td></tr>
<tr><td>Refers to Other Materials: No
Examine Cardiorespiratory Fitness as Outcome: No</td><td>Outcomes Examined: Height and weight: self reported.</td></tr>
<tr><td>Populations Analyzed: Male, female; other; French, adults 35–50; employees of national gas and electric company</td><td>Author-Stated Funding Source: Electricite de France-Gaz de France and INSERM, Cohortes Sante TGIR, Agence Nationale de la Recherche, Agence Francaise de Securite Sanitaire dew L'environnement et du Travail</td></tr>
</table>

<table>
<tr><td colspan="2">Original Research
Citation: Smith KJ, Gall SL, McNaughton SA, et al. Lifestyle behaviours associated with 5-year weight gain in a prospective cohort of Australian adults aged 26-36 years at baseline. BMC Public Health. 2017;17:54. doi:10.1186/s12889-016-3931-y.</td></tr>
<tr><td colspan="2">Purpose: To examine whether meeting simple guidelines of "eat breakfast," "limit take away and fast food to once per week," "watch television less than 2 hours per day," and "take at least 10,000 steps per day" was associated with 5-year weight gain among young adults.</td></tr>
<tr><td>Study Design: Prospective cohort study
Location: Australia
Sample: 1,155
Attrition Rate: 86.41%
Sample Power: Not Reported
Intervention: No
Exposure Measurement
Self-Reported:
International Physical Activity Questionnaire, estimated physical activity and sitting time. Total time (hours and minutes) spent watching TV, videos, or DVD on weekdays and weekend days.
Device-Measured:
Pedometer, worn for seven days, with pedometer diary; dichotomised by 10,000 steps or more/day.
Measures Steps: Yes
Measures Bouts: No</td><td>Abstract: BACKGROUND: Whether not meeting common guidelines for lifestyle behaviours is associated with weight gain is uncertain. This study examined whether 5-year weight gain was predicted by not meeting guidelines for: breakfast consumption (eating between 6 and 9 am), takeaway food consumption (<2 times/week), television viewing (<2 h/day) and daily steps (>/=10,000 steps/day). METHODS: One thousand one hundred and fifty-five Australian participants (43% men, 26-36 years) completed questionnaires and wore a pedometer at baseline (2004-06) and follow-up (2009-11). Weight was measured or self-reported, with a correction factor applied. For each behaviour, participants were classified according to whether they met the guideline: consistently met at baseline and follow-up (reference group); not met at baseline but met at follow-up; met at baseline but not met at follow-up; consistently not met at baseline and follow-up. For each behaviour, weight gain was calculated using linear regression. Weight gain by number of guidelines met was also examined. RESULTS: Mean 5-year weight gain was 2.0 kg (SD:6.3). Compared to the reference group, additional weight (mean, 95% CI) was gained among those who did not meet the guideline at follow-up, or consistently did not meet the guideline, for breakfast (1.8 kg, 0.7-2.9; 1.5 kg, 0.1-2.8); takeaway food (2.2 kg, 0.7-3.6; 1.9 kg, 0.7-3.1); watching television (1.9 kg, 0.9-2.9; 1.4 kg, 0.4-2.3); and daily steps (2.6 kg, 1.1-4.04; 1.6 kg, 0.5-2.7). Those who met </=1 guideline at follow-up gained 3.8 kg (95% CI 2.3-5.3) more than those meeting all guidelines. CONCLUSION: Individuals who adopted healthier behaviours between baseline and follow-up had similar weight gain to those who met the guidelines at both time points. Encouraging young adults to meet these simple guidelines may reduce weight gain.</td></tr>
<tr><td>Refers to Other Materials: No
Examine Cardiorespiratory Fitness as Outcome: No</td><td>Outcomes Examined: Baseline: weight (portable scale), height (portable stadiometer). Follow-up 1 and 2: self-reported height and weight.</td></tr>
<tr><td>Populations Analyzed: Individuals ages 7–15 at baseline, 26–36 at follow-up 1, 31–41 at follow-up 2</td><td>Author-Stated Funding Source: National Health and Medical Research Council (NHMRC), the National Heart Foundation, the Tasmanian Community Fund and Veolia Environmental Services, Sanitarium, ASICS and Target, NHMRC Early Career Fellowship, Heart Foundation Public Health Post-Doctoral Fellowship, Future Leader Fellowship, Australian Research Council Future Fellowship, NHMRC Public Health Training (Postdoctoral) Fellowship, NHMRC Research Fellowship</td></tr>
</table>

<table>
<tr><td colspan="2">Original Research
Citation: Williams PT, Thompson PD. Dose-dependent effects of training and detraining on weight in 6406 runners during 7.4 years. Obesity. 2006a;14:1975-1984.</td></tr>
<tr><td colspan="2">Purpose: To determine whether exercise reduces body weight and to examine the dose-response relationships between changes in exercise and changes in total and regional adiposity.</td></tr>
<tr><td>Study Design: Prospective cohort study</td><td rowspan="5">Abstract: OBJECTIVE: Prior randomized and non-randomized training studies have failed to establish a dose-response relationship between vigorous exercise and weight loss; this failure may be due, in part, to their short durations and small sample sizes. The objectives of this study were to determine whether exercise reduces body weight and to examine the dose-response relationships between changes in exercise and changes in total and regional adiposity. RESEARCH METHODS AND PROCEDURES: This was a large prospective study of 3973 men and 1444 women who quit running (detraining), 270 men and 146 women who started running (training), and 420 men and 153 women who remained sedentary during 7.4 years of follow-up. The outcomes measured were weekly running distance, body weight, BMI, body circumferences, and bra cup size. RESULTS: There were significant inverse relationships between the changes in the amount of vigorous exercise (km/wk run) and the changes in weight and BMI in men (slope +/- standard error: -0.039 +/- 0.005 kg/km per week and -0.012 +/- 0.002 kg/m(2) per km/wk, respectively) and in older women (-0.060 +/- 0.018 kg/km per week and -0.022 +/- 0.007 kg/m(2) per km/wk) who quit running, and in initially sedentary men (-0.098 +/- 0.017 kg/km per week and -0.032 +/- 0.005 kg/m(2) per km/wk) and women (-0.062 +/- 0.023 kg/km per week and -0.021 +/- 0.008 kg/m(2) per km/wk) who started running. Changes in waist circumference, an indicator of intra-abdominal fat, were also inversely related to changes in running distance in men who quit (-0.026 +/- 0.005 cm/km per week) or started running (-0.078 +/- 0.017 cm/km per week). DISCUSSION: The initiation of vigorous exercise and its cessation decrease and increase, respectively, body weight and intra-abdominal fat, and these changes are proportional to the change in exercise dose.</td></tr>
<tr><td>Location: Not Reported</td></tr>
<tr><td>Sample: 6,406
Attrition Rate: 0%
Sample Power: Not Reported</td></tr>
<tr><td>Intervention: No</td></tr>
<tr><td>Exposure Measurement
Self-Reported: Questionnaire, running history reported in miles per week, converted to kilometers/week.
Measures Steps: No
Measures Bouts: No</td></tr>
<tr><td>Refers to Other Materials: Yes
Examine Cardiorespiratory Fitness as Outcome: No</td><td>Outcomes Examined: Body mass index (kg/m2): calculated from self-reported height and weight; self-reported waist, hip, and chest circumference; bra cup size.</td></tr>
<tr><td>Populations Analyzed: Male, female; adults (females separated by >45 and <45)</td><td>Author-Stated Funding Source: National Heart, Lung, and Blood Institute, National Institute of Diabetes and Digestive and Kidney Diseases</td></tr>
</table>

<table>
<tr><td colspan="2">Original Research
Citation: Williams PT, Wood PD. The effects of changing exercise levels on weight and age-related weight gain. Int J Obes (Lond). 2006b;30:543-551.</td></tr>
<tr><td colspan="2">Purpose: To determine prospectively whether physical activity can prevent age-related weight gain and whether changing levels of activity affect body weight.</td></tr>
<tr><td>Study Design: Prospective cohort study</td><td rowspan="5">Abstract: Objective: To determine prospectively whether physical activity can prevent age-related weight gain and whether changing levels of activity affect body weight. Design/subjects: The study consisted of 8080 male and 4871 female runners who completed two questionnaires an average (7standard deviation (s.d.)) of 3.2072.30 and 2.5972.17 years apart, respectively, as part of the National Runners' Health Study. Results: Changes in running distance were inversely related to changes in men's and women's body mass indices (BMIs)(slope7standard error (s.e.):</td></tr>
<tr><td>Location: Not Reported</td></tr>
<tr><td>Sample: 12,568
Attrition Rate: 2.98%
Sample Power: Not Reported</td></tr>
<tr><td>Intervention: No</td></tr>
<tr><td>Exposure Measurement
Self-Reported: Weekly running distance (km)
Measures Steps: No
Measures Bouts: No</td></tr>
<tr><td>Refers to Other Materials: No
Examine Cardiorespiratory Fitness as Outcome: No</td><td>Outcomes Examined: Change in body mass index, weight, and waist circumference: self-reported weight, height, and waist circumference.</td></tr>
<tr><td>Populations Analyzed: Male, female; adults 18–75</td><td>Author-Stated Funding Source: National Heart, Lung, and Blood Institute</td></tr>
</table>

<table>
<tr><td colspan="2">Original Research
Citation: Williams PT. Maintaining vigorous activity attenuates 7-yr weight gain in 8340 runners. Med Sci Sports Exerc. 2007;39:801-809. doi:10.1249/mss.0b013e31803349b1.</td></tr>
<tr><td colspan="2">Purpose: To explore if running attenuates long-term weight gain independently of any change in activity level.</td></tr>
<tr><td>Study Design: Prospective cohort study
Location: Not Reported
Sample: 8,340
Attrition Rate: 84.82%
Sample Power: Not Reported
Intervention: No
Exposure Measurement
Self-Reported: Running distance grouped into three categories: modest (0-23 km/wk), intermediate (24-47 km/wk), and prolonged (> 48 km/wk).
Measures Steps: No
Measures Bouts: No</td><td>Abstract: OBJECTIVE: To determine prospectively whether physical activity can prevent age-related weight gain and whether changing levels of activity affect body weight. DESIGN/SUBJECTS: The study consisted of 8,080 male and 4,871 female runners who completed two questionnaires an average (+/-standard deviation (s.d.)) of 3.20+/-2.30 and 2.59+/-2.17 years apart, respectively, as part of the National Runners' Health Study. RESULTS: Changes in running distance were inversely related to changes in men's and women's body mass indices (BMIs) (slope+/-standard error (s.e.): -0.015+/-0.001 and -0.009+/-0.001 kg/m(2) per Deltakm/week, respectively), waist circumferences (-0.030+/-0.002 and -0.022+/-0.005 cm per Deltakm/week, respectively) and percent changes in body weight (-0.062+/-0.003 and -0.041+/-0.003% per Deltakm/week, respectively, all P<0.0001). The regression slopes were significantly steeper (more negative) in men than women for DeltaBMI and Delta%body weight (P<0.0001). A longer history of running diminished the impact of changing running distance on men's weights. When adjusted for Deltakm/week, years of aging in men and years of aging in women were associated with increases of 0.066+/-0.005 and 0.056+/-0.006 kg/m(2) in BMI, respectively, increases of 0.294+/-0.019 and 0.279+/-0.028% in Delta%body weight, respectively, and increases of 0.203+/-0.016 and 0.271+/-0.033 cm in waist circumference, respectively (all P<0.0001). These regression slopes suggest that vigorous exercise may need to increase 4.4 km/week annually in men and 6.2 km/week annually in women to compensate for the expected gain in weight associated with aging (2.7 and 3.9 km/week annually when correct for the attenuation due to measurement error). CONCLUSIONS: Age-related weight gain occurs even among the most active individuals when exercise is constant. Theoretically, vigorous exercise must increase significantly with age to compensate for the expected gain in weight associated with aging.</td></tr>
<tr><td>Refers to Other Materials: Yes
Examine Cardiorespiratory Fitness as Outcome: No</td><td>Outcomes Examined: Changes in weight measured in kilograms.</td></tr>
<tr><td>Populations Analyzed: Male, female, adults</td><td>Author-Stated Funding Source: National Heart, Lung, and Blood Institute and National Institute of Diabetes and Digestive and Kidney Diseases</td></tr>
</table>

