

# Weight Gain in College Freshmen: Emerging Adulthood and Health Responsibility

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## Abstract

**Background and Purpose:** College freshmen gain weight at double the rate of same-age peers, and personal, interpersonal, and situational factors play a role in this phenomenon. The objectives of the study were to quantify weight change in first semester college students and to identify predictors of weight gain. **Methods:** In fall 2011, 76 unmarried freshmen, living in dormitories at a public, southwestern U.S. university, participated in the study. Heights and weights were measured at the beginning and end of the semester, and an on-line survey was administered at both times. **Results:** In the first semester of college, 43% gained clinically significant weight ( $\geq 3.5$  pounds) and 15% gained more than 10 pounds. The group at highest risk was students with a normal BMI; 50% of this cohort gained clinically significant weight. Two variables predicted 12% of weight gain: a low level of health responsibility and a normal BMI. **Conclusion:** For college freshmen at highest risk of precipitous weight gain, health promotion strategies aimed at maximizing health responsibility is needed. Additionally, an integration of mediating influences related to the developmental stage of emerging adulthood, such as perceived social norms, positive peer influence and self-efficacy may result in improved long-term lifestyle practices.

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## Introduction

In the United States, obesity has become the most significant noninfectious health risk and is associated with cardiovascular, pulmonary, reproductive and metabolic morbidities. Currently, 35% of adults are obese, with an additional 33% being overweight (National Institute of Diabetes and Digestive and Kidney Diseases, 2012). Among children and adolescents, the overweight/obesity rate is approaching 32%, with 16% of adolescents being obese (Flegal, Carroll, Ogden, & Curtin, 2010; Healthy People.gov., 2014; Kumanyika, Parker, & Sims, 2010; Robert Wood Johnson Foundation (RWJF), 2012). According to the most recent National College Health Risk Behavior Survey (American College Health Association, 2016), based on self-reported height and weight, 23% of U.S. college students were found to be overweight, and 16% were obese.

## College Weight Gain

College admission doubles the risk of rapid weight gain for entering freshmen compared with same-age peers. College freshmen gain an average of 2.6 to 9.5 pounds in the first year of college, with three-quarters of the weight gained within the first semester of college (Cluskey & Grobe, 2009; Gillen & Lefkowitz, 2011; Gropper et al., 2009; Lloyd-Richardson, Bailey, Fava, Wing, & the Tobacco Etiology Research Network, 2009; Racette, Deusinger, Strube, Highstein, & Deusinger, 2005; Vella-Zarb & Elgar, 2009; Wengreen & Moncur, 2009). Additionally, weight gain continues past the first year. By the end of the sophomore year, females gain an average of 9.2 pounds and males an average of 9.5 pounds (Lloyd-Richardson et al., 2009; Racette et al., 2005). In two studies following college students through the entire undergraduate experience, the prevalence of overweight/obesity in college students increased from 23% to 34% by the fourth year of college (Nelson, Gortmaker, Subramanian, Cheung & Wechsler, 2007; Racette et al., 2008).

A related finding is that weight gain continues after students leave college. In two longitudinal studies, higher rates of obesity were experienced by college graduates, when compared with those who had never attended college. These findings are concerning, since long-term obesity can result in the development of chronic medical conditions and reduced life span (Gordon-Larson, The, & Adair, 2010; Ogden, Lamb, Carroll, & Flegal, 2010).

### **Emerging Adulthood**

The development stage of emerging adulthood (ages 18-25) may help to explain the increase in risky health behaviors of freshmen students. According to Arnett (2000, 2007a, 2007b), emerging adulthood is a time between adolescence and full adulthood - seen primarily in developed countries - in which unmarried, childless young adults are not yet fully self-reliant, or responsible, for their decisions and actions. Instead, this is a time of identity exploration, unpredictability, and self-focus; a time when roles have not yet become well-defined.

