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Identifying Clusters of College Students at Elevated Health Risk Based on Eating and Exercise Behaviors and Psychosocial Determinants of Body Weight

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ABSTRACT

Weight gain and an increase in overweight and obesity in college students raise serious health concerns. Weight management interventions for college-age men and women might be more effective if they were tailored to subgroups of students with similar behavioral and psychosocial characteristics associated with body weight status. The purpose of this study was to use cluster analysis to identify homogenous subgroups of college-aged men and women enrolled in a weight gain prevention study (Project WebHealth) using baseline data collected in 2008. Project WebHealth was a 15-month nutrition and physical activity intervention designed to decrease the rate of unwanted weight gain in 1,689 college students at eight geographically diverse universities in the United States. Outcome measures included anthropometrics, fruit and vegetable intake, physical activity, cardiorespiratory fitness, and psychosocial variables associated with weight status in college students. Cluster analysis was performed separately by sex using a two-step clustering procedure using weight-related eating and exercise behaviors and psychosocial variables. Cluster groupings were validated against students' measured weight status and waist circumference as indicators of health risk. The study design was cross-sectional. Results showed that three similar clusters were identified for each sex. Validity of the cluster solution was supported by significant group differences in body mass index and waist circumference with the High Risk cluster at elevated health risk compared to the others. For men, variability in eating competence and cognitive restraint scores contributed most to the difference between clusters, whereas for women, emotional eating and uncontrolled eating scores did. These findings could be used to improve effectiveness of messages and interventions by tailoring them to subgroups of college students with similar behavioral and psychosocial characteristics associated with elevated health risk.
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The challenging transition from the developmental stage of adolescence to that of emerging adulthood is often fully experienced for the first time by students attending 4-year colleges (1,2). Young adults relish independence and responsibility for making their own decisions; however, such freedom may lead to unhealthful dietary and physical activity choices that are associated with weight gain and increased metabolic risk (3-11). College provides a unique opportunity for targeted educational interventions based on perceived barriers and enablers of healthful choices (12-14).

To develop effective health promotion interventions in this population, it is important to identify subgroups of individuals who are similar to each other, but vary significantly on indicators of health risk. Unlike variable-

focused statistical methods such as factor analysis, cluster analysis is a person-focused method that identifies homogeneous subgroups with similar characteristics (15,16). The use of cluster analysis can aid in development of tailored interventions focused on weight gain prevention by identifying patterns of characteristics that are associated with indicators of health risk (17). The aims of this study were to use cluster analysis to identify sex-specific, homogeneous subgroups of students on the basis of selected psychosocial and behavioral characteristics, and to validate identified clusters against weight-related indicators of health-related risk (body mass index [BMI] and waist circumference) in college students.

METHODS
Design
This was a cross-sectional study of baseline data collected in fall 2008 as part of a randomized controlled trial, Project WebHealth. WebHealth was a 3-month, nutrition and physical activity intervention with 10 online sessions designed to decrease the rate of unwanted weight gain in college students using the Health at Every Size approach (18,19).

Participants/Procedures
Participants were full-time freshmen, sophomores, and juniors, aged 18 to 24 years, enrolled in eight universities participating in a US Department of Agriculture–funded multistate research project (20) (participants were: University of Maine, Michigan State University, The Pennsylvania State University, University of Rhode Island, South Dakota State University, Syracuse University, Tuskegee University, and University of Wisconsin-Madison). Students who met the following criteria were eligible to participate: BMI ≥18.5, not nutrition or exercise science majors, free from health conditions that could interfere with diet and exercise changes, and not pregnant or lactating.

Researchers recruited students using a variety of methods directing potential participants to a Web site for initial screening. Students passing the initial screening provided informed consent (the study was approved by the institutional review boards at all eight institutions) then completed an online questionnaire (described below), and made an appointment for physical assessment. At the appointment, trained research aides conducted anthropometric assessment on the potential participants who then completed the fitness testing (described later).

Of the 8,893 students responding, 3,626 completed the initial screening and were eligible and 2,333 consented to participate. However, 604 missed their appointment or did not complete the online survey and 40 students were excluded at appointment time due to BMI <18.5 or failure to complete the fitness test leaving a sample of 1,689 participants.

Online Questionnaires
Fruit and Vegetable Intake. Fruit and vegetable intake during the previous month (cups per day) was assessed using the National Cancer Institute Daily Fruit and Vegetable Screener, a validated 19-item instrument (21). Researchers calculated MyPyramid recommendations for fruits and vegetables for each participant based on age, sex, and activity level using the MyPyramid.gov standards (22). Participants with National Cancer Institute Daily Fruit and Vegetable Screener intake meeting MyPyramid recommendations were identified as "meeting guidelines."

Three-Factor Eating Questionnaire. This questionnaire is an 18-item validated instrument measuring cognitive and behavioral components of eating behavior (23,24). The three subscales are labeled cognitive restraint, uncontrolled eating, and emotional eating (23). Subscale scores were presented as percentages with a range of 0% (low) to 100% (high) (24).

Eating Competence. Eating competence was assessed with the Satter Eating Competence Inventory, a validated, reliable 16-item measure of eating attitudes, food acceptance, internal regulation, and contextual skills such as meal planning (25,26). Items were scored from 0 (never/rarely) to 3 (always). Scores ranged from 0 to 48.

Emotional/Psychological Stress. Emotional/psychological stress was assessed using the 12-item General Health Questionnaire, a reliable measure of current emotional health problems and psychological stress (27). Items were scored on a 4-point Likert scale from 0 (not at all) to 3 (much more than usual). Total scores ranged from 0 to 36 (27).

Physical Activity Behavior. Physical activity was assessed with the validated, seven-item International Physical Activity Questionnaire (IPAQ) (28). The IPAQ assessed walking, moderate-intensity activities, and vigorous-intensity activities as number of days per week and minutes per day of activity. Responses were converted to metabolic equivalent minutes per week (29). Activity subtotals were reported and summed for a continuous total activity score (30).

Demographics and Perceived and Desired Weight. Demographic data, including age, sex, year in school, major, residence, ethnicity, participation in sports, hours of paid employment per week, credit load, and prior nutrition coursework, were collected by a survey designed for Project WebHealth. Respondents also reported height and weight. Desired weight was ascertained by the question, "How much would you like to weigh?" Desired weight change was calculated as desired weight minus reported weight.

Physical Assessments
Anthropometrics and Health Risk. Anthropometric measurements were obtained using standard procedures (light clothing without shoes after voiding, following a minimum of a 4-hour fast) (31). All measurements were conducted in duplicate (unless the variance between measurements exceeded the standard, in which case the measurement was repeated as needed) and the average of the two measures recorded. Assessors were trained (video, manual, and supervised practice) and interobserver error was assessed (32). On average, interobserver error was weight 0.04 lb, height 0.08 in, and waist circumference 0.6 cm. Weight in pounds was assessed to the nearest ¼ lb using digital or balance beam scales that were calibrated using standard weights before measurements (Health-O-Meter model 597KL, Sunbeam Products