Table 3. Original Research Bias Assessment Chart

Nutrition Evidence Library (NEL) Bias Assessment Tool (BAT): Original Research							
	Adair, 2011	Basterra-Gortari, 2009	Bea, 2010	Blanck, 2007	Botosen eanu, 2012	Brien, 2007	Brown, 2016
(???) = Can't Determine							
Inclusion/exclusion criteria similar across study groups.	Yes	Yes	N/A	Yes	Yes	N/A	Yes
Strategy for recruiting or allocating participants similar across study groups.	Yes	Yes	N/A	Yes	Yes	N/A	Yes
Allocation sequence randomly generated.	N/A	N/A	???	N/A	N/A	N/A	N/A
Group allocation concealed (i.e., assignments could not be predicted).	N/A	N/A	???	N/A	N/A	N/A	N/A
Distribution of critical confounding factors similar across study groups at baseline, or analysis controlled for differences between groups.	Yes	Yes	Yes	Yes	Yes	N/A	???
Accounted for variations in execution of study from proposed protocol or research plan.	N/A	N/A	N/A	N/A	N/A	N/A	Yes
Adherence to study protocols similar across study groups.	N/A	Yes	Yes	Yes	Yes	N/A	Yes
Investigators accounted for unintended concurrent exposures that were differentially experienced by study groups and might bias results.	Yes	Yes	No	N/A	Yes	N/A	Yes
Participants blinded to their intervention or exposure status.	N/A	N/A	No	N/A	N/A	N/A	N/A
Investigators blinded to participants' intervention or exposure status.	N/A	N/A	No	N/A	N/A	N/A	N/A
Outcome assessors blinded to participants' intervention or exposure status.	Yes	No	Yes	No	No	No	No
Valid and reliable measures used consistently across study groups to assess inclusion/exclusion criteria, exposures, outcomes, and confounders.	No	No	Yes	No	No	No	No
Length of follow-up similar across study groups.	Yes	Yes	Yes	Yes	Yes	N/A	Yes
In cases of high or differential loss to follow-up, impact assessed through sensitivity analysis or other adjustment.	N/A	N/A	No	Yes	Yes	No	???
Other sources of bias taken into account in design and/or analysis of study through matching or other statistical adjustment.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adequate statistical methods used to assess primary outcomes.	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Nutrition Evidence Library (NEL) Bias Assessment Tool (BAT): Original Research							
	Chiriboga, 2008	Colchero, 2008	de Munter, 2015	Drenowatz, 2016	Drenowatz, 2017	French, 2012	Gebel, 2014
(???) = Can't Determine							
Inclusion/exclusion criteria similar across study groups.	N/A	Yes	Yes	N/A	N/A	N/A	Yes
Strategy for recruiting or allocating participants similar across study groups.	Yes	Yes	Yes	N/A	N/A	N/A	Yes
Allocation sequence randomly generated.	N/A	N/A	N/A	N/A	N/A	???	N/A
Group allocation concealed (i.e., assignments could not be predicted).	N/A	N/A	N/A	N/A	N/A	???	N/A
Distribution of critical confounding factors similar across study groups at baseline, or analysis controlled for differences between groups.	No	Yes	Yes	N/A	N/A	???	???
Accounted for variations in execution of study from proposed protocol or research plan.	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Adherence to study protocols similar across study groups.	Yes	Yes	Yes	N/A	N/A	Yes	Yes
Investigators accounted for unintended concurrent exposures that were differentially experienced by study groups and might bias results.	Yes	Yes	No	N/A	N/A	No	No
Participants blinded to their intervention or exposure status.	N/A	N/A	N/A	N/A	N/A	No	N/A
Investigators blinded to participants' intervention or exposure status.	N/A	N/A	N/A	N/A	N/A	No	N/A
Outcome assessors blinded to participants' intervention or exposure status.	Yes	Yes	No	Yes	Yes	No	No
Valid and reliable measures used consistently across study groups to assess inclusion/exclusion criteria, exposures, outcomes, and confounders.	Yes	No	No	Yes	Yes	Yes	No
Length of follow-up similar across study groups.	Yes	Yes	Yes	N/A	N/A	Yes	Yes
In cases of high or differential loss to follow-up, impact assessed through sensitivity analysis or other adjustment.	N/A	N/A	Yes	No	No	N/A	No
Other sources of bias taken into account in design and/or analysis of study through matching or other statistical adjustment.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adequate statistical methods used to assess primary outcomes.	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Nutrition Evidence Library (NEL) Bias Assessment Tool (BAT): Original Research							
	Gradidge, 2015	Hamer, 2013	Hankinson, 2010	Hillemeier, 2011	Kaikkonen, 2015	Kelly, 2015	Lee, 2010
(???) = Can't Determine							
Inclusion/exclusion criteria similar across study groups.	N/A	Yes	Yes	Yes	Yes	Yes	Yes
Strategy for recruiting or allocating participants similar across study groups.	N/A	Yes	Yes	Yes	Yes	Yes	Yes
Allocation sequence randomly generated.	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Group allocation concealed (i.e., assignments could not be predicted).	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Distribution of critical confounding factors similar across study groups at baseline, or analysis controlled for differences between groups.	N/A	Yes	Yes	Yes	No	Yes	Yes
Accounted for variations in execution of study from proposed protocol or research plan.	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Adherence to study protocols similar across study groups.	N/A	Yes	Yes	Yes	Yes	Yes	Yes
Investigators accounted for unintended concurrent exposures that were differentially experienced by study groups and might bias results.	N/A	Yes	Yes	No	No	Yes	No
Participants blinded to their intervention or exposure status.	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Investigators blinded to participants' intervention or exposure status.	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Outcome assessors blinded to participants' intervention or exposure status.	Yes	Yes	Yes	No	No	Yes	No
Valid and reliable measures used consistently across study groups to assess inclusion/exclusion criteria, exposures, outcomes, and confounders.	Yes	Yes	Yes	No	Yes	Yes	No
Length of follow-up similar across study groups.	N/A	Yes	Yes	Yes	Yes	Yes	Yes
In cases of high or differential loss to follow-up, impact assessed through sensitivity analysis or other adjustment.	No	Yes	Yes	No	No	Yes	N/A
Other sources of bias taken into account in design and/or analysis of study through matching or other statistical adjustment.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adequate statistical methods used to assess primary outcomes.	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Nutrition Evidence Library (NEL) Bias Assessment Tool (BAT): Original Research							
	MacInnis, 2014	Moholdt, 2014	Mortensen, 2006	Parsons, 2006	Rosenberg, 2013	Shibata, 2016	Sims, 2012
(???) = Can't Determine							
Inclusion/exclusion criteria similar across study groups.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Strategy for recruiting or allocating participants similar across study groups.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Allocation sequence randomly generated.	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Group allocation concealed (i.e., assignments could not be predicted).	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Distribution of critical confounding factors similar across study groups at baseline, or analysis controlled for differences between groups.	Yes	???	???	???	Yes	Yes	Yes
Accounted for variations in execution of study from proposed protocol or research plan.	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Adherence to study protocols similar across study groups.	Yes	Yes	Yes	Yes	Yes	No	Yes
Investigators accounted for unintended concurrent exposures that were differentially experienced by study groups and might bias results.	Yes	No	No	No	Yes	No	Yes
Participants blinded to their intervention or exposure status.	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Investigators blinded to participants' intervention or exposure status.	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Outcome assessors blinded to participants' intervention or exposure status.	Yes	Yes	No	No	No	Yes	Yes
Valid and reliable measures used consistently across study groups to assess inclusion/exclusion criteria, exposures, outcomes, and confounders.	Yes	Yes	No	No	No	No	No
Length of follow-up similar across study groups.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
In cases of high or differential loss to follow-up, impact assessed through sensitivity analysis or other adjustment.	No	No	N/A	Yes	N/A	No	N/A
Other sources of bias taken into account in design and/or analysis of study through matching or other statistical adjustment.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adequate statistical methods used to assess primary outcomes.	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Nutrition Evidence Library (NEL) Bias Assessment Tool (BAT): Original Research					
	Sjosten, 2012	Smith, 2017	Williams, 2006a	Williams, 2006b	Williams, 2007
(???) = Can't Determine					
Inclusion/exclusion criteria similar across study groups.	Yes	Yes	Yes	Yes	Yes
Strategy for recruiting or allocating participants similar across study groups.	Yes	Yes	Yes	Yes	Yes
Allocation sequence randomly generated.	N/A	N/A	N/A	N/A	N/A
Group allocation concealed (i.e., assignments could not be predicted).	N/A	N/A	N/A	N/A	N/A
Distribution of critical confounding factors similar across study groups at baseline, or analysis controlled for differences between groups.	Yes	???	???	???	???
Accounted for variations in execution of study from proposed protocol or research plan.	N/A	N/A	N/A	N/A	N/A
Adherence to study protocols similar across study groups.	Yes	Yes	Yes	Yes	Yes
Investigators accounted for unintended concurrent exposures that were differentially experienced by study groups and might bias results.	No	Yes	No	No	No
Participants blinded to their intervention or exposure status.	N/A	N/A	N/A	N/A	N/A
Investigators blinded to participants' intervention or exposure status.	N/A	N/A	N/A	N/A	N/A
Outcome assessors blinded to participants' intervention or exposure status.	No	No	No	No	No
Valid and reliable measures used consistently across study groups to assess inclusion/exclusion criteria, exposures, outcomes, and confounders.	No	Yes	No	No	No
Length of follow-up similar across study groups.	Yes	Yes	Yes	Yes	No
In cases of high or differential loss to follow-up, impact assessed through sensitivity analysis or other adjustment.	N/A	Yes	???	N/A	No
Other sources of bias taken into account in design and/or analysis of study through matching or other statistical adjustment.	Yes	Yes	Yes	Yes	No
Adequate statistical methods used to assess primary outcomes.	Yes	Yes	Yes	Yes	Yes

Appendices

Appendix A: Analytical Framework

Topic Area
Cardiometabolic Health and Weight Management

Systematic Review Questions

What is the relationship between physical activity and prevention of weight gain?

a. Is there a dose-response relationship? If yes, what is the shape of the relationship?
b. Does the relationship vary by age, sex, race/ethnicity, socio-economic status, or weight status?
c. Does the relationship vary based on levels of sedentary behavior, light, moderate, or vigorous physical activity?

Population
Adults, ages 18 and older

Exposure
All types and intensities of physical activity including lifestyle activities, leisure activities, and sedentary behavior

Comparison
Adults who participate in varying levels of physical activity, including no reported physical activity

Endpoint Health Outcomes

Weight
Weight change
Weight control
Weight gain
Weight maintenance
Weight regulation
Weight stability
Weight status

Key Definitions

- **Clinically significant weight loss:** A change in body weight of 5% or more.
- **Excessive weight gain:** A change in body weight of more than 2 kg per year (reference: Hill) or 10 kg per decade (reference: Williamson). Or, a weight change of ≥3% (reference: Stevens).