For students entering college, admission to a postsecondary institution engenders important developmental transitions within a new environment. These milestones include leaving home, increased autonomy, gaining a new perspective on life issues, changing and developing new social support systems and interpersonal relationships, instituting new health habits and routines, and being responsible for academic performance, all with little external guidance (Arnette 2000, 2007a, 2007b; Nelson et al., 2007; Nelson, Story, Larson, Newmark-Sztainer, & Lytle, 2008; Scharoun-Lee, Kaufman, Popkin, & Gordon-Larsen 2009).

Two major factors influence health status during this stage- the transition from adolescence to adulthood, and the weakening of the safety net of financial and psychosocial relationships with parents and other adults who provided support during childhood and earlier adolescence (Arnett 2000, 2007a, Arnett, 2007b; Tanner & Arnett, 2009). Unfortunately, since young adults have little experience in taking on health responsibility, the commitment to healthy

actions are often inconsistent and transitory in nature (Arnett, 2000; Nelson, Story, Larson, Neumark-Sztainer, & Lytle, 2008).

While young adulthood is often considered a time of optimal health, it is now recognized as a critical period when young adults establish and adopt long-lasting lifestyle habits. This presents a great health promotion opportunity, to target health interventions aimed at preventing unhealthy lifestyle behaviors that may lead to chronic disease risk associated with obesity, such as Type 2 diabetes, hypertension, and cardiovascular disease (Jackson, Tucker, & Herman, 2007; HealthyPeople.gov, 2016; Huang, Shimel, Lee, Delancey, & Strother, 2007; RWJF, 2012; Sacheck, Kuder, & Economos, 2010).

### **The Current Study**

The purpose of this study was to determine the personal, interpersonal, and situational predictors of weight gain specific to college freshmen, and to quantify the weight change over the first semester of college. In addition, the developmental stage of emerging adulthood was considered in how identified predictors may uniquely influence weight change. While entering college provides new opportunities for constructive growth toward the adult role, students must also make independent decisions in regard to lifestyle practices that could influence weight change (Roesner, 2013).

## **Methods**

### **Study Design**

The study utilized a prospective cohort design with a weight/height measurement and an online survey administered twice in the first semester of college: at weeks 2-3 (T1) and at weeks 16-17 (T2). The dependent variable for the study was weight change from T1 to T2, a 15-week time interval. The independent variables were factors implicated in weight gain in former studies (Burke, Reilly, Morrell, & Lofgren, 2009; Cluskey & Grobe, 2009; Gillen & Lefkowitz, 2011; Lloyd-Richardson et al., 2009; Nelson et al., 2007; Racette et al., 2007; Vella-Zarb & Elgar, 2009; Wengreen & Moncur, 2009) and included: BMI category, height, gender, race,

ethnicity, physical activity, sedentary behavior, nutritional intake, beverage and snack intake, alcohol consumption, stress management, interpersonal relations, spiritual growth, and health responsibility. The specific aims for this study were to:

1. Determine whether college freshmen experience clinically significant weight gain ( $\geq 3.5$  pounds) in the first semester of college;
2. Examine the effects of gender, ethnicity, and race on weight change in college freshmen during the first semester of college, after controlling for baseline BMI category and change in height; and to
3. Assess the additional predictive value of physical activity, sedentary behavior, nutritional intake, beverage and snack intake, alcohol consumption, stress management, interpersonal relations, spiritual growth, and health responsibility on weight change in college freshmen.

### **Participants and Setting**

The setting for the study was a public Southwestern university located in New Mexico. Approval from both the University of New Mexico's (UNM) institutional review board (Human Research Protection Office) and the university's human subjects committee was obtained prior to study implementation. The convenience sample for this study included 76 traditional college freshmen (18-19 years old, unmarried, childless, first time attending college) who attended classes on the main campus of the university. Participants lived in dormitory housing, and purchased the mandatory cafeteria food plan as the main source of meals. Participants were recruited through the 3-credit-hour introductory course to the university. Students were excluded if they had 30 credit hours or more of previous college course work, had children, were pregnant, lived off campus, or were married.

Power analysis for a regression model showed that the sample size of 76 would allow for detection of a medium standardized effect size

estimate ( $f^2 = 0.15$ ), corresponding to an overall  $R^2$  of approximately 0.13, with three predictors, an alpha of 0.05, and a power of 0.80.

