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Eating, Activity, and Weight-related Problems From Adolescence to Adulthood

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Abstract

Introduction—Determining the population-based scope and stability of eating, activity, and weight-related problems is critical to inform interventions. This study examines: (1) the prevalence of eating, activity, and weight-related problems likely to influence health and (2) trajectories for having at least one of these problems during the transition from adolescence to adulthood.

Methods—Project EAT I-IV (Eating and Activity in Teens and Young Adults) collected longitudinal survey data from 858 females and 597 males at four waves, approximately every 5 years, from 1998 to 2016, during the transition from adolescence to adulthood. Analyses were conducted in 2017–2018. Measures included high fast food intake (≥ 3 times/week), low physical activity (<150 minutes/week), unhealthy weight control, body dissatisfaction, and obesity status.

Results—Among females, the prevalence of having at least one eating, activity, or weight-related problems was 78.1% at Wave 1 (adolescence) and 82.3% at Wave 4 (adulthood); in males, the prevalence was 60.1% at Wave 1 and 69.2% at Wave 4. Of all outcomes assessed, unhealthy weight control behaviors had the highest prevalence in both genders. The stability of having at least one problem was high; 60.2% of females and 34.1% of males had at least one problematic outcome at all four waves.

Conclusions—The majority of young people have some type of eating, activity, or weight-related problem at all stages from adolescence to adulthood. Findings indicate a need for wide-reaching interventions that address a broad spectrum of eating, activity, and weight-related problems prior to and throughout this developmental period.

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INTRODUCTION

The high prevalence of eating, activity, and weight-related problems during adolescence is of great public health concern, given that adolescence is a period of rapid growth and development^{1–6} and behavioral patterns established during this time may set the stage for adulthood.⁷ If eating, activity, and other weight-related problems persist from adolescence into early adulthood, then young adults, and the future generations they influence as parents, will be at increased risk for developing chronic health outcomes. To inform the content and timing of interventions, it is important to understand the scope and stability of eating, activity, and weight-related problems throughout the critical period from adolescence to adulthood.

The current study examines the prevalence and stability of a broad spectrum of eating, activity, and weight-related factors that have been linked to adverse health consequences. Examining a broad spectrum of eating, activity, and weight-related problems concurrently is valuable for learning about the scope of various problems that may be interrelated and have cumulative impacts on health. The current study thus includes indicator variables from within the domains of eating, physical activity, weight control practices, body image, and weight status that have been found to be associated with adverse health outcomes: high fast food intake,^{8,9} low levels of moderate to vigorous physical activity (MVPA),^{10–12} unhealthy weight control practices,¹³ body dissatisfaction,^{14–17} and obesity.¹⁸ For example, eating fast food more than twice a week is associated with excess weight gain and increased insulin resistance 15 years later.⁹ Low MVPA predicts elevated all-cause mortality and cardiovascular risk 20 years later.¹⁹ Unhealthy weight control behaviors (e.g., skipping meals, taking diet pills) predict greater weight gain over time¹³ and low body satisfaction is linked to higher rates of binge eating, smoking,¹⁶ depression, and poor self-esteem.²⁰

Research questions to be addressed include: (1) How does the prevalence of eating, activity, and weight-related problems change over time among females and males during the transition from adolescence to early adulthood? And (2) What are the individual trajectories over time for having at least one eating, activity, or weight-related problem in females and males? Examining prevalence over time provides information about the scope of the problems, whereas examining individual trajectories provides information about the stability or consistency of having at least one problematic outcome. Findings will inform the field's understanding of the scope, timing, and patterns of eating, activity, and weight-related problems across key developmental periods of the life cycle and thus provide important information to guide policies, community- and school-based interventions, and clinical practices.

METHODS

Study Population and Measures

Project EAT (Eating and Activity in Teens and Young Adults) is a longitudinal study of eating, activity, and weight-related measures in young people. In 1998–1999 (Project EAT-I/ Wave 1), middle school and high school students ($n=4,746$, mean age=14.8 [SD=1.6] years) from 31 public schools in the Minneapolis and St. Paul metropolitan area completed surveys

and anthropometric measures.^{21,22} Follow-up mailed assessments were conducted at 5-year intervals: EAT-II/Wave 2 ($n=2,516$, mean age=19.4 [SD=1.7] years), EAT-III/Wave 3 ($n=2,287$, mean age=25.3 [SD=1.7] years), and EAT-IV/Wave 4 ($n=1,830$, mean age=31.0 [SD=1.6] years) to examine changes among participants as they progressed through adolescence and young adulthood.^{23–29} To allow for longitudinal comparisons, key variables, described in Table 1, were assessed using nearly identical survey items at each wave; any relevant differences made (e.g., to make more developmentally appropriate) are noted in the table. There were 858 females and 597 males who completed surveys at all four assessment waves. The University of Minnesota's IRB Human Subjects Committee approved all protocols.

