

Final Comprehensive Report and Executive Summary: Project EAT-II

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Project EAT-II: A Longitudinal Study

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I. Introduction

A. Nature of the Research Problem

Healthy People 2010 Objectives for Nutrition and Overweight aim for an increase in the number of youth meeting recommendations for intakes of fat, calcium, fruit, vegetables, and grains and a decrease in the prevalence of overweight, particularly among minority youth and those from low socio-economic backgrounds. However, adolescents fall short of achieving many of these objectives and show large disparities across ethnicity and socio-economic status (SES).

For example, Project EAT-I anthropometric data showed that 13% of girls and 17% of boys were overweight (BMI \geq 95th percentile for age and sex). An additional 20% of girls and 15% of boys were moderately overweight (BMI: 85th – <95th percentile). For girls, the prevalence of overweight was highest among African American, Hispanic, and Native American youth. In each group, over 40% of these youth were either overweight or moderately overweight. For boys, 50% of Native American and nearly 45% of Hispanic boys were either overweight or moderately overweight. Project EAT-I also found large gaps between national nutrition recommendations and actual dietary intake among adolescents. Only 30% of girls and 43% of boys consumed the recommended amount of calcium. Approximately 45% of both girls and boys ate the recommended two servings of fruit per day, while only 16% ate the recommended three servings of vegetables per day.

Longitudinal data allow us to understand the causal factors and precursors of eating patterns as youth become increasingly more independent and move into late adolescence/early adulthood. Factors identified as being the most potent causal factors of overweight status and dietary intake patterns targeted in the Healthy People 2010 Objectives need to be identified and addressed in public health interventions to ensure that these objectives will be achieved by the year 2010. It is particularly important to identify the most potent causal factors among minority youth and low SES youth who are at particularly high risk for overweight status and inadequate dietary intake patterns.

B. Purpose, scope, and methods of the investigation

In Project EAT-II, the original cohorts of adolescents from the first phase of Project EAT were followed up in a longitudinal study design. The time lapse between data collection at Time 1 and Time 2 was approximately five years. At Time 1, participants were in early adolescence (ages 11-14 years) or middle adolescence (ages 15-17 years). At Time 2, participants were in middle adolescence or late adolescence/early adulthood (ages 18-21 years). Thus, the study design allowed for examination of how weight status and dietary intake change as youth progress through adolescence and become more independent. Furthermore, it has provided insight into the most potent and predictive factors influencing weight status and dietary intake that need to be addressed in public health interventions. All participants from the initial cohort were mailed the Project EAT-II survey and a food frequency questionnaire.

C. Nature of the findings

Factors found to predict overweight status longitudinally in Project EAT-II included eating behaviors (e.g., breakfast skipping and binge eating), dietary intake (e.g., low fruit and vegetable intake and high intake of sweetened beverages), physical activity (e.g., sedentary behaviors in females and moderate-to-vigorous physical activity in males) and an array of variables related to weight concerns of adolescents and their social environments (e.g., body dissatisfaction, unhealthy weight control behaviors, dieting, and weight pressures from family and peers).

Project EAT-II found some disturbing longitudinal trends in the use of unhealthy weight control behaviors. For example, in females, smoking for weight control increased from 5% to 12% between early to middle adolescence and diet pill use increased from 8% to 20% from middle to late adolescence. Project EAT-II also identified some disturbing secular trends; for example, diet pill use increased from 8% to 14% in middle adolescent girls during the period 1999-2004. Unhealthy weight control behaviors co-occurred with poorer dietary intake and longitudinally predicted obesity. Adolescents using unhealthy weight control behaviors (e.g., skip meals, diet pills) at Time 1 were at about three times greater risk for overweight at Time 2, after adjusting for Time 1 weight status.

Dietary quality declined as adolescents got older. For example, adolescents decreased their daily fruit and vegetable intake by an average of 0.7 servings from early to middle adolescence and 0.6 servings from middle to late adolescence. A number of predictors of better dietary intake, such as more frequent family meals and home availability of fruits and vegetables, were identified.

II. Review of the Literature

Adolescents and young adults in the United States live in an environment that gives contradictory messages regarding weight-related issues and the adoption of healthy eating and physical activity behaviors. They receive messages about the importance of being thin and the hazards of obesity, yet are surrounded by an obesogenic environment that facilitates a sedentary lifestyle and the consumption of food that is high in calories, but low in nutrients.¹⁻⁴ The result is that many young people diet and use unhealthy weight control behaviors,⁵⁻⁸ too few young people engage in ongoing healthy eating,⁶⁻⁹ and the prevalence of obesity is disturbingly high.¹⁰

