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## The nutrition and enjoyable activity for teen girls study: A cluster randomized controlled trial

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# The nutrition and enjoyable activity for teen girls study: A cluster randomized controlled trial

## Abstract

**Background** Obesity prevention among youth of low SES is a public health priority given the higher prevalence of youth obesity in this population subgroup. **Purpose** To evaluate the 24-month impact of a school-based obesity prevention program among adolescent girls living in low-income communities. **Design** The study was a school-based group RCT, the Nutrition and Enjoyable Activity for Teen Girls (NEAT Girls) intervention. **Setting/participants** The study involved 12 secondary schools located in low-income communities in New South Wales, Australia. Participants were 357 adolescent girls (aged 13.2±0.5 years). **Intervention** The 12-month multicomponent intervention was guided by social cognitive theory and involved strategies to promote physical activity, reduce sedentary behaviors, and improve dietary outcomes. **Main outcome measures** The primary outcome was BMI, and secondary outcomes were BMI z-score; percentage body fat (bioelectrical impedance analysis); physical activity (accelerometers); dietary intake; and recreational screen-time (self-report). Data were collected in 2010–2012 and analyzed in 2012. **Results** After 24 months, there were no intervention effects on BMI (adjusted mean difference -0.33, 95% CI= -0.97, 0.28, p=0.353) and BMI z-score (-0.12, 95% CI= -0.27, 0.04, p=0.178). However, there was a group-by-time interaction for percentage body fat (-1.96%, 95% CI= -3.02, -0.89, p=0.006). Intervention effects for physical activity, screen time, and dietary intake were not significant. **Conclusions** The NEAT Girls intervention did not result in effects on the primary outcome. Further study of youth who are “at risk” of obesity should focus on strategies to improve retention and adherence in prevention programs.

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Two-Year Outcomes from the NEAT Girls Obesity Prevention Cluster Randomized  
Controlled Trial

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## ABSTRACT

**Background:** Obesity prevention among youth of low socio-economic position is a public health priority given the higher prevalence of youth obesity in this population sub-group.

**Purpose:** To evaluate the 24-month impact of a school-based obesity prevention program among adolescent girls living in low-income communities.

**Methods:** A school-based group randomized controlled trial that involved 12 secondary schools located in low-income communities in New South Wales, Australia. Participants were 357 adolescent girls ( $13.2 \pm 0.5$  years). The 12-month multi-component intervention was guided by Social Cognitive Theory and involved strategies to promote physical activity, reduce sedentary behaviors and improve dietary outcomes. The primary outcome was body mass index (BMI) and secondary outcomes were BMI z-score, percentage body fat (bioelectrical impedance analysis), physical activity (accelerometers), dietary intake and recreational screen-time (self-report). Data were collected in 2010-2012 and analyzed in 2012.

**Results:** After 24 months, the intervention effects on BMI (adjusted mean difference [95% CI] = -0.33 [-0.97 to 0.28]),  $p = 0.353$  and BMI z-score (-0.12 [-0.27 to 0.04],  $p = 0.178$ ) were not statistically significant. However, there was a significant group-by-time interaction for percentage body fat (-1.96% [-3.02 to -0.89,  $p = 0.006$ ). Intervention effects for physical activity, screen-time and dietary intake were not statistically significant.

**Conclusion:** The NEAT Girls intervention did not result in significant effects on the primary outcome. Further study of youth who are 'at risk' of obesity should focus on strategies to improve retention and adherence in prevention programs.

**Trial Registration:** Australian New Zealand Clinical Trials Registry No:ACTRN1261000033004

## 1 BACKGROUND

2 Both the negative consequences of unhealthy weight gain,<sup>1</sup> and the high likelihood of pediatric  
3 obesity tracking from childhood to adulthood,<sup>2</sup> highlight the importance of targeting youth who are  
4 'at risk' of obesity. While there is evidence to support the beneficial effects of school-based child  
5 obesity prevention interventions, few studies have assessed maintenance or sustainability of impact  
6 after the initial post-test assessments.<sup>3</sup> This paper presents the 24-month outcomes from the Nutrition  
7 and Enjoyable Activity for Teen Girls (NEAT Girls) intervention. NEAT Girls was a 12-month  
8 obesity prevention program targeting adolescent girls living in low-income communities.<sup>4</sup> After 12-  
9 months the intervention effects on body composition were not significant, but there was a significant  
10 group-by-time interaction for reduced screen-time. The aim of this paper is to report the sustained  
11 impact of the program on body composition and health behaviors.