Appendix B: Final Search Strategy

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

Database: PubMed; Date of Search: 12/7/2016; 333 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 us[sh] OR ut[sh] OR ve[sh] OR vi[sh])
Limit: Publication Date	AND ("2006/01/01"[PDAT] : "3000/12/31"[PDAT])
Limit: Publication Type Include	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	NOT (“comment”[Publication Type] OR “editorial”[Publication Type])
Physical Activity	AND (("Daily steps"[tiab] OR "Energy expenditure"[tiab] OR "Exercise"[mh] OR "Exercise"[tiab] OR "Leisure time physical activity"[tiab] OR "Leisure time physical activities"[tiab] OR "Pedometer"[tiab] OR "Physical activity"[tiab] OR "Physical conditioning"[tiab] OR "Sedentary lifestyle"[mh] OR "Step count"[tiab] OR "Steps/day"[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 "Physical activities"[tiab] OR "Resistance training"[tiab] OR "Sedentary"[tiab] OR "Strength training"[tiab] OR "Walking"[tiab]) NOT medline[sb]))
Outcome	AND ("Body weight"[mh] OR "Body weight change"[tiab] OR "Weight gain"[tiab] OR "Weight status"[tiab] OR "Overweight"[tiab] OR "Weight Control"[tiab] OR "Weight maintenance"[tiab] OR "Weight regulation"[tiab] OR "Weight stability"[tiab])

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

Database: CINAHL; Date of Search: 12/8/16; 19 results
Terms searched in title or abstract

Set	Search Terms
Physical Activity	("Aerobic activities" OR "Aerobic activity" OR "Cardiovascular activities" OR "Cardiovascular activity" OR "Daily steps" OR "Endurance activities" OR "Endurance activity" OR "Energy expenditure" OR "Exercise" OR "Exercise" OR "Leisure time physical activity" OR "Leisure time physical activities" OR "Pedometer" OR "Physical activities" OR "Physical activity" OR "Physical conditioning" OR "Resistance training" OR "Sedentary lifestyle" OR "Sedentary" OR "Step count" OR "Steps/day" OR "Strength training" OR "Walking")
Outcomes	AND ("Body weight" OR "Body weight change" OR "Weight gain" OR "Weight status" OR "Overweight" OR "Weight Control" OR "Weight maintenance" OR "Weight regulation" OR "Weight stability")
Systematic Reviews and 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	2006–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: 12/13/16; 132 results
Terms searched in title, abstract, or keywords

Set	Search Terms
Physical Activity	("Aerobic activities" OR "Aerobic activity" OR "Cardiovascular activities" OR "Cardiovascular activity" OR "Daily steps" OR "Endurance activities" OR "Endurance activity" OR "Energy expenditure" OR "Exercise" OR "Exercise" OR "Leisure time physical activity" OR "Leisure time physical activities" OR "Pedometer" OR "Physical activities" OR "Physical activity" OR "Physical conditioning" OR "Resistance training" OR "Sedentary lifestyle" OR "Sedentary" OR "Step count" OR "Steps/day" OR "Strength training" OR "Walking")
Outcomes	AND ("Body weight" OR "Body weight change" OR "Weight gain" OR "Weight status" OR "Overweight" OR "Weight Control" OR "Weight maintenance" OR "Weight regulation" OR "Weight stability")
Limits	2006–present Word variations not searched Cochrane Reviews and Other Reviews

Search Strategy: PubMed (Original Research)

Database: PubMed; Date of Search: 1/20/17; 494 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 ai[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	AND ("2006/01/01"[PDAT] : "3000/12/31"[PDAT])
Limit: Publication Type Exclude	NOT (“comment”[Publication Type] OR “editorial”[Publication Type] OR “review”[Publication Type] OR systematic[sb] OR "meta-analysis"[publication type] 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])
Study Design	AND (“Prospective studies”[mh] OR “longitudinal studies”[mh] OR “follow-up studies”[mh] OR (“Cohort”[tiab] AND “Prospective”[tiab]) OR (“Cohort”[tiab] AND “longitudinal”[tiab]) OR (“Cohort”[tiab] AND “Concurrent”[tiab]) OR (“follow*”[tiab] AND “Prospective*”[tiab]) OR (“follow*”[tiab] AND “over time”[tiab]))
Physical Activity	AND (("Daily steps"[tiab] OR "Energy expenditure"[tiab] OR "Exercise"[mh] OR "Exercise"[tiab] OR "Leisure time physical activity"[tiab] OR "Leisure time physical activities"[tiab] OR "Pedometer"[tiab] OR "Physical activity"[tiab] OR "Physical conditioning"[tiab] OR "Sedentary lifestyle"[mh] OR "Step count"[tiab] OR "Steps/day"[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 "Physical activities"[tiab] OR "Resistance training"[tiab] OR "Sedentary"[tiab] OR "Strength training"[tiab] OR "Walking"[tiab]) NOT medline[sb]))
Outcome	AND ("Weight gain"[mh] OR "Weight gain"[tiab] OR “Body weight”[tiab] OR "weight change"[tiab] OR "Weight status"[tiab] OR "Weight Control"[tiab] OR "Weight maintenance"[tiab] OR "Weight regulation"[tiab] OR "Weight stability"[tiab])

Search Strategy: CINAHL (Original Research)

Database: CINAHL; Date of Search: 1/20/17; 9 results
Terms searched in title or abstract

Set	Search Terms
Study Design	((“Cohort” AND “Prospective”) OR (“Cohort” AND “longitudinal”) OR (“Cohort” AND “Concurrent”) OR (“follow” AND “Prospective”) OR (“follow” AND “over time”))
Physical Activity	AND ("Aerobic activities" OR "Aerobic activity" OR "Cardiovascular activities" OR "Cardiovascular activity" OR "Daily steps" OR "Endurance activities" OR "Endurance activity" OR "Energy expenditure" OR "Exercise" OR "Leisure time physical activity" OR "Leisure time physical activities" OR "Pedometer" OR "Physical activities" OR "Physical activity" OR "Physical conditioning" OR "Resistance training" OR "Sedentary lifestyle" OR "Sedentary" OR "Step count" OR "Steps/day" OR "Strength training" OR "Walking")
Outcomes	AND ("Weight gain" OR “Body weight” OR "weight change" OR "Weight status" OR "Weight Control" OR "Weight maintenance" OR "Weight regulation" OR "Weight stability")
Limits	2006–present English language Peer reviewed Exclude Medline records Human

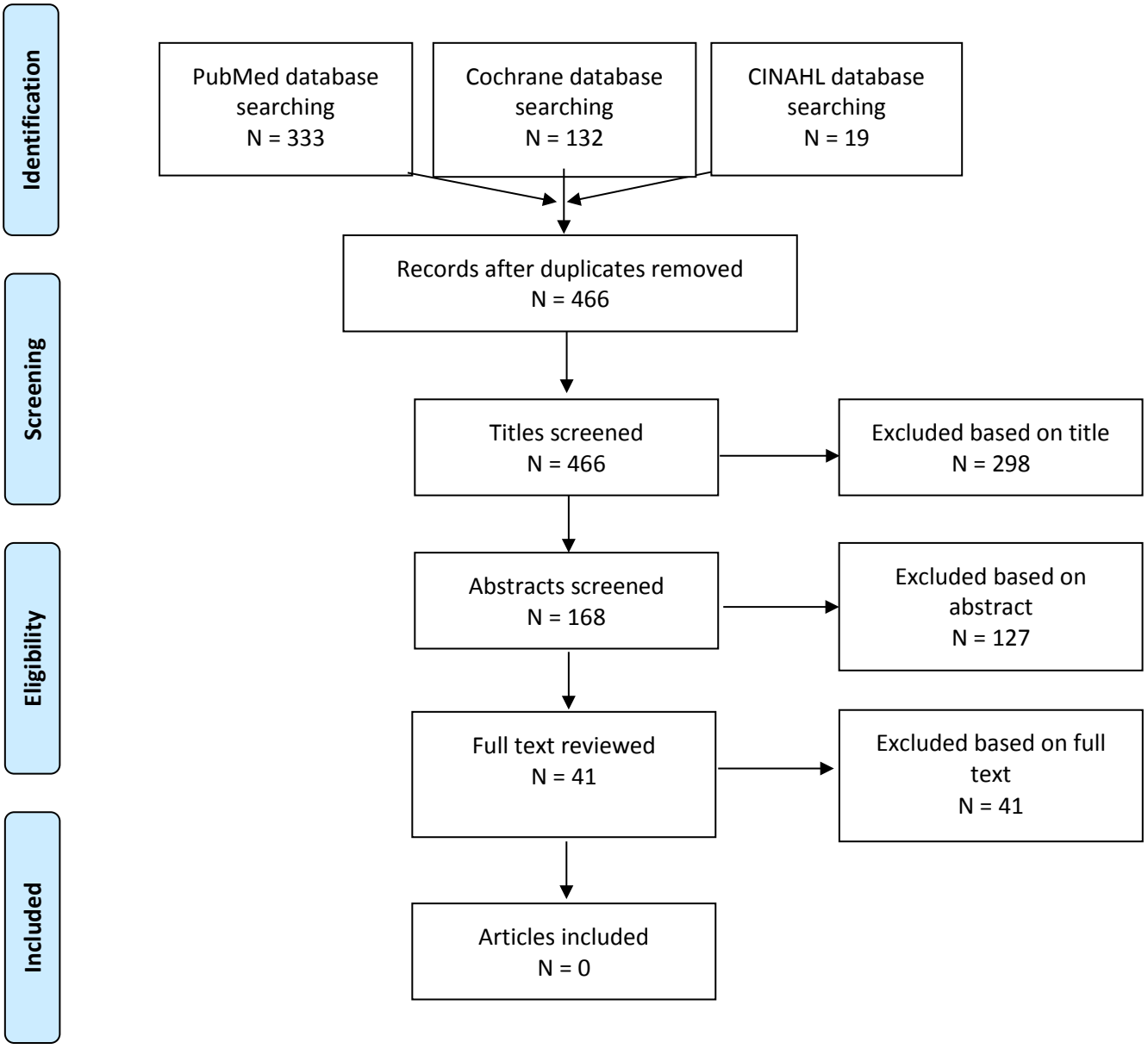
Search Strategy: Cochrane (Original Research)

Database: Cochrane; Date of Search: 1/20/17; 151 results
Terms searched in title, abstract, or keywords

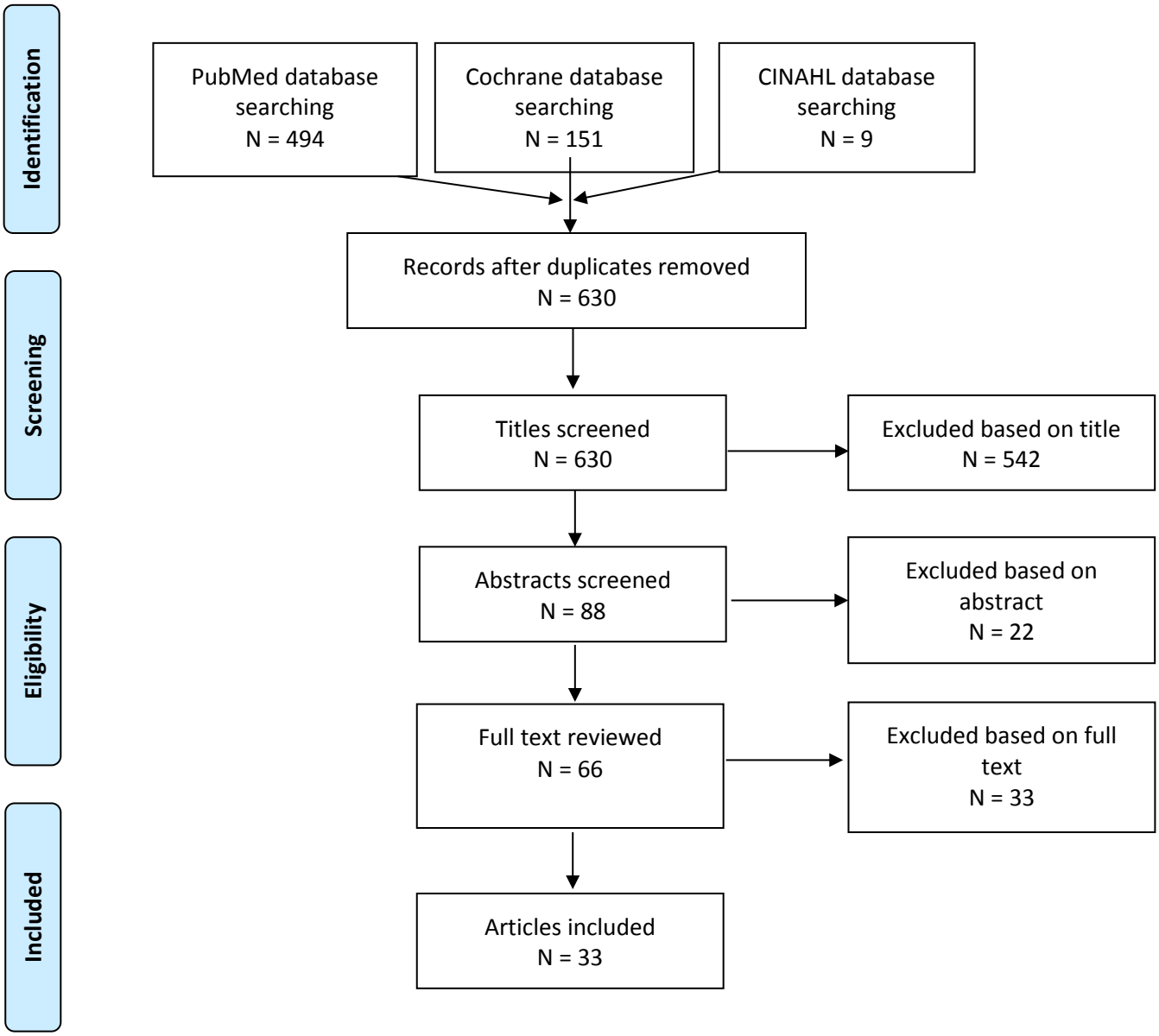
Set	Search Terms
Study Design	((“Cohort” AND “Prospective”) OR (“Cohort” AND “longitudinal”) OR (“Cohort” AND “Concurrent”) OR (“follow” AND “Prospective”) OR (“follow” AND “over time”))
Physical Activity	AND ("Aerobic activities" OR "Aerobic activity" OR "Cardiovascular activities" OR "Cardiovascular activity" OR "Daily steps" OR "Endurance activities" OR "Endurance activity" OR "Energy expenditure" OR "Exercise" OR "Leisure time physical activity" OR "Leisure time physical activities" OR "Pedometer" OR "Physical activities" OR "Physical activity" OR "Physical conditioning" OR "Resistance training" OR "Sedentary lifestyle" OR "Sedentary" OR "Step count" OR "Steps/day" OR "Strength training" OR "Walking")
Outcomes	AND ("Weight gain" OR “Body weight” OR "weight change" OR "Weight status" OR "Weight Control" OR "Weight maintenance" OR "Weight regulation" OR "Weight stability")
Limits	Trials 2006–present Word variations not searched

