



Published in final edited form as:

*Eat Behav.* 2013 December ; 14(4): 476–483. doi:10.1016/j.eatbeh.2013.08.001.

## Disordered Eating Behaviors and Health Risks in College-enrolled Young Adult Mexican American Women

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### 1.0. Introduction

Recent findings suggest that disordered eating behaviors such as food/calorie restricting, binge eating, self-induced vomiting, laxative and diet pill use for the purposes of weight control are as at least as prevalent in Latinas living in the United States as in non-Hispanic white women. For example, a statewide study of middle school student in Massachusetts showed that a greater percentage of Latinas reported severe weight control behaviors (e.g. diet pill, laxative and vomiting) in the last month compared to both White and Asian same-sex age mates (Austin et al., 2011). The Minnesota Student Survey showed that Hispanic high school freshman and senior level females had higher rates of disordered eating behaviors compared to all other racial and ethnic groups including whites, blacks, Asian and Native American students (Croll, Neumark-Sztainer, Story & Ireland, 2002). National epidemiological data both from Latina women residing in the United States and women residing in Mexico found high rates of binge eating and binge eating disorders and showed a steady progression from adolescent to young adulthood (Alegria, et al., 2007; Barriguete-Melendes, 2009; Marques, et. al, 2011). However, one limitation of these studies is that most studies completed to date have included heterogenous samples of Latinas despite evidence that significant variability exists among subpopulations in health outcomes (Fortmann, et al., 2012; George, Erb, Harris & Casazza, 2007), care seeking behaviors (Getrich, et al., 2012) and access to treatment (Gonzalez, Vega, Williams, Tarraf & West, 2010).

In addition to lack of specificity in Latina sample definition, studies that focus on disordered eating behaviors across all racial and ethnic groups tend to measure target behaviors using a single question over a relatively long interval of time (e.g. last month, last year, lifetime). Although this approach provides molar level evidence of the prevalence of the behaviors, the severity of the level of behavioral involvement remain unknown. In addition, the more molar

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levels of behavioral measurement limit ability to explore patterns of correspondence among varying levels of behaviors.

In this study, *Creando Posibilidades* (Creating Possibilities) we address these gaps by focusing on women of Mexican origin who are college-enrolled and living in the United States. We report on disordered eating and related health risks including alcohol, tobacco use and body mass index collected at baseline. We use ecological momentary assessment (EMA) to capture the prevalence and rates of disordered eating behaviors in the context of their daily activities.

## 1.1 Background

**Health Correlates and Consequences of Disordered Eating Behaviors**—Until fairly recently, the focus of research on disordered eating behaviors has been primarily within the context of the eating disorders of anorexia, bulimia nervosa and binge eating disorder. However, over the last five years, there has been a rapid increase in research that has examined the prevalence, persistence and consequences of subclinical levels of these behaviors. Studies have shown that disordered eating behaviors are prevalent in community based samples of adolescent and young adult females and that these behavioral patterns, once established, tend to be stable across time periods as long as ten years (Neumark-Sztainer et al., 2012). In addition, disordered eating behaviors are predictive of significant behavioral, emotional and physical health consequences (Crow, Eisenberg, Story, & Neumark-Sztainer, 2008; Ginty, Phillips, Higgs, Heaney & Carroll, 2011; Goldschmidt, Apen, Sinton, Tanofsky-Kraff & Wilfley, 2008; Hay, Mond, Paxton, Quirk & Rodgers, 2012; Mond, Hay, Rodgers, Own & Mitchell, 2006; Napolitano & Himes, 2011) For example, Project EAT followed two age-cohorts of male and female adolescents (cohort 1 early adolescents with mean age 12.8 years and cohort 2 middle adolescents with mean age 15.9 yrs) in a 10 year longitudinal study (see Neumark-Sztainer, Wall, Larson, Eisenberg & Loth, 2011). At the 5-year follow-up, girls who engaged in unhealthy and extreme weight control behaviors at baseline were more likely to have an increase in BMI compared to those with no behaviors at baseline (Neumark-Sztainer, Wall, Guo, Story, Haines & Eisenberg, 2006).

Ten-year follow-up results showed significant stability of behaviors with dieting and unhealthy eating behaviors persisting in both the younger and older cohorts and the extreme behaviors persisting for the older cohort girls. In addition at the 10-year follow-up for both normal weight and overweight females, dieting or disordered eating behaviors at baseline predicted greater increases in BMI (Neumark-Sztainer, Wall, Story & Standish, 2012). Using the same data set, Crow showed that females engaging in extreme weight control behaviors at baseline were more likely to report suicide ideation and suicide attempts at 5-year follow-up compared to females who were not engaging in those behaviors at baseline (Crow, Eisenberg, Story & Neumark-Sztainer, 2008).