Statistical Analysis

To address the first research question regarding the scope of eating, activity, and weight-related problems at each of the four waves, the prevalence of having each specific outcome, any of these outcomes, and at least three of the five outcomes were examined. Tests of trends in prevalence over time (increasing or decreasing), and gender differences in time effects, were tested using t -tests from a logistic model with generalized estimating equations to control for repeated measures within an individual. To address the second research question regarding the individual trajectories of eating, activity, and weight-related problems, a five-category trajectory was defined (i.e., never, starters, mixed, stoppers, always). Frequencies were summarized for each trajectory category and gender differences in likelihood of being in each category were assessed using chi-square tests. All analyses were stratified by sex given prior findings showing different levels of specific eating, activity, and weight-related variables in males and females,¹¹ and the importance of examining trajectories over time across sex.

The analytic sample included only participants who responded at all four study waves. Response propensity weighting³⁰ was used in all analyses so that estimates are generalizable to the population originally sampled in Wave 1. Response propensities were estimated using a logistic regression of responder status at all four waves on a large number of predictor variables from the Wave 1 survey. Responders to all four waves differed from the Wave 1 sample in that they were more likely to be female, non-Hispanic white, and of higher SES. After response propensity weighting, the distribution of demographics and Wave 1 weight-related problems among responders did not differ from the original sample (all p -values >0.05). The unweighted sample was 71.3% white, 7.6% African American, 13.2% Asian, 3.0% Hispanic, 1.9% Native American, and 3.0% mixed (e.g., noted both African American and Native American) or other (e.g., Pacific Islander) ethnic/racial backgrounds. Educational attainment was as follows: 20.4% high school degree or less; 24.1% vocational, technical, or associate degree; 37.6% bachelor's degree; and 17.8% graduate or professional degree. After nonresponse propensity weighting, the sample who completed surveys at all four waves matched the original sample: 46.9% white, 19.0% African American, 19.2% Asian, 5.2% Hispanic, 3.5% Native American, and 6.2% mixed or other ethnic/racial backgrounds; and educational attainment was as follows: 29.1% high school degree or less; 28.0% vocational, technical or associate degree; 29.8% bachelor's degree; and 13.1% graduate or professional degree.

Because of intermittent missing data on the five weight-related problems, the sample size varied slightly for testing trends in each outcome among complete cases. Missing data ranged from 0.9% to 4.4% for fast food, MVPA, unhealthy weight control, body dissatisfaction, and obesity; combining across all five outcomes, 7.4% of males and 9.7% of females were missing data for trends in the prevalence of having any one or any three of the weight-related problems. Females who were pregnant or breastfeeding at Waves 3 or 4 ($n=198$) were excluded from analyses of trends of obesity over time but remained in analyses of having any or three or more weight-related problems excluding obesity. All analyses were conducted in 2017 in SAS, version 9.4.

RESULTS

Prevalences of most eating, activity, and weight-related problems were high in adolescence and either remained high or increased during the transition to adulthood (Figure 1). For example, among females, the prevalence of low MVPA increased from 26.7% (Wave 1, adolescence) to 42.1% (Wave 4, adulthood). Among males, the prevalence of low MVPA increased from 16.5% to 28.7% during the study period. The prevalence of obesity tripled in females and nearly doubled in males from adolescence to young adulthood; nearly 30% of both females and males had BMI values in the obesity range at Wave 4. Body dissatisfaction increased in both sexes over time; at Wave 4, half (50.0%) of females and a quarter (25.9%) of males were dissatisfied. Unhealthy weight control practices were high at all waves; a slight decrease over time was found for females, while the prevalence increased among males. At Wave 4, there were 55.4% of females and 40.8% of males engaged in unhealthy weight control practices. The only potentially meaningful decrease in a problematic outcome was found for fast food intake among females, from 18.7% at Wave 1 to 14.2% at Wave 4.