Appendix C: Literature Tree

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



Original Research Literature Tree



Appendix D: Inclusion/Exclusion Criteria

Cardiometabolic Health and Weight Management Subcommittee

Systematic Review Question: What is the relationship between physical activity and prevention of weight gain?

a. Is there a dose-response relationship? If yes, what is the shape of the relationship?
b. Does the relationship vary by age, sex, race/ethnicity, socio-economic status, or weight status?
c. Does the relationship vary based on levels of sedentary, light, moderate, or vigorous physical activity?

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: Prospective (concurrent; longitudinal) cohort studies; Randomized Controlled Trials • Meta-analyses • Systematic reviews • Reports determined to have appropriate suitability and quality by PAGAC	
Study Subjects	**Include:** • Human subjects	
Age of Study Subjects	**Include:** • Adults ages 18 and older • When data are analyzed by age groups, only data with lower age range of 18 may be included (e.g., in a study with individuals 13–21 where data are presented for multiple age groups, only data for 18 and older may be included)	
Health Status of Study Subjects	**Include:** • Studies of people who are overweight or obese are ok if there are data for a normal weight group • Studies of people with a specific condition/disease state are ok as long as the study does not focus solely on that population and the study also includes healthy adults	

	Exclude: • Studies that include hospitalized patients • Studies that only include people with disordered eating • Studies that specifically include people because of their disease state (e.g., cancer, chronic disease, diabetes, cardiovascular disease) • Studies of smokers	
Comparison	**Include:** • Adults who participate in varying levels of physical activity, including no reported physical activity • Recreational athletes (marathons ok as long as the study looks at a diverse group of runners—not just the elites) **Exclude:** • High performance athletes • Studies comparing athletes to non-athletes • Studies comparing athlete types (e.g., comparing runners to soccer players)	
Date of Publication	**Include:** • Original research published 2006–2017 • Systematic reviews and meta-analyses published from 2006–2016	
Study Design	**Include:** • Randomized trials • Prospective cohort studies • Systematic reviews • Meta-analyses • PAGAC approved reports **Exclude:** • Non-randomized trials • Retrospective cohort studies • Case-control studies • Before-After studies • Narrative reviews • Commentaries • Editorials • Cross-sectional studies • Time series	
Intervention/ Exposure	**Include studies in which the exposure or intervention is:** • All types and intensities of physical activity including lifestyle activities, leisure activities, and sedentary behavior **Exclude:**	

	• Studies that do not include physical activity (or the lack thereof) as the primary exposure variable or used solely as a confounding variable • Studies missing physical activity (mental games such as Sudoku instead of physical activities) • Studies of a single, acute bout of exercise	
Outcome	**Include studies in which the outcome is:** • Weight • Weight change • Weight control • Weight gain • Weight maintenance • Weight regulation • Weight stability • Weight status	
Study Duration	• Minimum 1 year for observational studies	

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	Population	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
Abdullah A, Peeters A, de Courten M, et al. The magnitude of association between overweight and obesity and the risk of diabetes: a meta-analysis of prospective cohort studies. *Diabetes Res Clin Pract*. 2010;89(3):309-319. doi:http://dx.doi.org/10.1016/j.diabres.2010.04.012.	X					
Adams WM, Ferraro EM, Huggins RA, et al. Influence of body mass loss on changes in heart rate during exercise in the heat: a systematic review. *J Strength Cond Res.* 2014;28(8):2380-2389.	X					
Afshinnia F, Wilt TJ, Duval S, et al. Weight loss and proteinuria: systematic review of clinical trials and comparative cohorts. *Nephrol Dial Transplant.* 2010;25(4):1173-1183.	X					
Akande VO, Hendriks AM, Ruiter RA, et al. Determinants of dietary behavior and physical activity among Canadian Inuit: a systematic review. *Int J Behav Nutr Phys Act.* 2015;12:84.	X			X		
Al Khatib HK, Harding SV, Darzi J, et al. The effects of partial sleep deprivation on energy balance: a systematic review and meta-analysis. *Eur J Clin Nutr.* 2016;doi:10.1038/ejcn.2016.201.				X		
Alberdi G, McNamara AE, Lindsay KL, et al. The association between childcare and risk of childhood overweight and obesity in children aged 5 years and under: a systematic review. *Eur J Pediatr.* 2016;175(10):1277-1294.		X				
Alexander D, Rigby MJ, Di Mattia P, et al. Challenges in finding and measuring behavioural determinants of childhood obesity in Europe. *Z Gesundh Wiss.* 2015;23(2):87-94.		X				
Alshaikh MK, Filippidis FT, Baldove JP, et al. Women in Saudi Arabia and the Prevalence of Cardiovascular Risk Factors: A Systematic Review. *J Environ Public Health.* 2016;2016:7479357.				X		
Al-Zadjali M, Keller C, Larkey LK, et al. Evaluation of intervention research in weight reduction in post menopausal women. *Geriatr Nurs.* 2010;31(6):419-434.					X	

Citation	Outcome	Population	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
Amorim Adegboye AR, Linne YM. Diet or exercise, or both, for weight reduction in women after childbirth. *Cochrane Database Syst Rev.* 2013;(7):Cd005627.		X				
Amorim AR, Linne YM, Lourenco PM. Diet or exercise, or both, for weight reduction in women after childbirth. *Cochrane Database Syst Rev.* 2007;(3):Cd005627.		X				
Andersen LG, Angquist L, Gamborg M, et al. Birth weight in relation to leisure time physical activity in adolescence and adulthood: meta-analysis of results from 13 Nordic cohorts. *PLoS One.* 2009;4(12):e8192.	X					
Anderson LM, Quinn TA, Glanz K, et al. 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.					X	
Anderson PA, Dettori JR, Hermsmeyer JT. Does lumbar decompression in overweight patients assist in postoperative weight loss?. *Evid Based Spine Care J.* 2010;1(2):34-38. doi:10.1055/s-0028-1100912.				X		
Anothaisintawee T, Reutrakul S, Van Cauter E, et al. Sleep disturbances compared to traditional risk factors for diabetes development: Systematic review and meta-analysis. *Sleep Med Rev.* 2015;30:11-24.				X		
Antunes LC, Levandovski R, Dantas, G, et al. Obesity and shift work: chronobiological aspects. *Nutr Res Rev.* 2010;23(1):155-168.				X		
Antwi F, Fazylova N, Garcon MC, et al. The effectiveness of web-based programs on the reduction of childhood obesity in school-aged children: a systematic review. *JBI Libr Syst Rev*. 2012;10(suppl 42):1-14.		X				
Appuhamy JA, Kebreab E, Simon M, et al. Effects of diet and exercise interventions on diabetes risk factors in adults without diabetes: meta-analyses of controlled trials. *Diabetol Metab Syndr.* 2014;6:127.					X	
Arem H, Irwin ML. Obesity and endometrial cancer survival: a systematic review. *Int J Obes (Lond).* 2013;37(5):634-639.	X					
Ashton LM, Morgan PJ, Hutchesson MJ, et al. A systematic review of SNAPO (Smoking, Nutrition, Alcohol, Physical activity and Obesity) randomized controlled trials in young adult men. *Prev Med*. 2015;81:221-231.				X		
Atkinson SA, Koletzko B. Determining life-stage groups and extrapolating nutrient	X					

Citation	Outcome	Population	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
intake values (NIVs). *Food Nutr Bull.* 2007;28(suppl 1):S61-S76.						
Aubin HJ, Farley A, Lycett D, et al. Weight gain in smokers after quitting cigarettes: meta-analysis. *BMJ*. 2012;345:e4439.				X		
Augestad LB, Jiang L. Physical activity, physical fitness, and body composition among children and young adults with visual impairments: A systematic review. *British Journal of Visual Impairment.* 2015;33(3):167-182.						X
Azevedo LB, Ling J, Soos I, et al. The effectiveness of sedentary behaviour interventions for reducing body mass index in children and adolescents: systematic review and meta-analysis. *Obes Rev.* 2016;17(7):623-635.		X				
Baillot A, Audet M, Baillargeon JP, et al. Impact of physical activity and fitness in class II and III obese individuals: a systematic review. *Database of Abstracts of Reviews of Effects.* 2014;(2):721-739.					X	
Baker A, Sirois-Leclerc H, Tulloch H. The Impact of Long-Term Physical Activity Interventions for Overweight/Obese Postmenopausal Women on Adiposity Indicators, Physical Capacity, and Mental Health Outcomes: A Systematic Review. *J Obes*. 2016;2016:6169890.					X	
Barnett LM, Lai SK, Veldman SL, et al. Correlates of Gross Motor Competence in Children and Adolescents: A Systematic Review and Meta-Analysis. *Sports Med.* 2016;46(11):1663-1688.		X				
Barry VW, Baruth M, Beets MW, et al. Fitness vs. fatness on all-cause mortality: a meta-analysis. *Prog Cardiovasc Dis.* 2014;56(4):382-390.				X		
Batacan RB, Jr, Duncan MJ, Dalbo VJ, et al. Effects of high-intensity interval training on cardiometabolic health: a systematic review and meta-analysis of intervention studies. *Br J Sports Med.* 2017;51:494-503.						X
Beckwee D, Vaes P, Shahabpour M, et al. The influence of joint loading on bone marrow lesions in the knee: a systematic review with meta-analysis. *Am J Sports Med.* 2015;43(12):3093-3107.	X					
Bender MS, Choi J, Won GY, et al. Randomized controlled trial lifestyle interventions for Asian Americans: a systematic review. *Prev Med.* 2014;67:171-181.				X		