## 12 METHODS

### 13 Study design and participants

14 The study design, methods and participant characteristics at baseline are reported in detail elsewhere.  
15 <sup>5</sup> Briefly, the NEAT Girls intervention was evaluated using a group randomized controlled trial  
16 (RCT) which included involving 12 secondary schools located in low-income communities in New  
17 South Wales, Australia. Study participants were adolescent girls in Grade 8 at the time of  
18 recruitment. Ethics approval for the study was obtained from the University of Newcastle, Australia  
19 and the New South Wales Department of Education and Training Human Research Ethics  
20 Committees. School principals, parents and study participants provided written informed consent.  
21 The sample size calculation was based on change in body mass index (BMI). To detect a between  
22 group difference of one BMI unit,<sup>6</sup> 30 participants from each of the 12 schools were required. This  
23 calculation was based on an alpha of 0.05 (two tailed), power of 80% and a drop-out rate of 20%.  
24 Baseline assessments were carried out before randomization during May/June, 2010 (Figure 1). The  
25 12-month (immediate post-program) assessments were completed during May/June in 2011 and these  
26 outcomes have been reported.<sup>5</sup> This paper reports the 24-month outcomes (May/June, 2012).

## 1 **Intervention**

2 The intervention was guided by Social Cognitive Theory<sup>7</sup> and informed by the Program X pilot  
3 study.<sup>8,9</sup> NEAT Girls<sup>4</sup> combined a range of strategies to promote lifestyle (e.g. walking to school)  
4 and lifetime physical activity (e.g., resistance training), improve dietary intake and reduce sedentary  
5 behaviors. Intervention components included enhanced school sport sessions, lunchtime physical  
6 activity sessions, nutrition workshops, interactive educational seminars, pedometers for self-  
7 monitoring, student handbooks, parent newsletters, and text messages to reinforce and encourage  
8 targeted health behaviors.

## 9 **Outcome measures**

10 Data were collected at the study schools by trained research assistants. Group allocation to control or  
11 intervention treatment did not take place until after baseline assessments were conducted.

### 12 *Body Composition*

13 The primary outcome was BMI (weight [kg]/height [m]<sup>2</sup>). A portable digital scale (Model no. UC-  
14 321PC, A&D Company Ltd, Tokyo Japan) and a stadiometer (Model no. PE087, Mentone  
15 Educational Centre, Australia) were used to measure weight and height and BMI-z scores were  
16 calculated.<sup>10</sup> The Imp<sup>TM</sup> SFB7 bioelectrical impedance analyzer<sup>11</sup> examined percentage body fat.

### 17 *Physical Activity*

18 Actigraph accelerometers (MTI models 7164, GT1M, GT3X) were used to collect physical activity  
19 data. Participants' data were included in the analyses if accelerometers were worn for  $\geq 600$  minutes  
20 per day for at least three days, including a weekend day. Mean counts per minute (CPM) and  
21 percentage of time in moderate-to-vigorous physical activity (MVPA) were calculated.

### 22 *Dietary Intake*

23 Dietary intake was assessed using the Australian Child and Adolescent Eating Survey (version 1.2).

24 <sup>12</sup> Values for total kilojoules/day and total kilojoules/kilogram/day were reported.



## 1 *Sedentary Behavior*

2 Participants self-reported their screen-based sedentary behaviors using the Adolescent Sedentary  
3 Activity Questionnaire.<sup>13</sup>

## 4 **Analysis**

5 Analyses followed the intention-to-treat principle and were conducted using linear mixed models.<sup>14</sup>  
6 The mixed models were tested using the PROC MIXED statement in SAS V9.1 (SAS Institute Inc  
7 Cary NC) and were adjusted for clustering at the school level. All statistical tests were two-tailed and  
8 *p*-values were adjusted for multiple computations (critical *p*-value = 0.0063).