Other studies have shown that women who engaged in subclinical levels of disordered eating behavior have significantly blunted cortisol reactivity, attenuated vasodilation, cardiac output, heart rate and stroke volume changes in reaction to an acute stressor compared to controls (Ginty, Phillips, Higgs, Heaney, & Carroll, 2011) and higher usage of alcohol, tobacco, cocaine, amphetamine and prescription drug abuse (Piran & Robinson, 2011;

2006). Disordered eating behaviors are a modifiable source of health risk and understanding the prevalence and patterns of co-occurrence of these behaviors in subpopulations of Latinas is a critical prelude to the development of interventions that target reductions in health risks and health disparities that impact a particularly vulnerable group.

## 1.2 Focus on Mexican American college-enrolled young adult women

In this study, we focus on college-enrolled MA women for several reasons. First studies have shown that stress contributes to increases in disordered eating behaviors (Ball & Lee, 2000; Epel, Lapidus, McEwen & Brownell, 2001; Symth et al., 2007). For young adult women of Mexican origin, the transition to college is a major developmental transition that is particularly stressful due to financial difficulties, role demands, cultural values conflicts, exposure to ethnic biases, discrimination and significant changes in perceived family support (Castillo & Hill, 2004; Niemann, 2000). A recent qualitative study of Mexican American women in academia highlighted the denigrating and marginalizing interactions reflecting exclusion, ascriptions of inferiority and disconnection from their ethnic identity that make the college transition and experience particularly stressful for this population of women (Brisco, 2012). Second, although patterns of disordered eating and related risk behaviors typically are established earlier in adolescence, evidence suggests that rates increase during the transition to college (Delinsky & Wilson, 2008; Eisenberg, Nicklett, Roeder., & Kirz., 2011; LaBrie, et al., 2007; Raffaelli, et al, 2007).

## 1.3. Study Purpose

The primary purpose of this study, referred to as *Creando Posibilidades*, is to describe the prevalence and rates of 8 disordered eating behaviors including binge eating, self-induced vomiting, diet pill, diuretic and laxative use, restricting, fasting and excessive exercise in young adult college enrolled Mexican American women. In addition, patterns of associations among the disordered eating behaviors and with other health risk factors including alcohol and tobacco use and obesity are examined.

## 2. Design and Methods

### 2.1. Design

In *Creando Posibilidades*, a 12-month repeated measures longitudinal design was used to examine the effects of self-cognitions on patterns of disordered eating behavior during the life transition period of college-enrollment in young adult women of Mexican origin. Data was collected at five time points including baseline, 3, 6, 9 and 12 months after enrollment. The project was conducted at two sites, Michigan and Arizona. Data was collected during the period of 2006 and 2011.

### 2.2. Participants

The sample included 482 women recruited from community colleges, colleges and universities in the greater Detroit (n=246) and Phoenix (n=236) areas. Eligibility criteria included: 1) self-identified Mexican origin, 2) 18 to 35 years of age, and 3) currently enrolled in an undergraduate program at a university, college or community college and not in final year of study based on credit status. Women who were pregnant at the time of

enrollment (self-report), taking any psychotropic medication or in psychotherapeutic treatment for an eating disorder or substance use problem were not eligible for participation. Participants were recruited through targeted email messages, letters mailed by school registrars, flyers and announcements at university and school based Latina student organizations.

### 2.3. Measures

We used acculturation, ethnic identity, and generational status measures to characterize our sample.

**2.3.1—Hazuda Acculturation & Assimilation Scale** (Hazuda, Stern, & Haffner, 1988) is a self-report measure based on Gordon's assimilation model. Five subscales measure aspects of acculturation and two scales measure assimilation. Three subscales scores (Adult proficiency in English, Adult pattern of English vs Spanish language and Adult Interaction with Mainstream Society) are transformed to Z-scores and combined into a composite higher order measure that reflects adult functional integration with mainstream society. Positive scores reflect higher integration with mainstream society.