In addition to contributing to obesity, poor dietary intake contributes to some of the most prevalent, costly, debilitating, and potentially fatal conditions in the United States including coronary heart disease, atherosclerosis, diabetes, stroke, some types of cancer, and osteoporosis.¹¹ In light of the high prevalence of these serious conditions, their associations with eating behaviors, and the high potential for their prevention, Healthy People 2010 Objectives address dietary intake and overweight status.⁹ Many research studies show that high percentages of adolescents^{6, 12-18} and young adults¹⁹⁻²¹ are far from reaching these Healthy People 2010 Objectives, and large racial and socio-economic disparities exist.⁹

Studies have also found a high prevalence of body dissatisfaction and unhealthy weight control behaviors in adolescents,^{6, 8, 22-24} which are associated with lower levels of physical activity,²⁵ increased sedentary behaviors,²⁶ poorer dietary intake,²⁷⁻²⁹ and weight gain over time.^{30, 31} These findings suggest that adolescents are adopting weight control behaviors that are counterproductive to reaching Healthy People 2010 Objectives for dietary intake, physical activity, and weight status.

III. Study Design and Methods

A. Study Design

Project EAT-II is a follow-up study of Project EAT-I, a study of the socio-environmental, personal and behavioral determinants of dietary intake and weight status among a large and ethnically diverse adolescent population. The main aim of Project EAT-II was to follow the two cohorts of adolescents from EAT-I over a five-year period as they transitioned from early adolescence to middle adolescence and from middle adolescence to late adolescence/young adulthood. The study was designed to provide longitudinal data on how weight status, weight control behaviors, and dietary intake patterns track during key periods of transition and the types of factors that influence how patterns change over time. The study design also allowed for an examination of five-year secular trends in middle adolescents.

EAT-I participants were stratified by high school and young adult groups, and randomly selected into six data collection waves. After an initial letter describing the study, surveys were sent by mail to the address provided by the participant during EAT-I. Subsequent mailings included two reminder postcards and three additional survey packets – the first one was another regular survey packet, the second one was sent by Federal Express, and final survey packet was sent in an eye-catching envelope and included a fun pencil for completing the survey. The original survey packet included a two-dollar bill and participants received a financial incentive following survey completion. Data collection ran from April 2003 to June 2004. In the course of data collection, when any piece of mail was returned due to an incorrect address, staff used internet tracking services (e.g. www.anywho.com) to attempt to identify a correct current address using parent's name and last known address. If a new address was found for a participant, then the complete mailing cycle was restarted using that address at the time of the next data collection wave.

B. Population and Setting

In Project EAT-I, 4,746 middle and high school students in 31 Minnesota schools completed surveys and anthropometric measures during the 1998-1999 academic year. Of the original Project EAT-I study population, 1070 (22.6%) were lost to follow-up, primarily due to missing contact information at EAT-I (n=411) and no address found at follow-up (n=591). Of the remaining 3676 participants contacted by mail, 2516 completed surveys, representing 68.4% of participants who could be contacted for Project EAT-II and 53.0% of the original study population.

The final study population consisted of 1130 males (44.9%) and 1386 females (55.1%). One-third of the participants (32.0%) were in the younger cohort; their mean age was 17.2 years (SD=0.6). Two-thirds of the participants (68.0%) were in the older cohort; their mean age was 20.4 years (SD=0.8). The ethnic/racial background of the participants was as follows: 61.9% were white, 17.8% were Asian

American, 11.1% were African American, 4.5% were Hispanic, 1.9% were Native American and 2.7% were of mixed or other race. There was also diversity in SES: low (13.5%), middle-low (16.8%), middle (25.3%), middle-high (27.8%) and high (16.6%).

C. Instruments Used

The Project EAT survey was originally developed for Project EAT-I and revised for Project EAT-II. It assesses a range of perceived socio-environmental, personal, and behavioral factors of potential relevance to weight status, weight control and dietary intake in adolescents and young adults. It also assesses weight control behaviors and self-reported height and weight. Two versions of the survey were developed; one version was developed for young people currently of high school age (HS) and one version was developed for young adults (YA). Approximately two-thirds of the items in the HS version and 55% of items in the YA version were retained as they were in the original survey (or with very minor alterations). A draft of the YA survey was pilot tested with 20 young adults. Dietary intake was assessed with the 152-item youth version of the Willett Food Frequency Questionnaire (FFQ) Minor changes were made to the FFQ from the version used in EAT-I.