### **Measures**

Data collected for this study included height and weight measures obtained at both T1 and T2 by research assistants (without shoes, with empty pockets and no jacket/sweater or extra layers of clothing). At the same time, participants also completed the 89-item Health and Lifestyle Profile (HeLP) survey at T1 and T2, available on the Internet in Survey Monkey™ format. Included on the HeLP survey was demographic information, including age, gender, and pregnancy (yes/no). Race and ethnicity were self-identified according to guidelines from the UNM Federal Race and Ethnicity Code Compliance Project: Two Question Format and Phrasing Form, which is based on federal guidelines for the reporting of race and ethnicity (University of New Mexico, n.d.; U.S. Census Bureau, 1999).

A nominal \$10 incentive was given to participants at the completion of the study to encourage completion of the collection instruments at T2 (height/weight measurements and online Health and Lifestyle Profile (HeLP) survey). Additionally, all participants were contacted at T1 and T2 via a personal email address, and/or phone text or call, to remind them to complete the survey and to return for the collection of the T2 height and weight measurements.

### **HeLP Survey**

The psychosocial and behavioral items of the HeLP survey were developed for this study from an aggregate of four distinct instruments that contained characteristics found to have an influence on weight gain and general health status in adolescents and college students in prior studies. The four instruments' content remained intact as designed by the original authors and author permission was granted for use of each instrument. These included the Beverage and Snack Questionnaire (BSQ; Neuhouser, Lilley, Lund, & Johnson, 2009), the Student Alcohol Questionnaire (SAQ) drinking patterns subscale (Engs, 2007), the Health-

Promoting Lifestyle Profile (HPLP II) survey (Walker, Sechrist, & Pender, 1995), and the Sedentary Behavior Scale (SBS; Utter, Neumark-Sztainer, Jeffrey, & Story, 1997). Reliability of each instrument was established through prior research: the BSQ 4-6 week test/retest coefficients ranged from .72 to .85 for the beverages, snacks and fruit/vegetable groups (Neuhouser, Lilley, Lund, & Johnson, 2009) ; the SAQ Cronbach's alpha was .86 (Engs, 2007); the HPLP II survey total scale test/retest reliability coefficient was .89, with the six scale coefficient ranging from .79 to .87 (Walker et al., 1995); and the SBS test/retest with values ranging from .60 to .80 for the subscales of TV/video, computer, and reading/homework activities (Utter, Neumark-Sztainer, Jeffrey, & Story, 1997).

### **Procedures**

Students who agreed to participate were required to complete a contact information sheet, sign a study consent form, and have their heights and weights measured at the beginning (T1) and end (T2) of the fall semester (15 weeks). Each participant was provided a laminated ID card with a unique, randomly derived 3-digit study ID number. The study ID number provided the only link between the data collected for each participant. Contact information for the investigators was provided on the ID card, in case participants had questions or wanted to withdraw from the study.

### **Analyses**

All data were analyzed using IBM SPSS™ statistical software (20.0 Graduate Student Version). Since most continuous variables and scales were not normally distributed, and with a moderate-sized sample (76 participants), non-parametric statistics were conducted. When significant results were obtained during analysis, equivalent parametric testing was performed to calculate effect sizes.

## **Results**

### **Description of Participants**

Ninety participants had complete data sets at T1, and by T2, there were 76 remaining (15.6% attrition rate from T1). Table 1 compares the demographic characteristics of the participants with complete data at T1 (n= 90) and T2 (n= 76), and with the demographic information provided for the entire entering freshman class in fall 2011 (n= 689). A higher percentage of females (59.2%) than males (40.8%) completed the study, at a wider margin than the gender composition of the entire entering freshman class.

The ratios of Hispanics/Non-Hispanics in the entire class and at the completion of the study were very similar, as were the percentages for More than One Race, and Asian participants. In addition, the percentages of Black/African Americans, American Indian/Native Alaskans, Whites, and Unknown/Other races were much higher for the study participants than in the entire class. Overall, there were minimal differences in gender, race, and ethnicity between the participants with complete data at T1 and, again, at the completion of the study (T2).