**2.3.1—Multigroup Ethnic Identity Measure** (MEIM) (Phinney, 1992) is a 15-item questionnaire that was developed to measure the process of ethnic identity development in adolescent and young adult populations. The first 12-items are rated on a five-point scale anchored by "strongly disagree" (1) to "strongly agree" (5) with higher scores indicating higher levels of ethnic identity. The recommended score is a total scale score, which is the mean of the 12 items. The last 3 items assess personal ethnicity and are not scored (Phinney, 1992). Construct validity is satisfactory (Ponterotto, Gretchen, Utsey, Stracuzzi & Saya 2003). Alpha coefficients with 417 ethnically diverse high school students and 136 college students were .81 and .90 respectively (Phinney, 1992). In another study of 1,367 freshman students of Mexican background, the alpha coefficient for the MEIM was 0.83 (Cuellar, Nyberg & Maldonado, 1997). The measure has been shown to discriminate among different ethnic groups in a sample of Euro American, Asian, African American, and Hispanic Latino adolescents and young adults (Branch, 2001). The alpha coefficient in this sample was 0.87

**2.3.3—Generational Status** was determined by responses to three questions related to participant and her parents' places of birth included in the demographic questionnaire. Based on US Census Bureau definitions ([www.census.gov/population/foreign/about/faq.html#Q4](http://www.census.gov/population/foreign/about/faq.html#Q4)) first generation referred to participants born outside of the US, 2<sup>nd</sup> generation referred to birthplace of at least one parent outside the US and 3<sup>rd</sup> generation refers to both parents born in the US.

**2.3.4 Disordered Eating, Alcohol and Tobacco Use Behaviors**—A combined event-contingent, and signal-contingent ecological momentary assessment (EMA) methodology was used to record risk behavior outcomes. A computerized menu-driven interview was used to measure disordered eating, alcohol and tobacco use behaviors in the context of everyday life. For five 14-day intervals (baseline, 3, 6, 9 and 12 months. after enrollment), participants were asked to carry with them a hand-held computer (PDA) during

waking hours. Participants were instructed to record all targeted behaviors at the time they occur (event contingent) and were prompted through related screens to document specific properties of the behaviors and to verify intent for the purpose of weight control for each behavior. Responses were automatically entered with a date and time stamp. To enhance recording compliance, participants were also signaled at 3 points daily and asked to document any target behavior that occurred since the last signal but was not recorded. To measure weight control behaviors that occur over an extended unclearly demarcated time period (e.g., food/calorie restricting and fasting), participants were asked to respond to questions about these behaviors at the last signal each day.

Questions related to disordered eating behaviors were based on DSM-IV definitions of the behaviors (binge episode) items from the EDE Fairburn & Cooper, 1993) that were rewritten to focus on the current behavioral episode. Questions about the number of standard drinks and number of cigarettes smoked were based on items used in other EMA studies of alcohol use (Collins, Morsheimer, Shiffman, Paty, Gnys, & Papadonatos, 1998; Hufford, Shields, Shiffman, Paty, & Balabanis, 2002; Shiffman, Fischer, Paty, Gnys, Hickcox M, & Kassel, 1994) and tobacco use (Townshend, 2002; Shiffman, Paty, & Gnys, 1996; Shiffman, Gwaltney & Balabanis, 2002)

Behavioral data collected using EMA has been shown to have high validity compared to standard retrospective questionnaires by eliminating cognitive biases associated with recall (Loewenstein, Hamilton, Alagna, & Reid, 1987; Ptacek, Smith, Espe, & Rafferty, 1994; Stone & Shiffman, 2002). A 14-day interval was selected based on previous studies, which demonstrated that it is sufficient to capture intermittent behaviors such as disordered eating (Wegner, Smyth, Crosby, Wittrock, Wonderlich, 2002), alcohol (Muraven, Collins, Morsheimer, Shiffman, & Paty, 2005) and tobacco use Mermelstein, Hedeker, Flay, & Shiffman, 2003) in normal community samples while not being overly burdensome.

The EMA data was collected at baseline. For this study, we counted the day as a recording day if the participant responded to at least one of the three daily signals or made at least one behavioral entry. On average, participants completed 13.6 days of recordings with 383 participants recording on all 14 days. For participants with fewer than 14 days of recordings, a daily mean was computed for each behavior and multiplied by 14 to standardize sum scores.

**2.3.5 Body Mass Index**—A portable Detecto 439 Mechanical Doctor Scale that measures with high precision (400 lbs X 4 oz.) was used to measure body weight. Participants were weighed and measured in street clothes and stocking feet, back and heels against the height rod. Body mass index (BMI) was computed using the following formula: weight (kg)/height (meters<sup>2</sup>).