## 9 **RESULTS**

10 The study sample included 357 (*M*=13.2 years, *SD*=0.5) girls and at baseline, 27.9% and 16.2% of  
11 the sample were overweight or obese, respectively. At the 24-month assessments, 114 (64.0%) and  
12 123 (68.7%) girls were retained in the intervention and control groups (Figure 1). Changes in BMI  
13 were not statistically significant (Table 1), but there was a statistically significant group-by-time  
14 interaction effect for percentage body fat (-1.96%, *p*=0.006). The intervention group decreased their  
15 screen-time and both groups decreased their physical activity and total daily energy intake over the  
16 24-month study period. There were no significant group-by-effects for any of the health behaviors.

## 17 **DISCUSSION**

18 This paper reports the sustained impact of the NEAT Girls intervention on body composition and  
19 health behaviors. After 24-months, the NEAT Girls intervention effect on the primary outcome  
20 (BMI) was not significant, but there was a significant between group difference of almost 2% body  
21 fat in favor of the intervention group. A difference of this magnitude may be considered clinically  
22 significant. Evidence from recent longitudinal<sup>15</sup> and experimental<sup>16</sup> studies have demonstrated that  
23 similar changes in body composition are associated with more favorable cholesterol and fasting  
24 insulin levels in youth, respectively.

1 The absence of a statistically significant intervention effect on BMI and BMI z-score, despite  
2 significant improvements in body fatness is consistent with findings from previous obesity  
3 prevention studies in adolescents,<sup>17, 18</sup> and highlight the challenges of accurately assessing body  
4 composition in youth. Currently, there is no consensus regarding the most appropriate measure for  
5 assessing change in obesity prevention studies. Cole and colleagues<sup>19</sup> suggest BMI is the best  
6 measure of adiposity change in growing youth. Yet others have argued that BMI lacks the sensitivity  
7 to distinguish between fat and fat-free mass, and that alternate measures are more suitable for  
8 detecting change in body composition (e.g. skinfolds).<sup>17, 18</sup>

9 After 24 months, there were no significant intervention effects for any of the behavioral outcomes.  
10 Although there was a significant between group difference of 30 minutes screen-time at the 12-month  
11 assessments,<sup>5</sup> this difference was no longer significant in the 24-month follow-up analyses. It  
12 appears that the NEAT Girls intervention had a more favorable effect on sedentary behavior than  
13 physical activity or dietary behaviors. Interestingly, these results support findings from a review of  
14 behavioral interventions to prevent obesity in youth, which indicated that strategies to reduce  
15 unhealthy behaviors seem to be more effective than strategies to increase healthy behaviors.<sup>20</sup>

16 The study strengths include the group RCT design, the unique study population and monitoring of  
17 intervention fidelity. Further, the inclusion of 24-month assessments provides evidence for the distal  
18 impact of the 12-month intervention. However, there are some limitations that should be noted,  
19 including the use of self-report measures to assess changes in screen-time and dietary behaviors, and  
20 poor accelerometer compliance. Finally, due to participant attrition, the analyses were underpowered  
21 to detect small changes in BMI. This combined with lack of measurement precision may have  
22 prevented us from detecting relatively large intervention effects in behavioral outcomes.

## 23 **Conclusion**

24 The NEAT Girls intervention resulted in statistically significant improvements in body fatness that  
25 may have clinical importance. Reductions in screen-time were also observed over the study period

1 which may have important implications for preventing unhealthy weight gain among adolescent girls  
2 living in low-income communities. The current findings demonstrate the potential for multi-  
3 component school-based interventions, but also highlight the need to identify strategies for retaining  
4 participants in obesity prevention interventions, especially those from disadvantaged communities  
5 which have transient populations.

## 1 **ABBREVIATIONS**

2 BMI – Body Mass Index

3 CI – Confidence Intervals

4 CPM – Counts Per Minute

5 CONSORT - Consolidated Standards of Reporting Trials

6 MVPA – Moderate-to-Vigorous Physical Activity

7 NEAT Girls – Nutrition and Enjoyable Activity for Teen Girls

8 RCT – Randomized Controlled Trial

9 SCT – Social Cognitive Theory

10

11

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22 The individuals personally identified in the acknowledgements have consented to their names being

23 communicated.

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- 1 **List of titles for all figures**
- 2
- 3 Figure 1: Flow of Participants through the study