### **Weight Gain**

The change in weight ranged from an increase in weight of 22.2 pounds, to a decrease in weight of 26.0 pounds, over the first semester of college for participants (15 weeks), with a mean increase of 2.3 pounds (Table 2). A statistically significant difference was found for weight change between T1 (Med= 148.40) and T2 (Med= 152.50) on the Wilcoxon signed-rank test (n= 76,  $p \leq .01$ ). With the demonstration of statistical significance, a paired t-test was performed to estimate the effect size. The t-test also demonstrated a statistically significant increase in weight from T1 (M= 156.9, SD= 46.21) to T2 (M= 159.2, SD= 43.55,  $t_{(75)} = -2.26$ ,  $p < .01$ ); Cohen's d was -0.26, indicating a small effect size.

**Table 1.**

Comparison of Entire Entering Freshman Class With All Participants at T1 and Participants Completing Study at T2

Demographic Characteristics	Entire Class (N = 689)	T1 Participants (N = 90)	Participants Completing Study at T2 (N = 76)
	n (%)	n (%)	n (%)
Gender			
Male	344 (48.5)	40 (44.4)	31 (40.8)
Female	355 (51.5)	50 (55.6)	45 (59.2)
Ethnicity			
Hispanic/Latino	255 (37.1)*	29 (32.2)	28 (36.8)
Non- Hispanic/Latino	434 (62.9)*	61 (67.8)	48 (63.2)
Race			
Black/African American	39 (5.7)	10 (11.1)	10 (13.2)
American Indian/Native American	24 (3.6)	7 (7.8)	5 (6.6)
Native Hawaiian/Pacific Islander	0 (0.0)	0 (0.0)	0 (0.0)
White	304 (44.1)	55 (61.1)	45 (59.2)
Asian	2 (0.03)	2 (2.2)	2 (2.6)
Unknown/Other	45 (6.5)	12 (13.3)	10 (13.2)
More than One Race	20 (3.0)	4 (4.4)	4 (5.3)
White/Non-White Recode, n (%)			
White	Not available*	55 (61.1)	46 (60.5)
All Others	Not available*	35 (38.9)	30 (39.5)

\*For the entire class data, ethnicity and race were not reported separately.

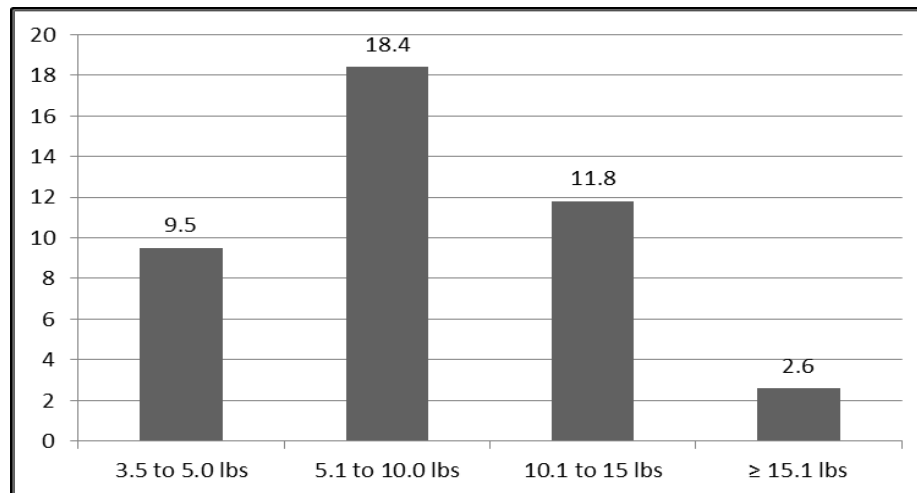
**Clinically Significant Weight Gain**

A categorical variable was developed to reflect the number and percentage of participants who gained a clinically significant amount of weight ( $\geq 3.5$  pounds) during the study period. Clinically significant weight gain was calculated using data from two prior studies for this age group.