## 2.4. Procedures

Women who were interested in participating in the project were asked to call the research office. After completing a brief screening questionnaire, women interested in participating scheduled an appointment for the first of two baseline data collection sessions. The written informed consent was completed at the start of session 1, followed by administration of a

number of paper and pencil measures not addressed in this report. The second session that occurred approximately two weeks later included completion of paper and pencil questionnaires, measurement of height and weight, followed by the EMA orientation. Definitions of the target behaviors were provided along with instructions on behavioral recording and PDA use in an individual orientation session that lasted approximately 45 minutes. A 24-hr practice period with a follow-up phone appointment was completed prior to the start of data collection and data from this period was not included in the analyses. A participant manual with step-by-step description of the recording and downloading procedures was also provided. At the end of the 24-hour period, the data collector phoned the participant to answer any questions and the 14-day PDA period began the following morning. Participants were instructed to download their PDA data to a secure website using a landline telephone at least once a week during the EMA period. Project staff was on call to address PDA problems whenever they occurred. In consideration of the amount of time and effort associated with the detailed EMA recording, participants were paid \$30 for PDA orientation session and 15-day recording period. In addition, a \$15 bonus was given for responding to 85% of signals over the 14-days.

### 3.0. Data Analysis

We first conducted descriptive statistical analysis. For continuous outcomes, we report the total number of observations, mean and standard deviation and for categorical outcomes, we report the frequencies. In addition, we examine the data distributions before we employ the statistical regression. From this examination, we found that the behavior outcomes are highly skewed with a high number of zeros. To deal with the distributional skewness, we tested several statistical models including the classical Poisson regression, zero-inflated Poisson regression, negative-binomial regression as well as the zero-inflated negative-binomial regression. We found the negative-binomial regression fits the data well. Then we made use of the negative-binomial regression model to accommodate the over-dispersion in the data variances which relax the dependence of the mean and variance function. In fact, the negative-binomial regression is a natural extension of the Poisson count regression from a Bayesian perspective where the mean count parameter is assumed to vary according to a gamma distribution so that an over-dispersion and skewness can be incorporated in this regression (Chen & Peace, 2010). To predict BMI, which was normally distributed, we used linear regression.

## 4.0. Results

### 4.1. Participant Characteristics

Of the 482 women enrolled in the study, a total of 5 women (Arizona  $n=2$  and Michigan  $n=3$ ) dropped out of the study before completing baseline data collection. In addition, five women completed fewer than 7 days for EMA recordings and their data was also eliminated from the analyses. Therefore, the sample size for the analyses reported in this paper is 472 women. Women enrolled at the Arizona site were significantly younger [ $M=19.4$  (1.4) years] compared to women enrolled at the Michigan sites [ $M=20.2$  (3.0);  $t(352)=-4.1$ ,  $p=.001$ ]. In addition, women at the two sites differed in terms of generational status with a greater

percentage of women from Arizona of first generation and fewer women of 3<sup>rd</sup> generation compared to women enrolled at the Michigan site ( $\chi^2(3)=25.0, p=.001$ ). In addition, participants from Arizona has significantly lower adult functional integration with main stream society scores (Hazuda composite  $M=-0.76(2.2)$  compared to participants from the Michigan site ( $0.71(2.2)$ ,  $t(473)=-7.3, p<.0001$ ). No significant group differences were found in ethnic identity.

#### 4.2. Prevalence of Disordered Eating Behaviors

Table 1 shows the percentage of the sample that recorded at least one episode of disordered eating behavior, alcohol or tobacco use over the 14 day EMA recording period. Also shown in Table 1 are descriptive statistics computed based only on women who engaged in the specific behavior at least once over the 14-day period. In our sample, the prevalence of any purging behaviors (self-induced vomiting, laxative, diuretic and diet pill use) was 13.6% ( $n=64$ ). However, the prevalence of individual purging behaviors was low ranging from 1.3% ( $n=6$ ) for diuretics to 8.6% ( $n=41$ ) for diet pill use.