Citation	Outcome	Population	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
Beranger GE, Karbiener M, Barquissau V, et al. In vitro brown and "brite"/"beige" adipogenesis: human cellular models and molecular aspects. *Biochim Biophys Acta.* 2013;1831(5):905-914.				X		
Berge JM, Everts JC. Family-based interventions targeting childhood obesity: a meta-analysis. *Child Obes.* 2011;7(2):110-121.		X				
Berger AA, Peragallo-Urrutia R, Nicholson WK. Systematic review of the effect of individual and combined nutrition and exercise interventions on weight, adiposity and metabolic outcomes after delivery: evidence for developing behavioral guidelines for post-partum weight control. *BMC Pregnancy Childbirth.* 2014;14:319.		X				
Bertoia ML, Mukamal KJ, Cahill LE, et al. Changes in intake of fruits and vegetables and weight change in United States men and women followed for up to 24 years: analysis from three prospective cohort studies. *PLoS Med.* 2015;12(9):e1001878.				X		
Birch L, Perry R, Penfold C, et al. What change in body mass index is needed to improve metabolic health status in childhood obesity: protocol for a systematic review. *Syst Rev.* 2016;5(1):120.		X				
Brooker K, van Dooren K, McPherson L, et al. A systematic review of interventions aiming to improve involvement in physical activity among adults with intellectual disability. *J Phys Act Health.* 2015;12(3):434-444.	X					
Brown T, Avenell A, Edmunds LD, et al. Systematic review of long-term lifestyle interventions to prevent weight gain and morbidity in adults. *Obesity Reviews*. 2009;10(6):627-638.					X	
Catenacci VA, Wyatt HR. The role of physical activity in producing and maintaining weight loss. *Nat Clin Pract Endocrinol Metab.* 2007;3(7):518-529.					X	
Caudwell P, Gibbons C, Finlayson G, et al. Exercise and weight loss: no sex differences in body weight response to exercise. *Exerc Sport Sci Rev.* 2014;42(3):92-101.					X	
Chaudhry ZW, Brown RV, Fawole OA, et al. Comparative effectiveness of strategies to prevent weight gain among women with and at risk for breast cancer: a systematic review. *Springerplus*. 2013;2(1):277.					X	
Choi JW, Fukuoka Y, Lee JH. The effects of physical activity and physical activity plus diet interventions on body weight in		X				

Citation	Outcome	Population	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
overweight or obese women who are pregnant or in postpartum: a systematic review and meta-analysis of randomized controlled trials. *Preventive Medicine.* 2013;56(6):351-364.						
Conn VS, Hafdahl A, Phillips LJ, et al. Impact of physical activity interventions on anthropometric outcomes: systematic review and meta-analysis. *Database of Abstracts of Reviews of Effects.* 2014;(2):203-215.					X	
Corona E, Flores YN, Arab L. Trends in evidence-based lifestyle interventions directed at obese and overweight adult Latinos in the US: A Systematic Review of the Literature. *J Community Health.* 2016;41(3):667-673.					X	
Craigie AM, Lake AA, Kelly SA, et al. Tracking of obesity-related behaviours from childhood to adulthood: a systematic review. *Maturitas*. 2011;70(3):266-284.	X					
da Silva SG, Ricardo LI, Evenson KR, et al. Leisure-time physical activity in pregnancy and maternal-child health: a systematic review and meta-analysis of randomized controlled trials and cohort studies. *Sports Med.* 2017;47(2):295-317. doi:10.1007/s40279-016-0565-2.		X				
de Rezende LF, Rey-Lopez JP, Matsudo VK, et al. Sedentary behavior and health outcomes among older adults: a systematic review. *BMC Public Health*. 2014;14:333.					X	
Dodd JM, Grivell RM, Crowther CA, et al. Antenatal interventions for overweight or obese pregnant women: a systematic review of randomised trials. *BJOG*. 2010;117(11):1316-1326.	X			X		
Elliott-Sale KJ, Barnett CT, Sale C. Systematic review of randomised controlled trials on exercise interventions for weight management during pregnancy and up to one year postpartum among normal weight, overweight and obese women. *Pregnancy Hypertens*. 2014;4(3):234.		X				
Farley AC, Hajek P, Lycett D, Aveyard P. Interventions for preventing weight gain after smoking cessation. *Cochrane Databse Syst Rev*. 2012. 1.doi:10.1002/14651858.CD006219.pub3.					X	
Fedewa MV, Hathaway ED, Williams TD, et al. Effect of exercise training on non-exercise physical activity: a systematic review and meta-analysis of randomized controlled trials. *Sports Med.* 2016.	X					

Citation	Outcome	Population	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
Fogelholm M. Physical activity, fitness and fatness: relations to mortality, morbidity and disease risk factors. A systematic review. *Obes Rev.* 2010;11(3):202-221.	X					
Garbers S, McDonnell C, Fogel SC, et al. Aging, weight, and health among adult lesbian and bisexual women: a metasynthesis of the multisite "healthy weight initiative" focus groups. *LGBT Health*. 2015;2(2):176-187.	X					
Gardner B, Wardle J, Poston L, et al. Changing diet and physical activity to reduce gestational weight gain: a meta-analysis. *Obesity Reviews*. 2011;12(7):e602-e620.		X				
Gomersall SR, Rowlands AV, English C, et al. The ActivityStat hypothesis: the concept, the evidence and the methodologies. *Sports Med*. 2013;43(2):135-149.	X					
Gorga E, Regazzoni V, Bansilal S, et al. School and family-based interventions for promoting a healthy lifestyle among children and adolescents in Italy: a systematic review. *J Cardiovasc Med (Hagerstown).* 2016;17(8):547-555.		X				
Goulao B, Santos O, Carmo Id. The impact of migration on body weight: a review. *Cad Saude Publica.* 2015;31(2):229-245.				X		
Goulet ED. Effect of exercise-induced dehydration on time-trial exercise performance: a meta-analysis. *Br J Sports Med*. 2011;45(14):1149-1156.	X					
Grasser G, Van Dyck D, Titze S, et al. Objectively measured walkability and active transport and weight-related outcomes in adults: a systematic review. *Int J Public Health.* 2013;58(4):615-625.	X					
Gravesande J, Richardson J. Identifying non-pharmacological risk factors for falling in older adults with type 2 diabetes mellitus: a systematic review. *Disabil Rehabil.* 2016:1-7.	X	X				
Gudzune K, Hutfless S, Maruthur N, et al. Strategies to prevent weight gain in workplace and college settings: a systematic review. *Preventive Medicine*. 2013;57(4):268-277.					X	
Gudzune KA, Lau BD, Hutfless S, et al. Strategies to prevent weight gain in adults: future research needs: identification of future research needs from comparative effectiveness review No. 97. *AHRQ Future Research Needs Papers.* 2013.			X			
Guy S, Ratzki-Leewing A, Gwadry-Sridhar F. Moving beyond the stigma: systematic review of video games and their potential to		X				

Citation	Outcome	Population	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
combat obesity. *Int J Hypertens.* 2011;2011:179124.						
Halk AB, Damstra RJ. First Dutch guidelines on lipedema using the international classification of functioning, disability and health. *Phlebology*. 2016.	X			X		
Hammad SS, Berry DC. The child obesity epidemic in Saudi Arabia: a review of the literature. *J Transcult Nurs.* 2016.	X	X		X		
Hammersley ML, Jones RA, Okely AD. Parent-focused childhood and adolescent overweight and obesity ehealth interventions: a systematic review and meta-analysis. *J Med Internet Res.* 2016;18(7):e203.		X				
Haney EM, Huffman LH, Bougatsos C, et al. U.S. Preventive Services Task Force Evidence Syntheses, formerly Systematic Evidence Reviews. Screening for lipid disorders in children and adolescents. 2007.	X	X		X		
Hankir A, Hankir M, Zaman R. Should Ramadan be prescribed after Christmas? Obesity in the healthcare profession and the health benefits of fasting. *BMJ Case Rep.* 2014.				X		
Harper C, Pattinson AL, Fernando HA, et al. Effects of obesity treatments on bone mineral density, bone turnover and fracture risk in adults with overweight or obesity. *Horm Mol Biol Clin Investig.* 2016;28(3):133-149.			X			
Harris L, Hankey C, Murray H, et al. The effects of physical activity interventions on preventing weight gain and the effects on body composition in young adults with intellectual disabilities: systematic review and meta-analysis of randomized controlled trials. *Clin Obes*. 2015;5(4):198-210.					X	
Hartman MA, Hosper K, Stronks K. Targeting physical activity and nutrition interventions towards mothers with young children: a review on components that contribute to attendance and effectiveness. *Public Health Nutr*. 2011;14(8):1364-1381.	X					
Hartmann-Boyce J, Johns DJ, Jebb SA, et al. Behavioural weight management programmes for adults assessed by trials conducted in everyday contexts: systematic review and meta-analysis. *Database of Abstracts of Reviews of Effects*. 2014;(2):920-932.	X			X		
Haydon AM, Macinnis RJ, English DR, et al. Effect of physical activity and body size on	X					

Citation	Outcome	Population	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
survival after diagnosis with colorectal cancer. *Gut*. 2006;55(1):62-67.						
Hebden L, Chey T, Allman-Farinelli M. Lifestyle intervention for preventing weight gain in young adults: a systematic review and meta-analysis of RCTs. *Obesity Reviews*. 2012;13(8):692-710.					X	
Hens W, Taeyman J, Cornelis J, et al. The effect of lifestyle interventions on excess ectopic fat deposition measured by noninvasive techniques in overweight and obese adults: a systematic review and meta-analysis. *J Phys Act Health.* 2016;13(6):671-694.	X					
Herbert K, Plugge E, Foster C, et al. Prevalence of risk factors for non-communicable diseases in prison populations worldwide: a systematic review. *Lancet*. 2012;379(9830):1975-1982.	X					
Heymsfield SB, Harp JB, Reitman ML, et al. Why do obese patients not lose more weight when treated with low-calorie diets? A mechanistic perspective. *Am J Clin Nutr.* 2007;85(2):346-354.				X		
Heymsfield SB, Thomas D, Nguyen AM, et al. Voluntary weight loss: systematic review of early phase body composition changes. *Obes Rev.* 2011;12(5):e348-e361.				X		
Hobbs M, Pearson N, Foster PJ, et al. Sedentary behaviour and diet across the lifespan: an updated systematic review. *Br J Sports Med.* 2015;49(18):1179-1188.	X					
Hochsmann C, Schupbach M, Schmidt-Trucksass A. Effects of exergaming on physical activity in overweight individuals. *Sports Med.* 2016;46(6):845-860.					X	
Hoffmann R, Eikemo TA, Kulhanova I, et al. The potential impact of a social redistribution of specific risk factors on socioeconomic inequalities in mortality: illustration of a method based on population attributable fractions. *J Epidemiol Community Health*. 2013;67(1):56-62.	X					
Ho-Pham LT, Nguyen UD, Nguyen TV. Association between lean mass, fat mass, and bone mineral density: a meta-analysis. *J Clin Endocrinol Metab*. 2014;99(1):30-38.	X					
Horner KM, Schubert MM, Desbrow B, et al. Acute exercise and gastric emptying: a meta-analysis and implications for appetite control. *Sports Med.* 2015;45(5):659-678.	X					
Houtkooper L, Abbot JM, Nimmo M. Nutrition for throwers, jumpers, and	X					

Citation	Outcome	Population	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
combined events athletes. *J Sports Sci*. 2007;25(suppl 1):S39-S47.						
Hutchesson MJ, Hulst J, Collins CE. Weight management interventions targeting young women: a systematic review. *J Acad Nutr Diet.* 2013;113(6):795-802.					X	
Ingram C, Courneya KS, Kingston D. The effects of exercise on body weight and composition in breast cancer survivors: an integrative systematic review. *Oncology Nursing Forum.* 2006;33(5):937-947.					X	
Ingram C, Visovsky C. Exercise intervention to modify physiologic risk factors in cancer survivors. *Semin Oncol Nurs.* 2007;23(4):275-284.					X	
Inoue M, Tsugane S. Insulin resistance and cancer: epidemiological evidence. *Endocr Relat Cancer.* 2012;19(5):F1-F8.	X			X		
James DC, Harville C, 2nd, Sears, et al. Participation of African Americans in e-health and m-health studies: a systematic review. *Telemed J E Health.* 2016.	X					
Jane L, Atkinson G, Jaime V, et al. Intermittent fasting interventions for the treatment of overweight and obesity in adults aged 18 years and over: a systematic review protocol. *JBI Database System Rev Implement Rep*. 2015;13(10):60-68.				X		
Jauch-Chara K, Oltmanns KM. Obesity—a neuropsychological disease? Systematic review and neuropsychological model. *Prog Neurobiol*. 2014;114:84-101.				X		
Jialal I, Kaur H, Devaraj S. Toll-like receptor status in obesity and metabolic syndrome: a translational perspective. *J Clin Endocrinol Metab.* 2014;99(1):39-48.				X		
Jiao L, Berrington de Gonzalez A, Hartge P, et al. Body mass index, effect modifiers, and risk of pancreatic cancer: a pooled study of seven prospective cohorts. *Cancer Causes Control*. 2010;21(8):1305-1314.	X					
Johansson K, Neovius M, Hemmingsson E. Effects of anti-obesity drugs, diet, and exercise on weight-loss maintenance after a very-low-calorie diet or low-calorie diet: a systematic review and meta-analysis of randomized controlled trials. *Am J Clin Nutr*. 2014;99(1):14-23.				X		
Johns DJ, Hartmann-Boyce J, Jebb SA, et al. Diet or exercise interventions vs combined behavioral weight management programs: a systematic review and meta-analysis of direct comparisons. *Database of Abstracts of Reviews of Effects.* 2014;(2):1557-1568.					X	