D. Statistical techniques employed

Because attrition in the study population did not occur completely at random, in all analyses, the data were weighted to adjust for differential response rates using the response propensity method³² where the inverse of the estimated probability that an individual responded at Time 2 was used as the weight. Response propensities (i.e., the probability of responding to the EAT-II survey) were estimated using a logistic regression of response to EAT-II (Yes/No) on a large number of predictor variables available from EAT-I. We followed the recommendation of Eltinge and excluded predictors with P values greater than 0.05.³³ Starting with 20 potential predictor variables, the final selected response propensity model included main effects for baseline gender, native born, ethnicity/race, SES, overweight status, parental marital status, individual's concern about health, and most common grade in school. Based on this model, nonresponse weights were then calculated taking the inverse of the predicted probability of responding to EAT-II. Weights were additionally calibrated so that the weighted total sample sizes used in analyses for each gender cohort accurately reflected the actual observed sample sizes in those groups. Under the assumption that attrition occurs at random conditional on the predicted response propensities, the weighting method results in estimates representative of a random sample of the original Project EAT-I sample. The weighted ethnic/racial and SES proportions are as follows: 48.3% white, 19.6% Asian, 18.9% African American, 5.8% Hispanic, 3.6% Native American, and 3.8% mixed or other race, while SES was low (17.8%), middle-low (18.9%), middle (26.7%), middle-high (23.3%), and high (13.3%). For the study's primary analyses, we compared responders to the Project EAT-II survey with non-responders for the variables (at Time 1) being examined (e.g. overweight status, extreme weight control behaviors). Analyses were stratified by gender and adjusted for SES and ethnicity/race and the nonresponse weights. No differences were found for any of these Time 1 variables between responders and non-responders, indicating that the weighting method was adequate for removing response bias that might have occurred at Time 2.

Longitudinal and secular trends were estimated and tested for all main outcomes using those individuals who had non-missing data at both time points for the particular outcome being examined. Mixed model regressions³⁴ including a main effect for year (1999 or 2004), cohort (younger or older), and a year by cohort interaction along with a random effect for individuals to account for longitudinal correlation were used to estimate and test differences of prevalence and means across time, both within and across cohorts. All mixed model regression analyses were stratified by gender and adjusted for baseline race and SES to balance observed demographic differences across the cohorts. In addition, adjustment for age (in years) was made in the mixed model regression so that estimates and tests for secular changes in high school adolescents from 1999 to 2004 would compare high school adolescents with the same mean age. SAS 9.1 was used in analyses (Statistical Analysis System Inc, Cary NC, 2002).

Various analytic techniques were employed for tests of predictors of the three main outcomes. Multiple linear and logistic regression analysis and general linear modeling were used, as appropriate. The Time 1 level of the dependent variable or the Time 2 – Time 1 change score was used as the dependent variable in order to predict the development of obesity, weight control behaviors or dietary intake, and capitalize on the longitudinal nature of the data.

IV. Presentation of Findings (detailed)

Project EAT-II focused on examining: 1) longitudinal trends in weight status, weight control behaviors and dietary intake patterns from early to middle adolescence and from middle to late adolescence; 2) secular trends in these variables among middle adolescents between 1999 and 2004; and 3) longitudinal predictors of these outcomes. Key results are summarized below.

A. Longitudinal trends

Over the five years between EAT-I and EAT-II, the prevalence of overweight remained high, but there were no further longitudinal increases in overweight status. Percentages of females with body mass index (BMI) values above the 85th and 95th percentiles did not change during the transition from early adolescence (28.7% and 9.0%, respectively) to middle adolescence (28.1% and 8.0%, respectively) or the transition from middle adolescence (22.0% and 8.4%, respectively) to late adolescence (23.8% and 8.3%, respectively).³⁵ Among males, the high prevalence of BMI values above the 85th and 95th percentiles also showed no change during the transition from early adolescence (28.0% and 12.3%, respectively) to middle adolescence (25.7% and 12.1%, respectively) adolescence or the transition from middle adolescence (23.7% and 10.6%) to late adolescence (26.0% and 10.5%, respectively).³⁵

Despite stability in the prevalence of overweight status, a number of disturbing longitudinal trends in weight control behaviors were observed.³⁵ In females, the use of all types of weight control behaviors was prevalent. There were no longitudinal changes in the use of healthy weight control behaviors (i.e., exercised, ate more fruits and vegetables, ate less high-fat foods, ate less sweets) in either cohort of females. During the transition from early adolescence to middle adolescence, there were increases in the use of unhealthy weight control behaviors (i.e., fasted, ate very little food, used a food substitute, skipped meals, smoked more cigarettes; 48.6% to 58.8%, $p = 0.001$) and extreme weight control behaviors (i.e., took diet pills, made myself vomit, used laxatives, used diuretics; 9.4% to 17.9%, $p < 0.001$). Extreme weight control behaviors also increased steeply from middle to late adolescence (14.5% to 23.9%, $p < 0.001$). Specific weight control behaviors used by females were also examined and statistically significant longitudinal increases in the percentages who reported eating fewer high-fat foods and fewer sweets for weight management from early to middle adolescence were observed. However, in this group, there were also statistically significant longitudinal increases in smoking cigarettes, fasting, eating very little, and skipping meals from early to middle adolescence. Smoking for weight control more than doubled from 5.4% to 12.0% ($p = 0.002$) as girls transitioned from early to middle adolescence. Diet pill use increased drastically from early to middle adolescence (3.5% to 14.2%, $p < 0.001$) and from middle to late adolescence (7.5% to 19.9%, $p < 0.001$).