The criteria used to determine an episode of binge eating is consistent with the DSM-IV and includes ingesting an objectively large quantity of food within a two-hour interval and accompanied by feelings of loss of control. Using these strict criteria, 13.3% ( $n=63$ ) of our sample engaged in at least one binge episode during the 14-day EMA period. Of the 63 women who reported binge eating episodes, 20.6% ( $n=13$ ) reported four or more episodes during the period. If sustained, this level is consistent with the binge frequency criteria for the diagnosis of both bulimia nervosa and binge eating disorder. Food/calorie restricting and fasting were the most common disordered eating behaviors in our sample with 48.1% ( $n=227$ ) reporting on or more days of restricting and 13.1% ( $n=62$ ) reporting fasting. Of those who restricted at least one day over the 14-day period, 23.8% ( $n=54$ ) restricted at least seven or more days. Excessive exercise was defined as the number of days with 1.5 hours or more of exercise for the purpose of controlling weight. Approximately 18% ( $n=83$ ) reported one or more days of exercise that met this criteria.

#### 4.3. Prevalence of Alcohol and Tobacco Use Behaviors

Forty-five percent ( $n=210$ ) of the total sample reported drinking at least one standard drink during the 14-day EMA period. Among the women who reported any drinking, the mean number of standard drinks across the 14-day period was 7.7 ( $SD=9.0$ ). Based on the National Institute on Alcohol Abuse and Alcoholism (NIAAA) daily risk limits for women of no more than three drinks in a single day, 114 women (54% of those who reported drinking and 24% of the total sample) exceeded the daily risk limits, referred to as heavy drinking days. The 14-day prevalence of tobacco use our in sample was 13.8% ( $n=65$ ). None of these women were heavy smokers; 71% of those who reported smoking smoked less than 1 cigarette per day. The two heaviest smokers smoked approximately  $\frac{1}{2}$  pack per day during the 14-day period.

#### 4.4. Body Mass Index

The mean BMI for our sample was 25.7 ( $sd=6.0$ ) with a range from 16.4 to 62.4. Using Center for Disease Control and Prevention weight category definitions <http://www.cdc.gov/>

[obesity/adult/defining.html](#), 3.4% (n=16) of our sample was underweight, 51.5% (n=241) was normal weight, 25.9% (n=121) overweight and 19.2% (n=90) obese.

#### 4.5. Disordered Eating, Alcohol and Tobacco Use Behaviors

We first examined the predictability of age, Hazuda total score and MEIM total score to the disordered eating behaviors and found there were not statistically significant relationship among them. Then bivariate negative binomial regression models were used to examine the extent to which a target behavior was predicted by each of the other disordered eating behaviors. Beta weights, their standard errors and significance are shown in Table 2. Predictor variables are in the top row and criterion variables are in the left column. Due to low prevalence of vomiting, laxative and diuretic use, these variables were combined with diet pills to form a purging variable. Thus, there were five disordered eating behaviors (restricting, fasting, bingeing, purging, and excessive exercise). The mean number of binge eating episodes for the 14 days was not significantly predictive of other disordered eating, tobacco or alcohol use behaviors. The number of purging episodes predicted the number of heavy drinking days, and the number of days of food/calorie restricting. Days of food/calorie restricting significantly predicted purging episodes, days fasting, and excessive exercise episodes. Fasting days predicted binge eating episodes, restricting days, and tobacco use. The number of excessive exercise episodes predicted days of food/calorie restricting. Though not shown in the table, number of alcohol drinks predicted heavy drinking days (beta=0.19,  $p<.001$ ) and tobacco use (beta=0.07,  $p<.05$ ).

#### 4.6. Disordered Eating, Tobacco and Alcohol Use as Predictors of BMI

Bivariate linear regression models were used to examine the relationships between the behavioral variables (DE, alcohol and tobacco) and BMI (See Table 2). Food/calorie restricting, binge eating, and tobacco use significantly and positively predicted BMI. A multiple linear regression model was conducted to examine the simultaneous effects of the five disordered eating behaviors on BMI. Results showed that BMI is statistically significantly related to restricting (beta = 0.26,  $p<.001$ ) and bingeing (beta = 0.62,  $p<.01$ ), but tobacco was no longer a significant predictor.

### 5.0. Discussion

Results of this study showed that in a community-based sample of college-enrolled young adult women of Mexican origin recruited based only on ethnicity, gender, age, and college matriculation, disordered eating behaviors were comparable, or for some behaviors slightly lower, than those found in other college enrolled female samples. Furthermore, among those who engaged in the behaviors, significant variability in severity was found with a few women reporting very high frequency of the behaviors across the 14-day period. Distinctive patterns of association among DE behaviors were found. The number of days of food restricting and fasting was associated with level of involvement in several other DE behaviors. Four DE behaviors including binge eating, restricting, purging, and fasting were differentially associated with health outcomes of alcohol use, tobacco use, and BMI. Finally, the health outcomes were also differentially associated with each other.