Citation	Outcome	Population	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
Jones GL, Sutton A. Quality of life in obese postmenopausal women. *Menopause Int*. 2008;14(1):26-32.	X					
Joseph RP, Dutton GR, Cherrington A, et al. Feasibility, acceptability, and characteristics associated with adherence and completion of a culturally relevant internet-enhanced physical activity pilot intervention for overweight and obese young adult African American women enrolled in college. *BMC Res Notes.* 2015;8:209.	X		X			
Karahalios A, English DR, Simpson JA. Weight change and risk of colorectal cancer: a systematic review and meta-analysis. *Am J Epidemiol*. 2015;181(11):832-845.	X			X		
Katzmarzyk PT, Lear SA. Physical activity for obese individuals: a systematic review of effects on chronic disease risk factors. *Obes Rev*. 2012;13(2):95-105.	X					
Kouvelioti R, Vagenas G, Langley-Evans S. The effects of exercise and diet on weight loss maintenance in overweight and obese adults: a systematic review. *Database of Abstracts of Reviews of Effects*. 2014;(2):456-474.	X					
Kuhlmann AK, Dietz PM, Galavotti C, et al. Weight-management interventions for pregnant or postpartum women. *Am J Prev Med.* 2008;34(6):523-528.		X				
Lamina S, Agbanusi EC. Effect of aerobic exercise training on maternal weight gain in pregnancy: a meta-analysis of randomized controlled trials. *Database of Abstracts of Reviews of Effects.* 2013;(2):59-64.		X				
Lovasi GS, Hutson MA, Guerra M, et al. Built environments and obesity in disadvantaged populations. *Epidemiol Rev.* 2009;31:7-20.				X		
Lyzwinski LN. A systematic review and meta-analysis of mobile devices and weight loss with an intervention content analysis. *J Pers Med.* 2014;4(3):311-385.				X		
Mastellos N, Gunn LH, Felix LM, Car J, Majee A. Transtheoretical model stages of change for dietary and physical exercise modification in weight loss management for overweight and obese adults. *Cochrane Database Syst Rev.* 2014;(2). doi:10.1002/14651858.CD008066.pub3.					X	
McCormack GR, Virk JS. Driving towards obesity: a systematized literature review on the association between motor vehicle travel time and distance and weight status in adults. *Prev Med*. 2014;66:49-55.						X

Citation	Outcome	Population	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
McDonald SM, Liu J, Wilcox S, et al. Does dose matter in reducing gestational weight gain in exercise interventions? A systematic review of literature. *J Sci Med Sport.* 2016;19(4):323-335.		X				
Miller CT, Fraser SF, Levinger I, et al. The effects of exercise training in addition to energy restriction on functional capacities and body composition in obese adults during weight loss: a systematic review. *PLoS One*. 2013;8(11):e81692.					X	
Moredich CA, Kessler TA. Physical activity and nutritional weight loss interventions in obese, low-income women: an integrative review. *J Midwifery Womens Health.* 2014;59(4):380-387. doi:10.1111/jmwh.12061.					X	
Mozaffarian D, Hao T, Rimm EB, et al. Changes in diet and lifestyle and long-term weight gain in women and men. *N Engl J Med.* 2011;364(25):2392-2404.			X			
Muktabhant B, Lawrie TA, Lumbiganon P, Laopaiboon M. Diet or exercise, or both, for preventing excessive weight gain in pregnancy. *Cochrane Database Syst Rev*. 2015;(6):CD007145. doi: 10.1002/14651858.CD007145.pub3.		X				
Nascimento SL, Surita FG, Cecatti JG. Physical exercise during pregnancy: a systematic review. *Curr Opin Obstet Gynecol*. 2012;24(6):387-394.		X				
Nascimento SL, Surita FG, Parpinelli MA, et al. Physical exercise, weight gain and perinatal outcomes in overweight and obese pregnant women: a systematic review of clinical trials. *Cadernos de Saude Publica*. 2011;27(3):407-416.					X	
Osman SM, Saaka M, Siassi F, et al. A comparison of pregnancy outcomes in Ghanaian women with varying dietary diversity: a prospective cohort study protocol. *BMJ Open*. 2016;6(9):e011498.			X			
Otto SJ, Korfage IJ, Polinder S, et al. Association of change in physical activity and body weight with quality of life and mortality in colorectal cancer: a systematic review and meta-analysis. *Support Care Cancer*. 2015;23(5):1237-1250.		X				
Palacios C, Joshipura K, Willett W. Nutrition and health: guidelines for dental practitioners. *Oral Dis*. 2009;15(6):369-381.			X			
Papandreou C, Mourad TA, Jildeh C, et al. Obesity in Mediterranean region (1997-	X					

Citation	Outcome	Population	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
2007): a systematic review. *Obes Rev*. 2008;9(5):389-399.						
Papas MA, Alberg AJ, Ewing R, et al. The built environment and obesity. *Epidemiol Rev.* 2007;29:129-143.				X		
Park S, Kim Y, Shin HR, et al. Population-attributable causes of cancer in Korea: obesity and physical inactivity. *PLoS One*. 2014;9(4):e90871.	X					
Parodi PW. Cooperative action of bioactive components in milk fat with PPARs may explain its anti-diabetogenic properties. *Med Hypotheses*. 2016;89:1-7.	X			X		
Parry L, Saxena S, Christie D. Addressing an overweight child and an unaware parent in the general practice consultation. *London J Prim Care (Abingdon)*. 2010;3(1):42-44.		X	X			
Passi SJ. Prevention of non-communicable diseases by balanced nutrition: population-specific effective public health approaches in developing countries. *Curr Diabetes Rev.* 2017;13(5):461-476. doi:10.2174/1573399812666160905105951.				X		
Patel SR, Hu FB. Short sleep duration and weight gain: a systematic review. *Obesity (Silver Spring).* 2008;16(3):643-653.				X		
Pearsall R, Smith DJ, Pelosi A, et al. Exercise therapy in adults with serious mental illness: a systematic review and meta-analysis. *BMC Psychiatry*. 2014;14:117.		X				
Pearson N, Biddle SJ. Sedentary behavior and dietary intake in children, adolescents, and adults. A systematic review. *Am J Prev Med.* 2011;41(2):178-188. doi:10.1016/j.amepre.2011.05.002.	X					
Peirson L, Douketis J, Ciliska D, et al. Treatment for overweight and obesity in adult populations: a systematic review and meta-analysis. *CMAJ Open.* 2014;2(4):E306-E317.					X	
Peirson L, Fitzpatrick-Lewis D, Morrison K, et al. Prevention of overweight and obesity in children and youth: a systematic review and meta-analysis. *CMAJ Open.* 2015;3(1):E23-E33.		X				
Peirson L, Fitzpatrick-Lewis D, Morrison K, et al. Treatment of overweight and obesity in children and youth: a systematic review and meta-analysis. *CMAJ Open*. 2015;3(1):E35-E46.		X				
Peng W, Lin JH, Crouse J. Is playing exergames really exercising? A meta-analysis of energy expenditure in active video games.	X					

Citation	Outcome	Population	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
Cyberpsychol Behav Soc Netw. 2011;14(11):681-688.						
Pereira-da-Silva L, Rego C, Pietrobelli A. The diet of preschool children in the Mediterranean countries of the European Union: a systematic review. *Int J Environ Res Public Health*. 2016;13(6).		X		X		
Perry KJ, Hickson M, Thomas J. Factors enabling success in weight management programmes: systematic review and phenomenological approach. *J Hum Nutr Diet.* 2011;24(3):301-302.	X			X		
Pinquart M. Associations of general parenting and parent-child relationship with pediatric obesity: a meta-analysis. *J Pediatr Psychol.* 2014;39(4):381-393.		X		X		
Playdon M, Thomas G, Sanft T, et al. Weight loss intervention for breast cancer survivors: a systematic review. *Curr Breast Cancer Rep*. 2013;5(3):222-246.	X					
Plotnikoff R, Collins CE, Williams R, et al. Effectiveness of interventions targeting health behaviors in university and college staff: a systematic review. *Am J Health Promot.* 2015;29(5):e169-e187.	X					
Poggiogalle E, Migliaccio S, Lenzi A, et al. Treatment of body composition changes in obese and overweight older adults: insight into the phenotype of sarcopenic obesity. *Endocrine*. 2014;47(3):699-716.	X					
Polkki T, Korhonen A. The effectiveness of music on pain among preterm infants in the neonatal intensive care unit: a systematic review. *JBI Libr Syst Rev*. 2012;10(58):4600-4609.	X	X		X		
Porter Starr KN, McDonald SR, Bales CW. Obesity and physical frailty in older adults: a scoping review of lifestyle intervention trials. *J Am Med Dir Assoc.* 2014;15(4):240-250.	X					
Power BT, Kiezebrink K, Allan JL, et al. Effects of workplace-based dietary and/or physical activity interventions for weight management targeting healthcare professionals: a systematic review of randomised controlled trials. *BMC Obes*. 2014;1:23.					X	
Raber M, Swartz MC, Santa Maria D, et al. Parental involvement in exercise and diet interventions for childhood cancer survivors: a systematic review. *Pediatr Res.* 2016;80(3):338-346.		X				
Rahman T, Cushing RA, Jackson RJ. Contributions of built environment to		X				

Citation	Outcome	Population	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
childhood obesity. *Mt Sinai J Med*. 2011;78(1):49-57.						
Rauner A, Mess F, Woll A. The relationship between physical activity, physical fitness and overweight in adolescents: a systematic review of studies published in or after 2000. *BMC Pediatr.* 2013;13:19.		X				
Robertson C, Avenell A, Boachie C, et al. Should weight loss and maintenance programmes be designed differently for men? A systematic review of long-term randomised controlled trials presenting data for men and women: The ROMEO project. *Obes Res Clin Pract*. 2016;10(1):70-84.					X	
Robertson C, Avenell A, Stewart F, et al. Clinical effectiveness of weight loss and weight maintenance interventions for men: a systematic review of men-only randomized controlled trials (The ROMEO Project). *Am J Mens Health*. 2015;11(4):1096-1123. doi:10.1177/1557988315587550.					X	
Ronnberg AK, Nilsson K. Interventions during pregnancy to reduce excessive gestational weight gain: a systematic review assessing current clinical evidence using the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) system. BJOG. *An International Journal of Obstetrics and Gynaecology*. 2010;117(11):1327-1334.	X					
Sales S, Walker N. A systematic review of the effectiveness of weight management interventions in adults with learning disabilities. *Journal of Human Nutrition & Dietetics*. 2011;24(3):303-303.					X	
Schubert MM, Desbrow B, Sabapathy S, et al. Acute exercise and subsequent energy intake. A meta-analysis. *Appetite*. 2013;63:92-104.	X					
Schwartz A, Kuk JL, Lamothe G, et al. Greater than predicted decrease in resting energy expenditure and weight loss: results from a systematic review. *Obesity (Silver Spring)*. 2012;20(11):2307-2310.	X					
Shaw K, Gennat H, O'Rourke P, Del Mar C. Exercise for overweight or obesity. *Cochrane Database Syst Rev.* 2006;(4):CD003817.					X	
Soderlund A, Fischer A, Johansson T. Physical activity, diet and behaviour modification in the treatment of overweight and obese adults: a systematic review. *Perspectives in Public Health*. 2009;129(3):132-142.					X	
Spencer L, Rollo M, Hauck Y, et al. The effect of weight management interventions that				X		