Prevalences of body dissatisfaction, low MVPA, and unhealthy weight control behaviors were always higher in females than in males ($t>3.00$, $p<0.002$ at each of the four waves). Obesity prevalence did not differ by sex at any wave. Fast food intake was higher among males at Waves 3 and 4 ($t=-4.93$, $p<0.001$ at Wave 3 and $t=-2.68$, $p=0.007$ at Wave 4). To determine if trends over time differed across sex, interactions between sex $\times$ study wave were examined. Interactions were significant for high fast food intake ($t=2.53$, $p=0.011$), with a decreased intake over time in females but not males, and for unhealthy weight control practices ($t=3.23$, $p=0.001$), with a decrease over time in females and an increase for males. Interactions were not significant for obesity ($t=-1.66$, $p=0.097$), body dissatisfaction ($t=0.44$, $p=0.662$), and low MVPA ($t=-0.12$, $p=0.904$); trends for these variables were similar over time across sex.

The vast majority of participants had at least one eating, activity, or weight-related problem at each study wave (Figure 2). Among females, prevalences ranged from 78.1% (Wave 1, adolescence) to 82.3% (Wave 4, adulthood; $t=1.79$, $p=0.074$). Among males, prevalences ranged from 60.1% at Wave 1 to 69.2% at Wave 4 ($t=2.96$, $p=0.003$). The prevalence of having at least one problem was significantly higher among females than males at each wave ($t>3.00$, $p<0.001$ at each wave). Interactions between sex $\times$ study wave were not statistically significant, indicating that trends over time for having at least one problematic outcome did not significantly differ across sex.

The clustering of eating, activity, and weight-related problems is evident in examining the prevalence of having at least three problems at each of the study waves (Figure 2). Among females, prevalence ranged from 19.9% (Wave 1) to 30.5% (Wave 4), a statistically significant increase ($t=5.31$, $p<0.001$). Among males, prevalence ranged from 10.6% (Wave 1) to 22.1% (Wave 4; $t=5.04$, $p<0.001$). The prevalence of having at least three problematic behaviors was higher among females than males at each wave ($t=3.12$, $p=0.002$ at Wave 1; $t=3.61$, $p<0.001$ at Wave 2; $t=4.27$, $p<0.001$ at Wave 3; $t=2.52$, $p=0.012$ at Wave 4). Interactions between sex $\times$ study wave were not statistically significant.

Trajectories for having any eating, activity, or weight-related problem were examined to assess the within-person stability of these problems over time (Figure 3). Trajectories were defined by combining information from all four waves and participants were categorized into five trajectories: always, never, stoppers, starters, and mixed. Among females ($n=775$), the majority (60.2%) had at least one problematic outcome at all assessment waves (always). Only 1.9% of female participants never had any of these problems (never), 8.4% had at least one problem at Wave 1, but stopped sometime between Wave 2 and 4 (stoppers), and 11.7% started to have a problem after Wave 1 and continued to have a problem through Wave 4 (starters). Finally, 17.8% of females had different patterns of trajectories over the four waves (mixed). Among males ($n=553$), 34.1% fell into the always category, 7.4% were in the never category, 19.4% were starters, and 10.7% were stoppers. A high percentage showed mixed patterns throughout the study period (28.5%).

DISCUSSION

There is both theoretical and empirical support for addressing a broad spectrum of eating, activity, and weight-related outcomes.^{13,16,23,31–34} Current study findings show that the majority of adolescents and young adults have problematic eating, activity, or weight-related outcomes and demonstrate the stability of these problems across critical developmental stages. Both the scope and the stability of having at least one eating, activity, or weight-related problem were particularly high among females. During adolescence, growth and development is rapid and behavioral patterns are becoming established as young people become more independent.⁷ Young adulthood is a time when many people begin to have their own families; thus, problematic eating, activity, and weight-related patterns during this life stage are also important. For example, periconceptual nutrition may impact the health of offspring through epigenetic imprinting³⁵ and behavioral patterns modeled by parents may get passed on to the next generation.^{36,37} The finding that the majority of young people have at least one eating, activity, or weight-related problem throughout adolescence and young adulthood is thus of public health concern, indicating a need for population-based interventions.