In one study, an absolute weight change of less than three pounds annually represented a normal, steady weight state in young adults, while a meta-analysis reported that the expected weight gain in 17- to 18-year-olds, based on a

linear regression model, was 15 g/week, (Levitsky, Halbmaier, & Mrdjenovic, 2004; Stevens, McClain, & Truesdale, 2008).

Since this study was conducted over a 15-week span, the expected weight gain was approximately 225 grams, or 0.495 pounds. Therefore, a positive mean weight change of 3.5 pounds or more, between T1 and T2, indicated clinically significant weight gain. In the study, 42.3% gained clinically significant weight; 9.5% gained 3.5 to 5.0 pounds, 18.4% gained 5.1 to 10.0 pounds, 11.8% gained 10.1 to 15.0 pounds, and 2.6% gained > 15 pounds (Figure 1).



**Figure 1.** Percentage of participants experiencing clinically significant weight gain ( $\geq 3.5$  pounds);  $n = 33/76$ .

### BMI and BMI Categories

The BMIs for participants ranged from 13.0 to 45.6, with one underweight participant and two participants being morbidly obese ( $\geq 40.0$  kg/m<sup>2</sup>). Table 2 demonstrates that the initial BMI mean was similar for participants at the baseline at T1 ( $n = 90$ ) and for those who completed the study ( $n = 76$ ). For those participants who completed the study at T2, there was a mean increase in the BMI of 0.4 (SD= 0.2). Three participants (5.8%) moved from the normal BMI category to the overweight BMI category, due to weight gain.

There was an inverse relationship found between BMI category and weight change; the lower the BMI category, the higher the weight gain. Overall, 50.0% in the normal BMI category gained clinically significant weight, as well as 33.3% of those in the overweight group and 22.2% of those in the obese group. For the participants in the normal BMI category, there was a mean weight increase of 3.6 pounds; in the overweight BMI category group, a mean increase of 2.6 pounds; and for those in the obese BMI category, a decrease in weight of 4.2 pounds.

### Weight Gain by Gender, Ethnicity, and Race

Mann-Whitney tests were conducted to determine if there were differences in weight gain related to gender, ethnicity, or race. Due to the larger number of White participants (61%),

race was re-coded as White/Non-White, and the categorical variables were dummy-coded prior to analysis. The Mann-Whitney test between White (Med= 1.5) and Non-White participants (Med= 2.7,  $U = 639.5$ ,  $z = -.54$ ,  $p = .59$ ) did not reveal a statistically significant difference in weight change. Additionally, no significant differences was found based on gender, between females (Med= 3.0) and males (Med= 0.8,  $U = 644$ ,  $z = -.57$ ,  $p = .57$ ); nor based on ethnicity, between non-Hispanic (Med= 1.1) and Hispanic participants (Med= 3.2,  $U = 579.5$ ,  $z = -.99$ ,  $p = .32$ ).

### Psychosocial and Behavioral Variables

The continuous variables in this study included beverage and snack intake, alcohol consumption, physical activity, nutritional intake, stress management, interpersonal relations, spiritual growth, health responsibility, and sedentary behavior. The bivariate relationship between each of the HeLP survey variables and weight change was determined, using Pearson's bivariate correlations (Table 3).

Only the HPLP II Health Responsibility subscale at T1 ( $r = -.26$ ,  $p = .03$ ) revealed a small, significant, relationship with weight change. This was an inverse relationship, as the level of health responsibility decreased, weight increased. Since the correlation was significant, the HPLP II Health Responsibility subscale was entered into the regression equation.