Among males, from early to middle adolescence, there was a large longitudinal decrease in the use of healthy weight control behaviors (75.9% to 57.7%, $p < 0.001$) and a small relative decrease in unhealthy weight control behaviors (35.0% to 28.6%, $p = 0.041$).³⁵ Between middle to late adolescence, extreme weight control behaviors doubled (3.4% to 6.3%, $p = 0.023$). All of the specific healthy weight control behaviors significantly decreased longitudinally among males from early to middle adolescence. In contrast, diuretic used increased from early to middle adolescence (0.8% to 2.9%, $p = 0.007$) and diet pill use increased six-fold from middle to late adolescence (0.9% to 6.1%, $p < 0.001$).

In regards to nutrition, longitudinal trends showed a decrease in dietary quality as adolescents got older. For example, during the transition from early to middle adolescence, average total daily fruit and vegetable servings decreased by 0.7 and 0.8 servings among females and males.³⁶ Both genders significantly reduced their daily servings of vegetables, dark green/orange vegetables, fruit, and fruit juice. Servings of french fries showed no decrease. During the transition from middle to late adolescence, average total daily fruit and vegetable servings also decreased by 0.6 servings in both genders. Females and males significantly reduced their servings of french fries, fruits, and fruit juice. Total vegetable servings did not decrease significantly in either females or males of the older cohort, but in males, intakes of dark green/orange vegetables decreased significantly.

B. Secular trends

The study design also allowed for an examination of five-year secular trends (1999 to 2004) in weight status, weight control behaviors, and dietary intake patterns among middle adolescents, since the older cohort were middle adolescents at Time 1 and the younger cohort were middle adolescents at Time 2. Comparison of the percentages of middle adolescents who were overweight in 1999 with percentages

of middle adolescents who were overweight in 2004 showed there were secular trends among females but not among males.³⁵ There was a secular increase in the prevalence of middle adolescent females with BMI values above the 85th percentile during the 5-year period (22.0% in 1999 to 28.1% in 2004, $p = 0.050$), but no statistically significant secular changes for BMI values above the 95th percentile. Mean BMI values increased significantly among middle adolescent females from 1999 (mean = 22.5, SE = 0.18) to 2004 (mean = 23.5, SE = 0.25, $p = 0.004$).

In general, secular trends in healthy, unhealthy, and extreme weight control behaviors were not statistically significant among females, although there was an alarming increase in diet pill use (7.5% to 14.2%, $p = .004$) from 1999-2004.³⁵ Among males, several significant and notable trends were observed.³⁵ Five-year secular trends among middle adolescent males showed a decrease in the use of healthy weight control behaviors (67.6% in 1999, 57.7% in 2004, $p = 0.007$); no change in unhealthy weight control behaviors; and nearly a doubling of extreme weight control behaviors (3.4% in 1999, 6.1% in 2004, $p = 0.118$), which, while notable, was not statistically significant. More specifically, there was a secular decrease in fruit and vegetable intake as a weight management strategy (40.2% in 1999 to 30.0% in 2004, $p = 0.007$). Laxative and diuretic use showed large secular increases in middle adolescent males between 1999 and 2004 (laxatives: 0.6% to 2.1%, $p = 0.038$; diuretics 0.5% to 2.9%, $p = 0.002$), and a secular increase in diet pill use approached statistical significance (0.9% to 3.6%, $p = 0.059$).

Finally, secular trends in dietary intake patterns among middle adolescents showed a decrease in diet quality over the five years. There was a decrease in fruit and vegetable intake of 0.7 servings among females and 0.4 servings among males.³⁶ In addition, there were secular decreases in daily servings of fruit and fruit juice in both females and males.