Citation	Outcome	Population	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
include a diet component on weight-related outcomes in pregnant and postpartum women: a systematic review protocol. *JBI Database System Rev Implement Rep.* 2015;13(1):88-98.						
Stehr MD, Lengerke T. Preventing weight gain through exercise and physical activity in the elderly: a systematic review. *Maturitas*. 2012;72(1):13-22.					X	
Streuling I, Beyerlein A, Kries R. Can gestational weight gain be modified by increasing physical activity and diet counseling? A meta-analysis of interventional trials. *American Journal of Clinical Nutrition*. 2010;92(4):678-687.				X		
Streuling I, Beyerlein A, Rosenfeld E, et al. Physical activity and gestational weight gain: a meta-analysis of intervention trials. BJOG. *An International Journal of Obstetrics and Gynaecology*. 2011;118(3):278-284.		X				
Sui Z, Grivell RM, Dodd JM. Antenatal exercise to improve outcomes in overweight or obese women: a systematic review. *Acta Obstetricia et Gynecologica* Scandinavica. 2012;91(5):538-545.		X				
Summerbell CD, Douthwaite W, Whittaker V, et al. The association between diet and physical activity and subsequent excess weight gain and obesity assessed at 5 years of age or older: a systematic review of the epidemiological evidence. *Int J Obes (Lond).* 2009;33(suppl 3):S1-S92.					X	
Thomas H, Fitzpatrick-Lewis D. Effectiveness of interventions to increase physical activity among marginalized populations. *Database of Abstracts of Reviews of Effects.* 2007;(2):87.	X					
Thorogood A, Mottillo S, Shimony A, et al. Isolated aerobic exercise and weight loss: a systematic review and meta-analysis of randomized controlled trials. *American Journal of Medicine*. 2011;124(8):747-755.					X	
Thorp AA, Owen N, Neuhaus M, et al. Sedentary behaviors and subsequent health outcomes in adults a systematic review of longitudinal studies, 1996-2011. *Am J Prev Med.* 2011;41(2):207-215.					X	
Uthman O, Aremu O. Comparison of physical activity level between overweight/obese and normal weight individuals: a systematic review. *Internet Journal of Nutrition & Wellness*. 2008;5(1):3-3.	X					
Verweij LM, Coffeng J, Mechelen W, et al. Meta-analyses of workplace physical activity					X	

Citation	Outcome	Population	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
and dietary behaviour interventions on weight outcomes. *Obesity Reviews*. 2011;12(6):406-429.						
Wanner M, Gotschi T, Martin-Diener E, et al. Active transport, physical activity, and body weight in adults: a systematic review. *Am J Prev Med.* 2012;42(5):493-502.					X	
Weber Buchholz S, Wilbur J, Halloway S, et al. Physical activity intervention studies and their relationship to body composition in healthy women. *Annu Rev Nurs Res*. 2013;31:71-142.					X	
Weerasekara YK, Roberts SB, Kahn MA, et al. Effectiveness of workplace weight management interventions: a systematic review. *Curr Obes Rep*. 2016;5(2):298-306.					X	
Weinheimer EM, Sands LP, Campbell WW. A systematic review of the separate and combined effects of energy restriction and exercise on fat-free mass in middle-aged and older adults: implications for sarcopenic obesity. *Nutrition Reviews*. 2010;68(7):375-388.					X	
Wieland LS, Falzon L, Sciamanna CN, et al. Interactive computer-based interventions for weight loss or weight maintenance in overweight or obese people. *Cochrane Database Syst Rev.* 2012. (8):CD007675. doi:10.1002/14651858.CD007675.pub2.				X		
Wu T, Gao X, Chen M, et al. Long-term effectiveness of diet-plus-exercise interventions vs. diet-only interventions for weight loss: a meta-analysis. *Obes Rev.* 2009;10(3):313-323.				X		
Yang K. A review of yoga programs for four leading risk factors of chronic diseases. *Evid Based Complement Alternat Med*. 2007;4(4):487-491.					X	
Zhong S, Jiang T, Ma T, et al. Association between physical activity and mortality in breast cancer: a meta-analysis of cohort studies. *Eur J Epidemiol*. 2014;29(6):391-404.		X				

Rationale for Exclusion at Abstract or Full-Text Triage for Original Research

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

Citation	Outcome	Population	Study Design	Exposure	Other
Agrawal P, Gupta K, Mishra V, et al. Effects of sedentary lifestyle and dietary habits on body mass index change among adult women in India: findings from a follow-up study. *Ecol Food Nutr.* 2013;52(5):387-406. doi:10.1080/03670244.2012.719346.					X
Bailey BW, Tucker LA, Peterson TR, LeCheminant JD. A prospective study of physical activity intensity and change in adiposity in middle-aged women. *Am J Health Promot.* 2007;21(6):492-497. doi:10.4278/0890-1171-21.6.492.					X
Cleland VJ, Dwyer T, Venn AJ. Physical activity and healthy weight maintenance from childhood to adulthood. *Obesity (Silver Spring).* 2008;16: 1427-1433. doi:10.1038/oby.2008.215.					X
Culnan E, Kloss JD, Grandner M. A prospective study of weight gain associated with chronotype among college freshmen. *Chronobiol Int.* 2013;30:682-690. doi:10.3109/07420528.2013.782311.					X
De Cocker KA, van Uffelen JG, Brown WJ. Associations between sitting time and weight in young adult Australian women. *Prev Med.* 2010;51:361-367. https://doi.org/10.1016/j.ypmed.2010.07.009					X
Ding D, Sugiyama T, Owen N. Habitual active transport, TV viewing and weight gain: a four year follow-up study. *Prev Med.* 2012;54: 201-204. doi:10.1016/j.ypmed.2012.01.021.					X
Ekelund U, Särnblad S, Brage S, Ryberg J, Wareham NJ, Aman J. Does physical activity equally predict gain in fat mass among obese and nonobese young adults?. *Int J Obes (Lond).* 2007;31:65-71.		X			
Field AE, Haines J, Rosner B, Willett WC. Weight-control behaviors and subsequent weight change among adolescents and young adult females. *Am J Clin Nutr*. 2010;91:147-153. doi:10.3945/ajcn.2009.28321.					X
Field AE, Willett WC, Lissner L, Colditz GA. Dietary fat and weight gain among women in the Nurses' Health Study. *Obesity (Silver Spring).* 2007;15:967-976.				X	
Florêncio TM, Bueno NB, Clemente AP, Albuquerque FC, Britto RP, Ferriolli E, Sawaya AL. Weight gain and reduced energy expenditure in low-income Brazilian women living in slums: a 4-year follow-up study. *Br J Nutr*. 2015;114:462-471. doi:10.1017/S0007114515001816.					X
Franklin RM, Ploutz-Snyder L, Kanaley JA. Longitudinal changes in abdominal fat distribution with menopause. *Metabolism.* 2009;58(3): 311-315. doi:10.1016/j.metabol.2008.09.030.					X

Citation	Outcome	Population	Study Design	Exposure	Other
Funtikova AN, Benítez-Arciniega AA, Gomez SF, Fitó M, Elosua R, Schröder H. Mediterranean diet impact on changes in abdominal fat and 10-year incidence of abdominal obesity in a Spanish population. *Br J Nutr.* 2014;111:1481-1487. doi:10.1017/S0007114513003966.				X	
Gebel K, Bauman AE, Sugiyama T, Owen N. Mismatch between perceived and objectively assessed neighborhood walkability attributes: prospective relationships with walking and weight gain. *Health Place*. 2011;17:519-524. doi:10.1016/j.healthplace.2010.12.008.	X			X	
Genton L, Karsegard VL, Chevalley T, Kossovsky MP, Darmon P, Pichard C. Body composition changes over 9 years in healthy elderly subjects and impact of physical activity. *Clin Nutr*. 2011;30:436-442. doi:10.1016/j.clnu.2011.01.009.	X				
Golubic R, Ekelund U, Wijndaele K, et al. Rate of weight gain predicts change in physical activity levels: a longitudinal analysis of the EPIC-Norfolk cohort. *Int J Obes (Lond).* 2005;37(3):404-409. doi:10.1038/ijo.2012.58.					X
Graff M, North KE, Monda KL, et al. The combined influence of genetic factors and sedentary activity on body mass changes from adolescence to young adulthood: the National Longitudinal Adolescent Health Study. *Diabetes Metab Res Rev*. 2011;27:63-69. doi:10.1002/dmrr.1147.				X	
Hand GA, Shook RP, Paluch AE, et al. The energy balance study: the design and baseline results for a longitudinal study of energy balance. *Res Q Exerc Sport*. 2013;84:275-286.					X
Helajarvi H, Rosenstrom T, Pahkala K, et al. Exploring causality between TV viewing and weight change in young and middle-aged adults. The Cardiovascular Risk in Young Finns study. *PloS One.* 2014;9(7): e101860. https://doi.org/10.1371/journal.pone.0101860.					X
Holm-Denoma JM, Joiner TE, Vohs KD, Heatherton TF. The "freshman fifteen" (the "freshman five" actually): predictors and possible explanations. *Health Psychol*. 2008;27:S3-S9.					X
Hootman KC, Guertin KA, Cassano PA. Longitudinal changes in anthropometry and body composition in university freshmen. *J Am Coll Health*. 2017;65(4):268-276. doi:10.1080/07448481.2017.1280498.					X
Houston DK, Cai J, Stevens J. Overweight and obesity in young and middle age and early retirement: the ARIC study. *Obesity (Silver Spring).* 2009;17:143-149. doi:10.1038/oby.2008.464.				X	
Ilich JZ, Brownbill RA. Habitual and low-impact activities are associated with better bone outcomes and lower body fat in older women. *Calcif Tissue Int.*					X

Citation	Outcome	Population	Study Design	Exposure	Other
2008;83(4):260-271. doi:10.1007/s00223-008-9171-0.					
Kyle UG, Melzer K, Kayser B, Picard-Kossovsky M, Gremion G, Pichard C. Eight-year longitudinal changes in body composition in healthy Swiss adults. *J Am Coll Nutr.* 2006;25:493-501.	X				
Kyle UG, Zhang FF, Morabia A, Pichard C. (2006). Longitudinal study of body composition changes associated with weight change and physical activity. *Nutrition.* 22(11-12): 1103-1111.					X
LaCroix AZ, Rillamas-Sun E, Woods NF, et al. Aging well among women veterans compared with non-veterans in the Women's Health Initiative. *Gerontologist*. 2016;56(suppl 1):S14-S26. doi:10.1093/geront/gnv124.	X				
Le Petit C, Berthelot JM. Obesity—a growing issue. *Health Rep.* 2006;17(3): 43-50.					X
Le YL, Rahman M, Berenson AB. Perceived weight gain as a correlate of physical activity and energy intake among white, Black, and Hispanic reproductive-aged women. *J Women's Health* (15409996). 2010;19(11):1987-1993. doi:10.1089/jwh.2009.1776.	X			X	
Lee DC, Park I, Jun TW, et al. Physical activity and body mass index and their associations with the development of type 2 diabetes in Korean men. *Am J Epidemiol*. 2012;176(1):43-51. doi:10.1093/aje/kwr471.	X				
Lindhom V, Lahti J, Rahkonen O, Lahelma E, Lallukka T. Joint association of physical activity and body weight with subsequent physical and mental functioning: a follow-up study. *BMC Public Health*. 2013;13:197. doi:10.1186/1471-2458-13-197.	X				
Lindvall K, Jenkins P, Scribani M, et al. Comparisons of weight change, eating habits and physical activity between women in Northern Sweden and Rural New York State- results from a longitudinal study. *Nutr J.* 2015;14:88. doi:10.1186/s12937-015-0078-0.					X
Mason C, Brien SE, Craig CL, et al. Musculoskeletal fitness and weight gain in Canada. *Med Sci Sports Exerc*. 2007;39:38-43.				X	
Matton L, Thomis M, Wijndaele K, et al. Tracking of physical fitness and physical activity from youth to adulthood in females. *Med Sci Sports Exerc*. 2006;38:1114-1120.		X			
Mekary RA, Grontved A, Despres JP, et al. Weight training, aerobic physical activities, and long-term waist circumference change in men. *Obesity (Silver Spring).* 2015;23(2):461-467. doi:10.1002/oby.20949.					X
Mekary RA, Willett WC, Hu FB, Ding EL. Isotemporal substitution paradigm for physical activity epidemiology and weight change. *Am J Epidemiol*. 2009;170:519-527.		X			