**Table 2.**  
Weight, BMI, and BMI Category at Baseline among all Participants at T1 and among Participants who Completed the Study

	Baseline (T1): All Enrolled Participants (N=90)	(T1): Participants who Completed Study (n=76)	T2: Participants who Completed Study (n=76)
	M (SD)	M (SD)	M (SD)
Weight (lbs)	157.4 (45.1)	156.9 (46.2)	159.2 (43.6)
Weight Δ	N/A	N/A	2.3 (7.4)
BMI	24.6 (6.3)	24.5 (6.5)	24.9 (6.0)
BMI Δ	N/A	N/A	0.4 (0.2)
	n (%)	n (%)	n (%)
Clinically significant weight gain			
< 3.5 lbs	N/A	N/A	43 (56.6%)
≥ 3.5 lbs	N/A	N/A	33 (42.3%)
BMI Category, n (%)			
Underweight/normal	60 (66.7%)	52 (68.5%)	49 (64.5%)
Overweight	17 (18.9%)	15 (19.7%)	18 (23.7%)
Obese	13 (14.4%)	9 (11.8%)	9 (11.8%)

**Table 3.**  
Pearson's Correlations of Scales/Subscales and Weight Change at T1

Independent Variable (N)	r	p
Beverage and Snack Questionnaire (68)	.15	.23
SAQ Drinking Patterns (74)	-.14	.22
HPLP II Total (70)	-.14	.23
HPLP II Physical Activity (71)	.02	.85
HPLP II Nutrition (70)	-.08	.51
HPLP II Stress Management (72)	.02	.89
HPLP II Interpersonal Relations (73)	-.11	.37
HPLP II Spiritual Growth (70)	-.18	.15
HPLP II Health Responsibility (72)	-.26	.03*
Sedentary Behavior Scale (73)	.09	.43

**Regression Model- Weight Change**

To answer which independent variables (IVs) predicted weight change in the first semester of college for freshmen, a standard multiple regression was conducted with the dependent variable, weight change, and the IVs that demonstrated significant relationships to weight change, the Health Responsibility subscale at T1 and the dummy coded BMI categories at T1. Group 1 was comprised of the underweight/normal BMI category (n= 52), and Group 2 included overweight and obese BMI categories (n= 24). The IVs were entered into the regression equation in a single block.

The regression results indicated an overall model of the two predictors (Health Responsibility subscale and BMI categories, both at T1), which significantly predicted weight change,  $R^2 = .14$ , Adjusted  $R^2 = .12$ ,  $F_{(2,69)} = 5.70$ ,  $p \leq .001$  (Table 4). This model accounted for 12.0% of variance in weight change. On average, after controlling for baseline (dichotomized) BMI category, a one category difference in Health Responsibility at Time 1 (e.g., from an average score of 1[never] to 2[sometimes]) was associated with an approximate three pound weight change by Time 2. The relationship was negative, indicating that a lower level of health responsibility was associated with an increase in weight.

**Table 4.**

Final Regression Model- Weight Change

	B	SE(B)	Beta	t	p
Constant	9.10	3.01		3.02	.01*
BMI Categories- T1	-4.06	1.82	-.26	-2.23	.03*
HPLP II Health Responsibility- T1	-3.09	1.55	-.22	-2.00	.05*

**Discussion**

Through non-parametric and parametric testing, it was determined that weight change in the first semester of college had an inverse relationship with two factors, health responsibility and BMI categories; the lower the level of health responsibility: the greater the increase in weight. The results demonstrated that weight change for these first semester college students ranged from an increase in weight of 22.2 pounds, to a decrease in weight of 26.0 pounds. There was a mean increase in weight of 2.3 pounds over the first semester of college, with clinically significant weight gain ( $\geq 3.5$  pounds) in 42% of participants. Additionally, those participants who were in the normal BMI category had the largest weight gain, with 50% in this BMI

category gaining  $\geq 3.5$  pounds. There was no significant difference in weight gain as it related to gender, race, or ethnicity. There was also no significant change in weight related to the personal, interpersonal and situational variables of beverage and snack intake, alcohol consumption, physical activity, nutritional intake, stress management, interpersonal relations, spiritual growth, and sedentary behavior.