Over the last decade, several studies have addressed the prevalence of subclinical disordered eating behaviors in samples of majority and minority college enrolled women, and with the exception of food/calorie restricting, the reported rates have generally been higher than those found in our sample. Rates of self-induced vomiting for weight control have ranged from 5–7% over a one month to a 12-month estimate (Delinsky & Wilson, 2008; Kelly –Weeder, 2009; Mintz & Betz, 1988), and 12% for lifetime estimates (Piran & Robison, 2006, 2011). Laxative use has ranged from 4–10% monthly to lifetime engagement (Kelly –Weeder, 2009; Mintz & Betz, 1988; Piran & Robison, 2006; Piran & Robison, 2011) and binge eating behaviors ranged from 22% annually to 31% for lifetime and 3–17% of the individuals engaged in binge eating behaviors at least 2 times per week or greater (Delinsky & Wilson, 2008; Kelly–Weeder, 2009; Piran & Robison, 2006; Piran & Robison, 2011). Thirty seven to forty percent engaged in restricting annually and 3% of the samples engaged in daily restriction over the course of one month (Piran & Robison, 2006, 2011).

When compared to results of studies that focused on mixed samples of Latina from diverse subcultures (e.g. Puerto Rico, Latin American, South American), prevalence rates in our sample of Mexican American women also seem lower than typically reported (see Franko, Becker, Thomas & Herzog, 2007; Reyes-Rodriguez, et al, 2010). For example, in a sample of Latinas seeking treatment at university administered family planning clinics (N=624) almost half of the sample reported exercise to lose weight in the last 30 days (46.6%) and 16.9% reported using diet pills to lose or control weight (Breitkopf & Berenson, 2004). Similarly in a study of adolescent Latinas, Croll and colleagues reported prevalence rates of vomiting (10.4%) and binge eating (34.4%) that were substantially larger than found in our study (Croll, Neumark-Sztainer, Story & Ireland, 2002). Whereas in a study of Latina high school athletes, Pernick et al. (2006) found the prevalence rates of vomiting to be larger than we found but the prevalence of laxative use and binge eating were similar. In this study, the focus was exclusively on women who were Mexican-American college students and we are one of the first to describe disordered eating behaviors and their relationship to alcohol, tobacco and BMI in this population.

The disparity in prevalence rates in our sample compared to previous research with college aged majority women and more diverse samples of Latinas could be a result of measurement issues. As noted above, studies measure behaviors over different time frames ranging from lifetime (Kelly-Weeder, 2002), weekly (Granillo, Jones-Rodriguez, & Carvajal, 2005; Mitz & Betz, 1988) or even unspecified intervals (see Regan & Cachelin, 2006). Cross study comparisons are further complicated by the inconsistency in the behaviors studied (e.g. skipping meals instead of food restricting or fasting; use of dietary supplements rather than diet pills or preparations). In addition, previous studies completed to date have relied on retrospective recall and used a single, often dichotomous question that focused on any instance of the behavior over the specified time interval. In this study, EMA methodology enabled in vivo measurement of behavioral episodes and the algorithm of questions for each behavior enabled us to identify behavioral episodes that met DSM-IV definitional criteria.

Deployment of EMA methodology reduces recall bias and eliminates the need for participants to try to summarize behaviors over an extended period of time and allows for measurement to occur in the natural environment (Smyth & Stone, 2003; Stone & Shiffman,

1994), providing more robust measurement strategies. Studies have shown that recall strategies provide overestimates and poor agreement in affect measures and behavioral measures when compared to EMA (Shiffman et al., 1997; Stone et al., 1998). EMA has proven to be feasible in accurately measuring disordered eating behaviors which has been beneficial in understanding a more refined pattern of behaviors (Engel et al., 2005; Smyth, et al., 2009). This study extends the knowledge base of disordered eating behaviors and their correlates in young adult Mexican American women by being the first to use EMA methodology to capture the behaviors in real-time.