The scope and stability of having at least one eating, activity, or weight-related problem among young women is particularly concerning; nearly two thirds of females had at least one problem at all four assessments, whereas less than 2% never had an eating, activity, or weight-related problem. The high prevalence and stability of eating, activity, and weight-related problems point to a need for interventions during or prior to adolescence and continuing throughout young adulthood. These findings expand upon prior research

demonstrating that female adolescents and young adults are at high risk for body dissatisfaction and unhealthy weight control practices,¹³ most likely because of strong societal pressures emphasizing thinness^{38,39} within a society wherein energy-dense foods are often inexpensive and widely available,⁴⁰ and opportunities for sedentary activity have increased.^{41,42} Interventions addressing unrealistic societal standards for female appearance are of high priority. The low level of MVPA among young females also demonstrates a need for interventions tailored to the unique barriers young adult females may experience (e.g., career development, parenting young children).

More than two thirds of male participants had at least one problem at each study wave and one third of males consistently had one of these problems across the study period. Although the prevalence of some problems was higher among females, the prevalence of obesity among males and females was similar. Furthermore, fast food intake decreased among females, but not among males, who had higher intakes at each study wave. Given that fast food intake tends to be energy dense,⁴³ and that young adulthood is a high-risk period for weight gain,^{44,45} interventions to both decrease fast food intake and improve its nutritional density are warranted. Given that males may be less likely than females to be targeted, and to participate, in health-oriented interventions for themselves and their children,^{46–49} work is needed to meet the needs of young adult males. Similar to what is recommended for females, interventions aimed at health promotion in males, and particularly those focusing on healthy weight management, should ensure that these interventions do not inadvertently lead to undesirable outcomes such as unhealthy weight control practices and body dissatisfaction.

Among both female and male participants, the large increase in obesity over time is of public health concern. There is a need for prevention prior to adolescence, during adolescence, and throughout young adulthood.^{7,50–53} Because dieting and unhealthy weight control practices strongly predict weight gain over time,^{13,23,54–57} interventions should help young people avoid these behaviors, and instead engage in healthy eating and physical activity behaviors. Of note, although BMI cut off points are useful for examining population-based trends, other factors such as past history of an eating disorder, overall energy intake, and percentage body fat, should be taken into account in determining healthy weight status.

Limitations

Study strengths and limitations should be considered in interpreting the findings. This study allowed for the assessment of multiple eating, activity, and weight-related problems, in a large population, during the important transition from adolescence to adulthood. It may be advantageous to intervene on multiple interrelated outcomes within interventions,^{31,32,51} therefore it is useful to have data on a broad spectrum of eating, activity, and weight-related measures. That said, in the interest of parsimony, indicators from various domains were selected for inclusion, whereas other potentially relevant variables were excluded (e.g., fruit and vegetable intake). Furthermore, in this study, associations between the different measures were not examined; future analyses should examine these associations over time (e.g., how body dissatisfaction is related to physical activity). Although height and weight

were assessed via self-report at all assessments, at Wave 1 all participants also had their height and weight measured and at Wave 3 a validation substudy was conducted; correlations between measured and reported heights and weights were very high at both timepoints.^{58–60} Although having data over a 15-year period is a study strength, the 5-year intervals between assessments does not allow for the capture of changes during these periods. Additionally, data were not collected at baseline on pubertal development, which can be useful in looking at weight-related variables. Although attrition was a study limitation, statistical weighting was employed to allow for generalizations to be made to the original baseline population.³⁰ Finally, the study population was originally from one geographic location and analyses were not stratified by ethnicity/race; future research should examine trends in broader populations and by subgroups.

CONCLUSIONS

Study findings indicate that eating, activity, and weight-related problems are prevalent and have high stability over critical stages of physical and psychosocial development. Addressing eating, activity, and weight-related concerns in a comprehensive manner, both early on and throughout adolescence and young adulthood, is warranted. An example of an intervention that addresses a broad spectrum of eating, activity, and weight-related problems in adolescent girls is New Moves⁶¹ (www.newmovesonline.com). New Moves is designed as an alternative physical education class, with sessions on a non-dieting approach to healthy eating and body image, which can be adapted to other settings. To improve the broad spectrum of eating, activity, and weight-related problems that are associated with adverse health outcomes, possible policy interventions include efforts to ensure that healthy food options and opportunities for physical activity are available, accessible, and affordable for young people and their families, whereas there should be limitations on unhealthy exposures (e.g., fast food options within and adjacent to schools, false media advertisements for weight control products, and ongoing exposure to extremely thin media images). Community and school-based interventions need to be monitored to ensure that messages given do not inadvertently lead to one problem (e.g., body dissatisfaction) while trying to solve another problem (e.g., obesity). Clinical practices should involve working with adolescents and their families toward preventing the broad spectrum of eating, activity, and weight-related problems,^{50,51} and appropriate guidelines and services are needed to meet the needs of young adults.