Citation	Outcome	Population	Study Design	Exposure	Other
Pai CW, Edington DW. Association between behavioral intention and actual change for physical activity, smoking, and body weight among an employed population. *J Occup Environ Med.* 2008;50:1077-1183.				X	
Patel AV, Feigelson HS, Talbot JT, et al. The role of body weight in the relationship between physical activity and endometrial cancer: results from a large cohort of US women. *Int J Cancer*. 2008;123:1877-1882.	X				
Piaggi P, Thearle MS, Bogardus C, Krakoff J. Lower energy expenditure predicts long-term increases in weight and fat mass. *J Clin Endocrinol Metab.* 2013;98:E703-E707.				X	
Pinto G, Beltran-Sanchez H. Prospective study of the link between overweight/obesity and diabetes incidence among Mexican older adults: 2001-2012. *Salud Publica Mex.* 2015;57(suppl 1):S15-S21.	X				
Proper KI, Picavet HS, Bemelmans WJ, et al. Sitting behaviors and mental health among workers and nonworkers: the role of weight status. *J Obes.* 2012;2012:607908.	X		X		
Pullman AW, Masters RC, Zalot LC, et al. Effect of the transition from high school to university on anthropometric and lifestyle variables in males. *Appl Physiol Nutr Metab.* 2009;34:162-171.					X
Raguso CA, Kyle U, Kossovsky MP, et al. A 3-year longitudinal study on body composition changes in the elderly: role of physical exercise. *Clin Nutr*. 2006;25(4):573-580. doi:10.1016/j.clnu.2005.10.013.					X
Raynor DA, Phelan S, Hill JO, Wing RR. Television viewing and long-term weight maintenance: results from the National Weight Control Registry. *Obesity (Silver Spring).* 2006;14:1816-1824.				X	
Riou MÈ, Abdulnour J, Brochu M, Prud'homme D, Rabasa-Lhoret R, Doucet E. Light physical activity is a better determinant of lower adiposity during the menopausal transition. *Climacteric*. 2014;17(1):79-86. doi:10.3109/13697137.2013.810715.					X
Roos V, Elmstahl S, Ingelsson E, et al. Metabolic syndrome development during aging with special reference to obesity without the metabolic syndrome. *Metab Syndr Relat Disord*. 2017;15(1).	X				
Rosell M, Appleby P, Spencer E, Key T. Weight gain over 5 years in 21,966 meat-eating, fish-eating, vegetarian, and vegan men and women in EPIC-Oxford. *Int J Obes (Lond).* 2006;30:1389-1396.				X	
Saidj M, Jørgensen T, Jacobsen RK, Linneberg A, Oppert JM, Aadahl M. Work and leisure time sitting and inactivity: Effects on cardiorespiratory and metabolic health. *Eur J Prev Cardiol*. 2016;23(12):1321-1329. doi:10.1177/2047487315619559.					X

Citation	Outcome	Population	Study Design	Exposure	Other
Scott D, Ebeling PR, Sanders KM, et al. Vitamin D and physical activity status: associations with five-year changes in body composition and muscle function in community-dwelling older adults. *J Clin Endocrinol Metab.* 2015;100(2):670-678. doi:10.1210/jc.2014-3519.				X	
Shihab HM, Meoni LA, Chu AY, et al. Body mass index and risk of incident hypertension over the life course: the Johns Hopkins Precursors Study. *Circulation*. 2012;126:2983-2939.				X	
Soriguer F, Rojo-Martinez G, Valdes S, et al. Factors determining weight gain in adults and relation with glucose tolerance. *Clin Endocrinol (Oxf).* 2013;78:858-864.				X	
Staiano AE, Marker AM, Martin CK, Katzmarzyk PT. Physical activity, mental health, and weight gain in a longitudinal observational cohort of nonobese young adults. *Obesity (Silver Spring).* 2016;24:1969-1975.				X	
Stevenson JL, Krishnan S, Stoner MA, et al. Effects of exercise during the holiday season on changes in body weight, body composition and blood pressure. *Eur J Clin Nutr*. 2013;67:944-949.					X
Thomee S, Lissner L, Hagberg M, Grimby-Ekman A. Leisure time computer use and overweight development in young adults—a prospective study. *BMC Public Health*. 2015;15:839. doi:10.1186/s12889-015-2131-5.					
van Uffelen, JG, Watson, MJ, Dobson, AJ, et al. Sitting time is associated with weight, but not with weight gain in mid-aged Australian women. *Obesity (Silver Spring).* 2010;18:1788-1794.					X
Wengreen HJ, Moncur C. Change in diet, physical activity, and body weight among young-adults during the transition from high school to college. *Nutr J.* 2009;8:32.					X
Wu L, Chen R, Ma D, et al. Effects of lifestyle intervention improve cardiovascular disease risk factors in community-based menopausal transition and early postmenopausal women in China. *Menopause.* 2014;21:1263-1268.				X	

References

1. Adair LS, Gultiano S, Suchindran C. 20-year trends in Filipino women's weight reflect substantial secular and age effects. *J Nutr.* 2011;141:667-673. doi:10.3945/jn.110.134387.

2. Colchero MA, Caballero B, Bishai D. The effect of income and occupation on body mass index among women in the Cebu Longitudinal Health and Nutrition Surveys (1983-2002). *Soc Sci Med.* 2008;66(9):1967-1978. doi:10.1016/j.socscimed.2008.01.008.

3. Brown WJ, Kabir E, Clark BK, Gomersall SR. Maintaining a healthy BMI: data from a 16-year study of young Australian women. *Am J Prev Med.* 2016;51:e165-e178. doi:10.1016/j.amepre.2016.09.007.

4. Gebel K, Ding D, Bauman AE. Volume and intensity of physical activity in a large population-based cohort of middle-aged and older Australians: prospective relationships with weight gain, and physical function. *Prev Med.* 2014;60:131-133. doi:10.1016/j.ypm.

5. MacInnis RJ, Hodge AM, Dixon HG, et al. Predictors of increased body weight and waist circumference for middle-aged adults. *Public Health Nutr.* 2014;17:1087-1097. doi:10.1017/S1368980013001031.

6. Shibata AI, Oka K, Sugiyama T, Salmon JO, Dunstan DW, Owen N. Physical activity, television viewing time, and 12-year changes in waist circumference. *Med Sci Sports Exerc.* 2016;48:633-640. doi: 10.1249/MSS.0000000000000803.

7. Smith KJ, Gall SL, McNaughton SA, et al. Lifestyle behaviours associated with 5-year weight gain in a prospective cohort of Australian adults aged 26-36 years at baseline. *BMC Public Health.* 2017;17:54. doi:10.1186/s12889-016-3931-y.

8. Hamer M, Brunner EJ, Bell J, et al. Physical activity patterns over 10 years in relation to body mass index and waist circumference: the Whitehall II cohort study. *Obesity.* 2013;21: E755-E761. doi:10.1002/oby.20446.

9. Parsons TJ, Manor O, Power C. Physical activity and change in body mass index from adolescence to mid-adulthood in the 1958 British cohort. *Int J Epidemiol.* 2006;35:197-204.

10. Blanck HM, McCullough ML, Patel AV, et al. Sedentary behavior, recreational physical activity, and 7-year weight gain among postmenopausal U.S. women. *Obesity.* 2007;15:1578-1588.

11. Botoseneanu A, Liang J. The effect of stability and change in health behaviors on trajectories of body mass index in older Americans: a 14-year longitudinal study. *J Gerontol A Biol Sci Med Sci.* 2012;67:1075-1084. doi:10.1093/gerona/gls073.

12. Chiriboga DE, Ma Y, Li W, et al. Gender differences in predictors of body weight and body weight change in healthy adults. *Obesity.* 2008;16:137-145. doi:10.1038/oby.2007.38.

13. Hankinson AL, Daviglus ML, Bouchard C, et al. Maintaining a high physical activity level over 20 years and weight gain. *JAMA.* 2010;304:2603-2610. doi: 10.1001/jama.2010.1843.

14. Hillemeier MM, Weisman CS, Chuang C, Downs DS, McCall-Hosenfeld J, Camacho F. Transition to overweight or obesity among women of reproductive age. *J Womens Health.* 2011;20:703-710. doi:10.1089/jwh.2010.2397.

15. Kelly MC, Latner JD. Evaluating patterns of weight and body composition change among college women. *Eat Behav.* 2015;17:157-162. doi: 10.1016/j.eatbeh.2015.01.016.

16. Lee IM, Djousse L, Sesso HD, Wang L, Buring JE. Physical activity and weight gain prevention. *JAMA.* 2010;303:1173-1179. doi: 10.1001/jama.2010.312.

17. Mortensen LH, Siegler IC, Barefoot JC, Gronbaek M, Sorensen TI. Prospective associations between sedentary lifestyle and BMI in midlife. *Obesity.* 2006;14:1462-1471. doi:10.1038/oby.2006.166.

18. Rosenberg L, Kipping-Ruane KL, Boggs DA, Palmer JR. Physical activity and the incidence of obesity in young African-American women. *Am J Prev Med.* 2013;45:262-268. doi:10.1016/j.amepre.2013.04.016.

19. Sims ST, Larson JC, Lamonte MJ, et al. Physical activity and body mass: changes in younger versus older postmenopausal women. *Med Sci Sports Exerc.* 2012 Jan;44(1):89-97. doi: 10.1249/MSS.0b013e318227f906.

20. Basterra-Gortari FJ, Bes-Rastrollo M, Pardo-Fernandez M, et al. Changes in weight and physical activity over two years in Spanish alumni. *Med Sci Sports Exerc.* 2009;41:516-522. doi:10.1249/MSS.0b013e318188607c.

21. Brien SE, Katzmarzyk PT, Craig CL, Gauvin L. Physical activity, cardiorespiratory fitness and body mass index as predictors of substantial weight gain and obesity: the Canadian physical activity longitudinal study. *Can J Public Health.* 2007;98:121-124.

22. de Munter JS, Tynelius P, Magnusson C, Rasmussen F. Longitudinal analysis of lifestyle habits in relation to body mass index, onset of overweight and obesity: results from a large population-based cohort in Sweden. *Scand J Public Health.* 2015;43:236-245.

23. Kaikkonen JE, Mikkila V, Juonala M, et al. Factors associated with six-year weight change in young and middle-aged adults in the Young Finns Study. *Scand J Clin Lab Invest.* 2015;75:133-144. doi:10.3109/00365513.2014.992945.

24. Moholdt T, Wisloff U, Lydersen S, Nauman J. Current physical activity guidelines for health are insufficient to mitigate long-term weight gain: more data in the fitness versus fatness debate (The HUNT study, Norway). *Br J Sports Med.* 2014;48:1489-1496. d.

25. Sjosten N, Kivimaki M, Singh-Manoux A, et al. Change in physical activity and weight in relation to retirement: the French GAZEL Cohort Study. *BMJ Open.* 2012;2:e000522. doi: 10.1136/bmjopen-2011-000522.

26. Gradidge PJ, Norris SA, Micklesfield LK, Crowther NJ. The role of lifestyle and psycho-social factors in predicting changes in body composition in black South African women. *PloS One.* 2015;10:e0132914. https://doi.org/10.1371/journal.pone.0132914.

27. Drenowatz C, Gribben N, Wirth MD, et al. The association of physical activity during weekdays and weekend with body composition in young adults. *J Obes.* 2016;8236439. http://dx.doi.org/10.1155/2016/8236439.

28. Drenowatz C, Hill JO, Peters JC, Soriano-Maldonado A, Blair SN. The association of change in physical activity and body weight in the regulation of total energy expenditure. *Eur J Clin Nutr.* 2017;71(3):377-382. doi:10.1038/ejcn.2016.228.

29. Williams, PT. Maintaining vigorous activity attenuates 7-yr weight gain in 8340 runners. *Med Sci Sports Exerc.* 2007;39:801-809. doi:10.1249/mss.0b013e31803349b1.

30. Williams PT, Thompson PD. Dose-dependent effects of training and detraining on weight in 6406 runners during 7.4 years. *Obesity.* 2006a;14:1975-1984.

31. Williams PT, Wood PD. The effects of changing exercise levels on weight and age-related weight gain. *Int J Obes (Lond).* 2006b;30:543-551.