Notably, approximately half of the sample engaged in food/calorie restricting at least once over the 14-day period and the number of days restricting positively and significantly predicted three other DE behaviors including purging, excessive exercise, and fasting, and there was a trend toward predicting binge-eating episodes. These findings are consistent with those of other cross sectional and longitudinal studies that showed that restricting behaviors often precede binge eating particularly in females (Goldschmidt, Wall, Loth, LeGrange, Neumark-Sztainer, 2012; Neumark-Sztainer, Wall, Guo, Story, Haines, & Eisenberg, 2006) and that dietary restraint was associated with exercise, diet pill use and self-induced vomiting (Breitkopf et al., 2004; Mond, Hay, Rodgers, Own & Mitchell, 2006). Together these findings suggest that as the number of day of restricting increase, involvement in other disordered eating behaviors increases. Except for number of days fasting which may be considered an extreme form of restricting, other DE behaviors appeared to be more isolated and unrelated to level of involvement in other behaviors.

The prevalence of alcohol use and heavy drinking were somewhat higher in our sample compared to the national prevalence rates for Hispanic women of child-bearing age, whereas tobacco use prevalence was slightly lower. The 14-day prevalence rate for alcohol use in our sample was 45%; the 30-day prevalence of alcohol use among non-pregnant Hispanic women aged 18–44 from the CDC *Behavioral Risk Factor Surveillance System* data is 36% (CDC, 2012). The 14-day prevalence of heavy drinking (four or more drinks in one day) was 24% in our sample, whereas the 30-day prevalence of heavy drinking in Hispanic women from the BRFSS data was 10% (CDC, 2012). Smoking prevalence of 14% in our sample was slightly lower than national prevalence estimates for Mexican American adult women. A population-based cohort study to examine risk and protective factors for chronic disease, the *Hispanic Community Health Study/Study of Latinos*, showed that the prevalence of smoking in U.S. Hispanic women of Mexican descent who are aged 18 and over is 17% (Daviglius et al., 2012). Given that our sample was experiencing a major developmental transition and likely responding to changes in environment, responsibilities, family relationships and perhaps experiencing conflict between family values and roles of young Latinas, the alcohol use and heavy drinking rates reported in our study are not surprising.

Two DE behaviors were differentially associated with substance use in our sample. Purging behaviors (vomiting, diuretics, laxatives, and diet pills) were associated with the number of heavy drinking days. This finding is consistent with other studies that found associations between purging and alcohol use in community samples (Adebe, Lien, Torgersen, & von Soest, 2012) and in women with eating disorders (Baker et al., 2013; Corte & Stein, 2000). In a meta-analysis of 41 studies that examined co-occurrence of DE behaviors and alcohol

use in clinical, community, and student samples, Gadalla and Piran (2007) found an overall effect size of .41 for purging and alcohol use. Because both purging and heavy drinking are considered high-risk behaviors, women who engage in these behaviors may already be approaching serious illness.

Fasting was associated with tobacco use in our sample. This is consistent with findings of other studies that have found that smoking is used as a weight control strategy by women (Jo, Talmadge & Role, 2002; Wee, Rigotti, Davis, & Phillips, 2001). Population-based data from the *Youth Risk Behavior Survey* showed that adolescent girls who engaged in fasting were three times more likely to be smokers than those who did not engage in fasting (Seo, Jiang & Kolbe, 2009). In an experimental study to determine the effects of fasting on smoking, Leeman, O'Malley, White & McKee (2010) randomly assigned smokers to either fasting for 12 hours or no fasting. During a one-hour laboratory session in which participants were permitted to smoke but offered a monetary award not to smoke, participants in the fasting condition were more likely to smoke and smoked earlier compared to those who were in the no-fasting condition. Moreover, other investigators have argued that fasting undermines efforts to quit smoking in women (Shmueli & Prochaska, 2009). Taken together, these findings suggest that fasting has very detrimental health effects including potentiating smoking, a highly addictive behavior.

The multivariate findings of our study show that BMI was significantly and positively associated with binge eating episodes and the days of food restricting. For our study participants, the higher the woman's BMI, the greater the number of binge eating episodes and food restricting days reported over the 14-day EMA period. These results are consistent with findings of other studies in adolescent and young adult female samples that show that persons who are overweight or obese use dieting to control or lose weight (Boutelle, Neumark-Sztainer, Story & Resnick, 2002; Keski-Rahkonen, et al., 2007; Desai, Miller, Staples & Bravender, 2008; Neumark-Sztainer, Story, Hannan, Perry & Irving, 2002). However, paradoxically dieting behaviors contribute to weight gain over time (Lowe, et al., 2006; Neumark-Sztainer et al., 2012), perhaps due to episodes of loss of control and overeating (Keski-Rahkonen, et al., 2007). Although not new, our results highlight the fact within a community sample of young adult MA women, a subset of those at the higher end of the weight continuum may be trapped in an enduring cycle of overeating and food restricting. Community based interventions targeted to overweight and obese young adult Mexican American women are needed to stabilize food intake patterns over time and prevent future weight gain.