C. Predictors of main outcomes

A primary study aim was to identify longitudinal predictors of weight status, weight control behaviors, and dietary intake patterns in adolescents in order to guide the development of interventions aimed at improving the nutritional health of adolescents. Factors found to predict overweight status longitudinally in Project EAT-II have included eating behaviors (e.g., breakfast skipping and binge eating), dietary intake (e.g., low fruit, vegetable, and milk intake and high intake of sweetened beverages), physical activity (e.g., sedentary behaviors in females, and low moderate-to-vigorous physical activity in males), and an array of variables related to weight concerns of adolescents and their social environments (e.g., body dissatisfaction, unhealthy weight control behaviors, dieting, and weight pressures from family and peers).³⁷ For instance, adolescents using unhealthy weight control behaviors (e.g., skip meals, diet pills) at Time 1 were at about three times greater risk for overweight five years later at Time 2, after adjusting for Time 1 weight status (OR = 2.7 for females; OR = 3.2 for males).³⁸

Unhealthy weight control behaviors were also predicted by several factors related to weight concerns of adolescents and weight pressures within their social environments. Among females, factors found to predict unhealthy weight control behaviors included frequent self-weighing, reading magazine articles about dieting or weight loss, low body satisfaction, and frequent dieting.³⁸⁻⁴¹ A strong relationship was observed between reading magazine articles and weight control behaviors; females who reported reading magazines about dieting or weight loss had between 2.4 (sometimes) and 3.2 (often read) times the odds of engaging in extreme weight control behaviors, compared to non-readers.⁴⁰ Females who reported dieting at Time 1 had greater than twice the odds for engaging in extreme weight control behaviors (i.e., self-induced vomiting and use of diet pills, laxatives, and diuretics) and reporting an eating disorder five years later (OR = 1.95 and 2.34, respectively) than nondieters.³⁸ Among males, factors found to longitudinally predict unhealthy weight control behaviors have included frequent self-weighing, low body satisfaction, and weight teasing.^{38, 40-42} For example, in males, the predicted prevalence over five years of follow-up for incident unhealthy weight control behaviors was 27.5% among those who were teased about their weight as compared to 19.3% for those who were not teased, after adjustment for sociodemographic characteristics and BMI.⁴²

The findings from analyses of factors predicting eating behaviors (i.e., binge eating and eating breakfast) and dietary intake provided additional support for the strong influence of weight concerns and social environment as well as the home food environment on eating. Factors found to predict binge eating in Project EAT-II included low body satisfaction, frequent self-weighing, being teased about weight, and dieting.^{38, 39, 41, 42} For example, Time 1 dieting was significantly associated with Time 2 binge eating with loss of control among females and males in analyses adjusted for baseline binge eating, baseline BMI, and

sociodemographic characteristics (OR = 1.9 for females; OR = 3.4 for males).³⁸ Adolescents reporting unhealthy weight control behaviors at Time 1 were at increased risk for binge eating (OR = 6.4 for females; OR = 5.9 for males) at Time 2, compared with adolescents not using any weight control behaviors.³⁸ Among females, an association was also observed between Time 1 dieting and more frequent breakfast skipping at Time 2.⁴³

Longitudinal analyses of Project EAT-II data have shown Time 1 body satisfaction and report of parental eating behaviors and the home food environment to predict diet quality at Time 2. Among females, body satisfaction at Time 1 was found to be predictive of higher fruit and vegetable intake at Time 2 ($p = 0.037$).⁴¹ Parental report of serving vegetables at dinner was found to be predictive of adolescent intakes of vegetables at five-year follow-up among both genders and cohorts after adjusting for adolescent intakes at Time 1, age, race, cohort or gender, parent socioeconomic status, and parent gender.⁴⁴ Males consumed 0.5 and females consumed 0.7 additional servings of vegetables at Time 2 in homes where vegetables were always served at dinner versus sometimes/never at Time 1.⁴⁴ In addition, parental intakes of dairy foods were found to be predictive of female adolescents' dairy intake five years later. Females consumed 0.6 additional servings of dairy at Time 2 if parents reported consuming 4 or more servings of dairy versus less than 1 serving of dairy at Time 1.⁴⁴

V. Discussion of Findings

A. Conclusions to be drawn from findings

Findings from Project EAT clearly indicate that dietary and weight-related problems in adolescents are of major public health concern. High prevalences of adolescents are overweight, but are engaging in behaviors that are not conducive to long-term weight management.³⁵ Weight-related concerns of adolescents and weight pressures from their social environments predict the use of unhealthy weight control behaviors.⁴⁰⁻⁴² Ironically, these behaviors then lead to weight gain, instead of weight loss, over time.^{37, 38} Behaviors recommended for healthy weight management, such as eating more fruits and vegetables or engaging in physical activity, are not being implemented with enough intensity to be effective in weight management.⁴⁵ Support from one's family in terms of providing healthy food options at home and regular family meals can help adolescents have healthier dietary intakes.^{44, 46, 47} The study findings point to a need for interventions that provide adolescents with the skills and support to engage in healthy eating and physical activity behaviors, yet do not lead to excessive weight concerns and body dissatisfaction, which may be counter-productive to long-term weight management.

B. Study strengths and limitations

Study strengths include the large and diverse study population, the wealth of information collected on dietary patterns and weight-related issues, the five-year longitudinal nature of the study that captured major transitional periods during adolescence, and our ability to assess secular changes over a five-year period among middle adolescents. Limitations include the attrition between Time 1 and Time 2, self-reported heights and weights at Time 2, and inaccuracies associated with self-reports of dietary intake. To the best of our ability, we have addressed these limitations through analytical strategies and careful interpretations of our findings within publications.