**Health Responsibility and Weight Gain**

Health responsibility was the sole psychosocial/behavioral variable that demonstrated a significant inverse relationship with weight gain in the study; the lower the score on the Health Responsibility subscale, the



higher the weight gain. Health responsibility is defined as an active sense of accountability for one's own health through education and health-promotive actions (Callaghan, 2003; Callaghan, 2006; Lee & Yuen Loke, 2005; Roesner, 2013). No prior studies with U.S. college students, using the HPLP II which includes the Health Responsibility subscale, was found. However, in a study of U.S. adolescents, ages 14-19, the Health Responsibility subscale had the lowest subscale mean on the HPLP II (Callaghan, 2003). Similarly, in two studies among college students in Hong Kong using the Chinese version of the HPLP II and in another university-based study using the Japanese version, the responses demonstrated that Health Responsibility had the lowest mean of the six HPLP II subscales, similar to findings in this study (Lee & Yuen Loke, 2005; Wei et al., 2012).

Health responsibility had not been directly linked to weight gain in prior studies, but related constructs have been linked to other health-promoting behaviors. In one study, the variables of health self-efficacy and health value predicted 51% of the level of engagement in health promotion behaviors, including activities related to nutrition, psychological well-being, physical activity, and general preventive health practices (Jackson et al., 2007). Similar findings of self-care responsibility and initiative to perform healthy lifestyle behaviors in adolescents, which included physical activity and nutrition, were reported by Callahan (2003; 2006) in two other studies.

### **BMI Category and Weight Gain**

The normal BMI category also predicted weight gain in the regression model, and three participants in the normal BMI group (5.8%) moved into the overweight category due to weight gain. Half of the normal BMI group experienced clinically significant weight gain, compared to a third of the overweight group and a quarter of the obese group. Additionally, for the 42% of participants who gained clinically significant weight, approximately 80% were in the normal BMI category.

This finding was in opposition to several prior studies that found that students at highest risk for clinically significant weight gain were those who were overweight or obese upon admission to college (Brown, 2008; Gordon-Larsen et al., 2010; Lloyd-Richardson et al., 2009; Ogden, Carroll & Flegal, 2008). Only one prior study noted that participants in the normal BMI category gained significant weight, but did not identify this as an unique area for further investigation (Cluskey & Grobe, 2009). While several other studies noted a mean increase in BMI ranging from  $\pm 0.3$ -  $1.0 \text{ kg/m}^2$  for students in the first year of college, weight gain based specifically on BMI categories was not specifically identified (Gropper et al., 2009; Racette et al., 2008).

### **Limitations**

A convenience sample was recruited for this exploratory descriptive study, and the participants were from a single, regional southwestern university. Therefore, the findings may differ from those found in populations of students from other universities, or might vary, if conducted in a different sociocultural environment. This was a small convenience sample, with 76/90 participants (84.4%) completing the height/weight measures and the HeLP survey at T2. However, in spite of the 16% attrition rate and the smaller sample size than anticipated, the demographics of the sample closely reflected the gender and race/ethnicity (Hispanic/non-Hispanic) of the entering freshman class (Eastern New Mexico University, 2012).

There was a decrease, however, in those who did not complete the study in the obese BMI group, with four participants (2.6%) dropping out of the study from T1 to T2. There may have been a greater tendency of obese participants who gained weight to drop out of the study. However, it cannot be substantiated that those who did not complete the study differed substantially from those who did, relative to the key outcome of interest, weight gain.

## **Implications for Future Research**

### **Normal BMI and Weight Gain**

This study has several implications for future research. First, identification of participants in the normal weight category as the group at most risk for clinically significant weight gain in this study was a finding that merits further exploration. A targeted interventional study for this newly identified risk group could result in increased awareness, increased participation in healthy lifestyle activities, and a reduction of clinically significant weight gain. While previous studies have demonstrated that overweight and obese individuals are at risk for significant weight gain; this study also demonstrated that those in the normal BMI category are at higher risk.

The finding of the higher incidence of weight gain in the normal BMI group is noteworthy and necessitates further investigation. This finding generates concern from a health perspective, since persons who are overweight or obese are at higher risk for development of chronic health problems; health risks associated with metabolic syndrome (hypertension, cardiovascular disease, diabetes) are increased. Huang et al. (2005; 2007) calculated that overweight college students have three times the risk of developing at least one component of metabolic syndrome, compared with normal weight students. There is also an increased risk for other chronic medical conditions, including asthma, sleep apnea, menstrual irregularity, and infertility (Burke et al., 2009; Huang et al., 2005; Sacheck et al., 2010).