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Figure 1.

Trends in specific eating, activity, and weight-related problems from adolescence (Wave 1) to young adulthood (Wave 4) at 5-year intervals over a 15-year period, by gender.

Figure 2. Trends in having at least one type (1+), and at least three types (3+), of eating, activity, and weight-related problem from adolescence (Wave 1) to young adulthood (Wave 4) at 5-year intervals over a 15-year period, by gender.

Figure 3.

Trajectories for having any eating, activity, or weight-related problem.

Key: Always: Had at least one problem at all four waves; Stoppers: Had at least one problem at Wave 1, but not at later waves; Starters: Did not have a problem at Wave 1, but started at a future wave; Never: Did not have a problem at any waves; Mixed: Different pattern to any of the above.

Table 1

Description of Survey Measures Included on the Project EAT Wave 1–4 Surveys

Measure	Survey items or description ^a
High fast food intake	Frequency of fast food intake was assessed with the question: <i>In the past week, how often did you eat something from a fast food restaurant (like McDonald's, Burger King, etc.)?</i> Response categories included <i>never, 1–2 times, 3–4 times, 5–6 times, 7 times, and more than 7 times</i> . High intake was defined by a response of three or more times per week (test-retest agreement=86%).
Low moderate-to- vigorous physical activity (MVPA)	Hours of physical activity during a typical week was assessed using questions adapted from the widely used Godin Leisure-Time Exercise Questionnaire. ^{62,63} Survey items assessed individually strenuous (for example, jogging, swimming laps, basketball) and moderate activity (for example, walking quickly, easy bicycling, snowboarding) in a typical week, with several examples of each level of activity provided; item wording was identical at each wave but some of the team sport examples were dropped for surveys administered after participants had transitioned to adulthood. Response options were <i>none, less than ½ hour, ½ hour to 2 hours, 2½ to 4 hours, 4½ to 6 hours, and 6 or more hours</i> . Each response was assigned a midpoint value and responses were then summed to compute total weekly hours (Test-retest reliability $r=0.84$). Low levels of MVPA was defined as less than 150 minutes per week.
Use of any unhealthy weight control practices	Use of any unhealthy weight control practices was assessed with the question: <i>Have you done any of the following things in order to lose weight or keep from gaining weight during the past year?</i> Participants were asked to respond yes/no for each of nine specific practices (e.g., fasted, ate very little food, took diet pills, made myself vomit, used laxatives). Scores were dichotomized to none or 1 method (test-retest agreement=86%).
High body dissatisfaction	Body dissatisfaction was assessed using a modified version of the Body Shape Satisfaction Scale. ⁶⁴ Participants rated their satisfaction with 10 different body parts (height, weight, body shape, waist, hips, thighs, stomach, face, body build, shoulders) using a 5-point Likert scale (range: 10–50, Cronbach's $\alpha=0.92$, test-retest $r=0.82$). High dissatisfaction was defined by a score of <30.
Obesity	Self-reported height and weight were found to be highly correlated with measured values collected at Time 1 (BMI males $r=0.88$ and females $r=0.85^{58}$; and Time 3 (BMI males $r=0.95$ and females $r=0.98^{59,65}$; and were used to calculate BMI at each time point (test-retest height $r=0.98$, weight $r=0.97$). For Wave 1 and Wave 2, obesity status was determined based on a BMI at or above the 95th percentile for sex and age. ^{66,67} For Wave 3 and Wave 4, obesity was defined according to current BMI guidelines for adults (overweight: BMI ≥ 30 kg/m ²). ⁶⁸

^aPsychometrics for survey items were assessed at all four study waves; values included here are for Project EAT-IV. Scale psychometric properties were assessed in the full EAT-IV survey sample and estimates of item test-retest reliability were determined in a subgroup of 103 participants who completed the EAT-IV survey twice within a period of 1 to 4 weeks.

Project EAT, Project Eating and Activity in Teens and Young Adults