C. Comparisons with other studies and implications for practice and policy

Findings from the study indicate a clear need for addressing dietary and weight problems in adolescents and provide insight into how best to improve the nutritional and weight-related health of youth. Numerous studies have demonstrated the high prevalence of obesity in adolescents.^{48, 49} Findings from Project EAT are in line with these studies and provide additional evidence for the need to implement obesity prevention interventions prior to the onset of adolescence and to continue with these efforts throughout adolescence as autonomy increases. Findings from Project EAT and other studies⁵⁰⁻⁵³ further illustrate the importance of developing interventions that take into account social pressures to conform to a certain body shape and size and are sensitive to the high levels of body dissatisfaction and unhealthy weight control behaviors in adolescents. Obesity prevention interventions in homes, clinics, schools, communities, and society need to be supportive of healthy eating behaviors and aim to decrease body dissatisfaction and unhealthy weight control behaviors in youth. Parents should be educated about the important role that they can play by providing healthful food options at home, organizing frequent family meals, and ensuring that the home is an environment in which negative weight comments are not allowed.

D. Suggestions for further research

One of the successes of Project EAT has been its high level of productivity in terms of scientific manuscripts and presentations. Furthermore, the study has provided a training base for numerous students, post-doctoral fellows, and young investigators. We are currently engaged in a number of strategies that will allow our research team to continue to work together to address unanswered questions from Projects EAT-I and II. In order to take full advantage of the rich data set, we are interested in conducting further analyses on untapped questions. We have received additional funds to explore the importance of family meals in adolescent development. We have submitted a grant proposal to MCHB for exploration of the shared risk factors for obesity and disordered eating behaviors, including extreme weight control behaviors and binge eating. We are also working with a number of pre-doctoral and post-doctoral fellows, funded by various training programs, to examine several questions including the use of dairy products, fast foods, and whole grains.

Projects EAT-I and II indicated that the family plays an important role in influencing eating patterns in adolescents. It is important to further explore more distal influences such as peer groups, the school environment and the neighborhood, and to examine how the different levels work together to impact dietary patterns and weight status in youth. It is also of interest to examine how physical activity works together with dietary intake to influence weight status. Finally, it is important to examine how eating patterns established in early and middle adolescence impact eating patterns and weight status in young adulthood. We have submitted a study, Project EAT-III, to NIH to explore these issues.

Finally, it is crucial to take the principles learned in Projects EAT-I and II, integrate them into interventions with adolescents and their families and schools, and evaluate the impact of these programs. We are currently implementing some of these principles into an obesity prevention program for high school girls at risk for obesity. The New Moves program aims to help adolescent girls feel better about their bodies and thus hopes to motivate them toward healthier eating and physical activity behaviors. Further research is needed on different interventions, particularly with parents of adolescents.

VI. List of products

Twenty-three manuscripts using Project EAT-II data have been submitted for review in scientific journals (detailed below), and numerous additional manuscripts using Project EAT-I data have also been submitted since our most recent annual report. The complete list of 75 Project EAT articles published, in press or under review is attached as an Appendix.

Peer Reviewed articles

1. Neumark-Sztainer D, Wall M, Eisenberg ME, Story M, Hannan PJ. Overweight status and weight control behavior in adolescents: Longitudinal and secular trends from 1999-2004. *Preventive Medicine*. 2006;43:52-59.
2. Eisenberg ME, Neumark-Sztainer D, Haines J, Wall M. Weight-teasing and emotional well-being in adolescents: Longitudinal findings from Project EAT. *Journal of Adolescent Health*. 2006;38:675-683.
3. Neumark-Sztainer D, Wall M, Guo J, Story M, Haines J, Eisenberg M. Obesity, disordered eating, and eating disorders in a longitudinal study of adolescents: How do dieters fare five years later? *Journal of the American Dietetic Association*. 2006;106:559-568.
4. Paxton SJ, Eisenberg ME, Neumark-Sztainer D. Prospective predictors of body dissatisfaction in adolescent girls and boys: A five year longitudinal study. *Developmental Psychology*. 2006;42:888-899.
5. Haines J, Neumark-Sztainer D, Eisenberg ME, Hannan PJ. Weight-teasing and disordered eating behaviors in adolescents: Longitudinal findings from Project EAT (Eating Among Teens). *Pediatrics*. 2006;117:e209-215.
6. Paxton SJ, Neumark-Sztainer D, Hannan P, Eisenberg ME. Body dissatisfaction prospectively predicts depressive symptoms and low self-esteem in adolescent girls and boys. *Journal of Child and Adolescent Clinical Psychology*. 2006;35:539-549.
7. Neumark-Sztainer D, Paxton SJ, Hannan PJ, Haines J, Story M. Does body satisfaction matter? Five-year longitudinal associations between body satisfaction and health behaviors in adolescent females and males. *Journal of Adolescent Health*. 2006;39:244-251.