### **Health Responsibility and Weight Gain**

Further exploration of the relationship between health responsibility and weight gain is needed. The relationship between significant weight gain and health responsibility was a finding not previously reported in the U.S. The HPLP II (Walker et al., 1995) had not previously been used in the college student population in the U.S., and replication of these findings is indicated, with a larger and more demographically diverse sample and from more

than one setting. In addition, a study designed to more accurately measure the construct of health responsibility would be another potential area of research, since there has only been one research instrument developed using this construct (Walker et al., 1995). Producing an instrument that would extend the definition and operationalization of the construct of health responsibility, including the rigorous process of measuring and validating a new instrument, could result in a better understanding of the relationship between health responsibility and weight change.

### **Emerging Adulthood and Weight Gain**

College students are in the developmental stage of emerging adulthood, and they are inexperienced in performing consistent healthy lifestyle behaviors. Further study exploring the connection between this life stage and high risk health behaviors related to weight gain is needed. This period of time, from age 18-25 years, is a critical time of change and transition for students, with roles, relationship skills, support systems, and conscientious behaviors still being established. Lifestyle habits contributing to weight gain may be off-set by health promotion programs which target perceived social norms, positive peer influence and self-efficacy (Arnett, 2000, 2007a, 2008; Nelson et al., 2008; Roesner, 2013). Investigation of lifestyle practices that will lead to healthy weight management in college students, through this developmental lens, can be used to guide interventions to improve long-term health outcomes.

### **Longitudinal Studies**

Longitudinal studies over the first year of college, and extending throughout the undergraduate experience, can also generate additional information that can be used in future interventional research studies. This could assist in determining if the same variables are implicated in weight change throughout the college experience, and if the pace of weight change is constant or changes over time.

## Conclusion

In this study, college freshman were found to be at risk for clinically significant weight gain, with findings similar to previous research studies (Brown, 2008; Gillen & Lefkowitz, 2011; Lloyd-Richardson et al., 2009; Nelson et al., 2007; Racette et al., 2007; Vella-Zarb & Elgar, 2009). Unchecked, this weight gain can lead to chronic health conditions associated with obesity. Two predictors of weight gain over the first semester of college were identified, a low level of Health Responsibility and a normal BMI category.

Evidence-based health promotion strategies integrate clinical expertise with current and best empirical information and are anchored by a strong theoretical framework in order to provide optimal health outcomes. The knowledge gained from this study adds to the body of knowledge regarding weight gain in college freshmen by providing new findings about factors that may place students at high risk for significant weight gain.

The first role of the health educator, in this instance, is to assess the health care needs of college students by examining their current health status, current health-related behaviors, the perceived barriers and benefits of healthy actions, and existing support systems. Targeted interventions to improve the performance of

healthy behaviors to attain, or maintain, a healthy weight within the university environment needs to be developed, with health promotion strategies to create stronger support systems, to improve the level of health responsibility, and to encourage the consistent performance of healthy weight behaviors. The novel approach of basing an interventional health promotion program on the theory of Emerging Adulthood may also demonstrate efficacious results.

While this study indicated that normal weight freshmen are at highest risk for clinically significant weight gain, it is those who are overweight and obese who are at highest risk for chronic health consequences related to obesity (Gordon-Larsen et al., 2010; Huang et al., 2005; Huang et al., 2007; Ogden et al., 2010; Sacke et al., 2010; Stevens et al., 2008). Therefore, for all freshmen, an integrated intervention plan would include information to increase awareness of health risk, explore attitudes toward health promotion practices, provide specific health education content related to health promotion behaviors, and include interventions targeted to build perceived self-efficacy to perform regular and consistent healthy behaviors. These interventions would assist in preventing rapid weight gain, reducing risky socially-mediated behaviors, and improve health status overall.

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