The primary limitation is that the data in this report are cross-sectional. This limits our ability to infer causal direction between the disordered eating behaviors and our outcomes of BMI, heavy drinking, and tobacco use. However, this report is on the baseline data from a longitudinal study in which these measures were also obtained at 3, 6, 9, and 12 months. The findings from the baseline data are suggestive and will guide further analyses of the longitudinal data.

## Conclusions

These findings suggest that for Mexican American college-enrolled women, engaging in DE behaviors -- even at subclinical levels -- is pernicious, and may paradoxically lead to obesity and substance use/problems. Young college women, particularly those who are descended from cultural subgroups that have values and family traditions that influence women's roles in the family and society, as were our sample of primarily first and second generation MA women, may be uniquely vulnerable to developmental and social transitions related to college life or other developmental milestone changes (Coe, Palmer, Palmer & DeVito, 2011). Thus, early identification of DE behaviors in college-enrolled MA women is essential. Community-based interventions targeting these women may help reduce disparities associated with overweight and obesity in this population.

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**Table 1**

Prevalence and Descriptive Statistics for Disordered Eating, Alcohol and Tobacco Use Behaviors

Disordered Eating Behavior	Number of cases with at least one behavior episode <sup>+</sup>	Percent with at least one behavior episode <sup>+</sup>	M (SD) <sup>*</sup>
Vomiting	17	3.6%	1.8(1.1)
Laxative use	11	2.3%	2.5(3.2)
Diuretic use	6	1.3%	2.5 (2.8)
Diet pills	41	8.6%	4.2(5.4)
Total Purging Behaviors	64	13.6%	3.8(4.7)
Binge eating episodes	63	13.3%	2.6(2.4)
<sup>/</sup> Restriction	227	48.1%	4.9(3.8) <sup>*</sup>
<sup>/</sup> Fasting	62	13.1%	2.2(1.8) <sup>*</sup>
<sup>/</sup> Exercise Episodes	83	17.6%	2.0 (1.7)
Alcohol Use	210	44.5%	7.7 (9.0)
Smoking	65	13.8%	19.0 (33.2)

<sup>+</sup>Number and percentage of cases with at least one episode over 14-day recording period

<sup>\*</sup>Descriptive statistics are computed for those with one or more episodes of the behavior over 14 day period (Mean number of episodes over 14-day recording period)

<sup>/</sup>Restricting, fasting and excessive exercise are mean number of days of behaviors over 14-day recording period

Table 2

DE behaviors as predictors of alcohol use, heavy drinking, tobacco use, and BMI

	Binge eating		Purging		Restricting		Fasting		Excessive Exercise	
	Est. Coef.	(SE)	Est. Coef.	(SE)	Est. Coef.	(SE)	Est. Coef.	(SE)	Est. Coef.	(SE)
Binge eating	--	--	<b>.02</b> <sup>**</sup>	(.08)	<del>.08</del>	(.05)	<b>.44</b> <sup>**</sup>	(.16)	.20	(.16)
Purging	.02	(.15)	--	--	.20	(.05)	.15	(.19)	.12	(.18)
Restricting	<del>.12</del>	(.07)	<b>.09</b> <sup>**</sup>	(.04)	--	--	<b>.47</b> <sup>***</sup>	(.08)	<b>.19</b> <sup>*</sup>	(.08)
Fasting	.16	(.12)	.10	(.07)	<b>.30</b> <sup>***</sup>	(.03)	--	--	.15	(.15)
Excessive Exercise	.15	(.09)	.07	(.06)	<b>.10</b> <sup>**</sup>	(.03)	.20	(.12)	--	--
Alcohol use	.09	(.08)	.08	(.05)	.02	(.03)	.03	(.10)	.10	(.10)
Heavy drinking	.10	(.07)	.10	(.04)	.03	(.03)	.08	(.10)	.11	(.09)
Tobacco use	-.02	(.20)	-.10	(.12)	.01	(.07)	<b>.97</b> <sup>***</sup>	(.25)	.18	(.25)
BMI	<b>.02</b> <sup>**</sup>	(.01)	-.00	(.00)	.01	<sup>***</sup>	.00	(.01)	-.01	(.01)

Note.

\* p&lt;.05;

\*\* p&lt;.01;

\*\*\* p&lt;.001;

~~†~~ p=.06