8. Eisenberg ME, Neumark-Sztainer D, Paxton SJ. Five-year change in body satisfaction among adolescents. *Journal of Psychosomatic Research*. 2006;61:521-527.
9. Larson NI, Perry CL, Story M, Neumark-Sztainer D. Food preparation by young adults is associated with better diet quality. *Journal of the American Dietetic Association*. In Press.
10. Neumark-Sztainer D, van den Berg P, Hannan PJ, Story M. Self-weighing in adolescents: Helpful or harmful? Longitudinal associations with body weight changes and disordered eating. *Journal of Adolescent Health*. In Press.
11. Larson NI, Neumark-Sztainer D, Hannan PJ, Story M. Trends in adolescent fruit and vegetable consumption, 1999-2004. *American Journal of Preventive Medicine*. In Press.
12. Nelson MC, Neumark-Sztainer D, Hannan PJ, Sirard JR, Story M. Longitudinal and secular trends in physical activity and sedentary behavior during adolescence. *Pediatrics*. In Press.
13. van den Berg P, Neumark-Sztainer D, Cafri G, Wall M. Steroid use among adolescents: Longitudinal findings from Project EAT. *Pediatrics*. In Press.
14. van den Berg P, Neumark-Sztainer D, Hannan PJ, Haines J. Dieting advice from magazines-helpful or harmful? Five year associations with weight control behaviors and psychological outcomes in adolescents. *Pediatrics*. In Press.
15. Neumark-Sztainer D, Wall M, Haines J, Story M, Eisenberg ME. Why does dieting predict weight gain in adolescents? Findings from Project EAT-II: A five-year longitudinal study. *Journal of the American Dietetic Association*. In Press.
16. Paxton SJ, Keery H, Wall M, Guo J, Neumark-Sztainer D. Body dissatisfaction and body comparison with media images in males and females. Under Review.
17. Crow SJ, Eisenberg ME, Story M, Neumark-Sztainer D. Weight related concerns and suicidal behaviors in adolescents: A longitudinal study. Under Review.
18. Eisenberg ME, Neumark-Sztainer D. Sex, students and the “forgotten half”: Do risk behaviors differ for college students and other young adults? Under Review.
19. Arcan C, Neumark-Sztainer D, Hannan P, van den Berg P, Story M, Larson N. Parental eating behaviors, home food environment and adolescent intakes of fruits, vegetables and dairy foods: Longitudinal findings from Project EAT. Under Review.
20. Haines J, Neumark-Sztainer D, Wall M, Story M. Personal, behavioral, and socio-environmental risk and protective factors for adolescent overweight. Under Review.
21. Eisenberg ME, Neumark-Sztainer D, Fulkerson JA, Story M. Family meals and substance use initiation: Is there a long-term protective effect? Under Review.
22. Ackard DM, Eisenberg ME, Neumark-Sztainer D. The long-term impact of adolescent dating violence on the behavioral and psychological health of male and female youth. Under Review.
23. Larson NI, Neumark-Sztainer D, Hannan PJ, Story M. Family meals in adolescents: Longitudinal associations with dietary intake and meal patterns in young adulthood. Under Review.

Conference presentations

1. Neumark-Sztainer D, Wall M, Eisenberg ME, Story M. Obesity and eating disorders in adolescents: Does early dieting make things better or worse? Poster presented at: *Society for Adolescent Medicine Annual Meeting*; March, 2005; Los Angeles, California.
2. Eisenberg ME, Neumark-Sztainer D, Haines J, Wall M. Weight teasing and emotional well-being in older adolescents. Paper presented at: *Society for Adolescent Medicine Annual Meeting*; March, 2005; Los Angeles, California.
3. Boutelle K, Hannan PJ, Neumark-Sztainer D, Himes J. Weight control behaviors in adolescents who have successfully lost weight. Poster presented at: *Society for Behavioral Medicine Annual Meeting and Scientific Sessions*; April, 2005; Boston, Massachusetts.
4. Neumark-Sztainer D. Preventing obesity in adolescent girls: Considering the broad spectrum of weight related problems. Invited presentation at: *Minnesota Obesity Center, 7th Annual Center-Wide Retreat*; April, 2005; Minneapolis, Minnesota.
5. Crow SJ, Eisenberg ME, Story M, Neumark-Sztainer D. Disordered eating symptoms, body dissatisfaction, weight and suicide attempts in adolescents and young adults. Poster presented at: *Eating Disorders Research Society Annual Meeting*; September, 2005; Toronto, Canada.
6. Fulkerson JA, Neumark-Sztainer D, Story M. The longitudinal effects of family meal frequency on disordered eating behaviors during adolescence and the transition to adulthood: An analysis of two

- cohorts. Poster presented at: *Eating Disorders Research Society Annual Meeting*; September, 2005; Toronto, Canada.
7. Neumark-Sztainer D, Paxton S, Hannan PJ, Haines J, Story M. Does body satisfaction matter? Five-year longitudinal associations between body satisfaction and health behaviors in adolescent and young adult females and males. Poster presented at: *Eating Disorders Research Society Annual Meeting*; September, 2005; Toronto, Canada.
 8. Eisenberg ME, Haines J, Neumark-Sztainer D. Weight-related teasing and psychosocial factors and disordered eating in adolescents. Paper presented at: *Deborah E. Powell Center for Women's Health, 2nd Annual Women's Health Research Conference*; September, 2005; Minneapolis, Minnesota.
 9. Neumark-Sztainer D. Disordered eating among adolescent girls and boys: Findings from Project EAT. Invited presentation at: *Deborah E. Powell Center for Women's Health, 2nd Annual Women's Health Research Conference*; September, 2005; Minneapolis, Minnesota.
 10. Paxton SJ, Neumark-Sztainer D, Hannan PJ, Eisenberg ME. Does body dissatisfaction prospectively predict depression and self-esteem in adolescent girls and boys? Paper presented at: *4th Annual Australian and New Zealand Adolescent Health Conference*; November, 2005; Melbourne, Australia.
 11. Neumark-Sztainer D. Weight-related problems in adolescents: Findings from Project EAT and implications for prevention. Invited presentation at: *Harvard School of Public Health Nutrition Seminar*; January, 2006; Cambridge, Massachusetts.
 12. Neumark-Sztainer D. Weight-related problems in adolescents: Findings from Project EAT and implications for prevention. Invited presentation at: *Division of Epidemiology and Community Health Seminar*; January, 2006; Minneapolis, Minnesota.
 13. van den Berg P, Neumark-Sztainer D. Fat 'n happy 5 years later: Is it bad for overweight girls to like their bodies? Paper presented at: *Academy of Eating Disorders International Conference on Eating Disorders*; June, 2006; Barcelona, Spain.
 14. Arcan C, Neumark-Sztainer D, van den Berg P, Story M, Larson NI. Parental eating behaviors, home food environment and adolescent intakes of fruits, vegetables and dairy foods: Longitudinal findings from Project EAT. Paper presented at: *International Society of Behavioral Nutrition and Physical Activity Annual Meeting*; July, 2006; Boston, Massachusetts.
 15. Larson NI, Perry C, Story M, Neumark-Sztainer D. Experience with food preparation is associated with better diet quality among young adults. Poster presented at: *Society for Nutrition Education Annual Conference*; July, 2006; San Francisco, California.
 16. van den Berg P, Neumark-Sztainer D. Fat 'n happy 5 years later: Is it bad for overweight girls to like their bodies? Poster presented at: *Deborah E. Powell Center for Women's Health, 3rd Annual Women's Health Research Conference*; September, 2006; Minneapolis, Minnesota.
 17. Nelson MC, Neumark-Sztainer D, Hannan PJ, Sirard JR, Story M. Longitudinal and secular trends in physical activity and sedentary behavior during adolescence. Poster presented at: *American Dietetic Association Food and Nutrition Conference & Expo*; September, 2006; Honolulu, Hawaii.
 18. Larson NI, Neumark-Sztainer D, Hannan PJ, Story M. Intakes of fruits and vegetables among adolescents in Minnesota: Longitudinal and secular trends from 1999-2004. Poster presented at: *American Dietetic Association Food and Nutrition Conference & Expo*; September, 2006; Honolulu, Hawaii.
 19. Timlin M, Pereira M, van den Berg P, Story M, Neumark-Sztainer D. Breakfast eating and weight change in a 5-year prospective analysis of 2,222 adolescents: Project EAT. Paper presented at: *NAASO The Obesity Society Annual Scientific Meeting*; October, 2006; Boston, Massachusetts.
 20. Neumark-Sztainer D. "I'm, Like, SO Fat!" Helping your teen make healthy choices about eating and exercise in a weight-obsessed world. Keynote speaker at: *Eating Disorder Education Organization: Beyond Beauty*; October, 2006; Edmonton, Canada.
 21. Neumark-Sztainer D. Obesity in adolescent girls: What do we know and where do we go from here? Invited presentation at: *Society for Women's Health Research: Women, Obesity, and Public Health: An Interdisciplinary Workshop*; October, 2006; Washington, DC.

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