BMI, WEIGHT-RELATED BEHAVIOR, AND WEIGHT-RELATED ATTITUDES AMONG COLLEGE DORMITORY RESIDENTS

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Abstract

This research examined the influence of social dynamics on weight, weight-related behaviors, and weight-related attitudes within the friendship networks of ethnically diverse dormitory residents at the University of Hawai‘i. Ninety student residents from the Hale Laulima dormitory completed an online questionnaire assessing friendship dynamics, demographics, acculturation, eating attitudes, weight attitudes, health behaviors, and depression. Descriptive network analyses were conducted. Inferential testing was performed using Quadratic Assignment Procedure (QAP) correlations and regressions. Separate QAP regressions were performed to assess male and female inter-gender friendships. Correlation results indicated a positive relationship between closeness and all weight-related variables. QAP regressions analyses by gender revealed an inverse relationship between closeness and BMI concordance and a positive relationship between closeness and shared health behaviors and eating attitudes in men only.
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Introduction

The prevalence of obesity in the United States is a growing problem with significant health and social implications (Ogden, Carroll, Kit, & Flegal, 2012; Gortmaker, Must, Perrin, Sobol, & Dietz, 1993; Sturm, 2002). In 2009-2010, 68.5% of U.S. adults over the age of 20 were overweight (Body Mass Index [BMI] ≥ 25.0; National Center for Health Statistics [NCHS], 2013). Of these individuals, 35.3% were obese (BMI ≥ 30.0; NCHS, 2013). Over the same time period, 18.4% of adolescents aged 12-19 were classified as obese (BMI-for-age ≥ 95th percentile; NCHS, 2013). Alarmingly, this figure indicates that obesity rates in this age bracket have more than tripled since 1980 (NCHS, 2013).

Majority and ethnic minority populations vary substantially in their risk for overweight and obesity (Ogden, Carroll, Kit, & Flegal, 2013). In Hawai‘i, more than 75% of Pacific Islanders (including Native Hawaiians and Samoans) are overweight or obese, compared with 52% of Caucasians, 46% of Japanese, and 45% of Filipinos (Davis et al., 2004). While rates of obesity and overweight are lower among Asian Americans adults in general, studies have shown that Asian Americans have the fastest growing rate of overweight and obese children (Harrison et al., 2005).

Obesity has been linked to numerous health complications including metabolic syndrome, Type 2 diabetes, hypertension, coronary artery disease, and stroke (Kopelman, 2007). Asian Americans and Pacific Islanders (AAPI) have been found to suffer disproportionately from many of these obesity-related diseases (Davis et al., 2004; Harrison et al., 2005). Mounting evidence suggests that the degree of risk to health posed by being even mildly overweight may be greater for AAPI than other ethnic groups (Harrison et al., 2005). This may be the result of a greater tendency toward the development of visceral fat (fat surrounding inner organs) among
AAPI, which can lead to an increased risk for impaired glucose tolerance and cardiovascular disease at a lower BMI than other ethnic groups (Harrison et al., 2005).

Obesity also represents a significant economic burden (Finkelstein, Trogdon, Cohen, & Dietz, 2009). Obesity is associated with 9.1% of annual medical spending, with costs totaling approximately $147 billion in 2008 dollars (Finkelstein et al., 2009). Beyond the well-established physical and economic toll of excess body weight, recent research has also linked the weight-based discrimination and stigma faced by many obese individuals to a range of psychosocial issues including difficulties in occupational advancement, delivery of health services, educational attainment, family relations, and self-concept (Carr & Friedman, 2005; Carr & Friedman, 2006; Crosnoe, 2007; Crosnoe, Frank, & Mueller, 2008). Among racial and ethnic minority groups, these stressors may be compounded by racial discrimination. Racial discrimination has been independently linked to increased BMI and obesity among Asian Americans (Gee, Ro, Gavin, & Takeuchi, 2008).

**Obesity Treatment and Prognosis**

Research indicates that a weight reduction of just 5-10% can substantially reduce obesity-associated medical complications and increase longevity in obese individuals (Goldstein, 1992; National Heart, Lung, and Blood Institute, 1998). Evidence suggests, however, that this modest weight loss is difficult to achieve and maintain (Curioni & Lourenço, 2005; Kraschnewski et al., 2010; Wing & Phlean, 2005). A recent examination of weight data from the 1999-2006 National Health and Nutrition Examination Survey (NHANES) found that only 17.3% of overweight or obese participants reported long-term weight loss maintenance of at least 10% after one year (Kraschnewski et al., 2010). Furthermore, weight loss maintenance has been found to be particularly challenging for many non-White ethnic populations (Kaholokula et al., 2011). These
groups tend to lose less weight and are more likely to regain weight than Whites given the same intervention (Kaholokula et al., 2011). Findings such as these indicate a clear need for effective, sustainable, and culturally sensitive interventions to address overweight and obesity.

**Causal and Maintenance Factors**

Research on causal and maintenance factors associated with overweight suggests a complex nomological network surrounding this issue. One recent model of obesity identifies four broad contributing factors: our physical environment (e.g., reliance on automobiles, building design), social environment, behavior, and biology (Bouchard, 2007). The model suggests that physical and social factors produce an obesogenic environment that favors the adoption of obesogenic behavior (e.g., consumption of large portion size meals, high fat and sugar diets, sedentary lifestyle). These factors, in combination with a biological predisposition toward weight gain, may lead to the development of obesity. Though some of these contributing factors are not easily modifiable, it is suggested that the manipulation of one’s social environment has the potential to yield significant changes in the development of overweight and obesity. Thus, an exploration of social factors associated with weight gain has been identified as a promising avenue of research for the development of obesity interventions (Koehly & Loscalzo, 2009).

Social factors are widely recognized by both academic researchers and federal health agencies as an important determinant of health (Emmons, 2000; U.S. Department of Health and Human Services, 1996). It is theorized that the social environment influences behavior by “shaping norms, enforcing patterns of social control (which may be health-promoting or health-damaging), providing or not providing environmental opportunities to engage in certain behaviors, reducing or producing…stress…and plac[ing] constraints on individual choice” (Berkman & Kawachi, 2000, p. 7-8). Social networks, the collective structure of social
relationships that surround an individual, are an important dimension the social environment (McNeill, Kreuter, & Subramanian, 2006).

In some ethnic minority groups, there is a strong cultural value placed on interdependence over independence in the family and social structure (Nilchaikovit, Hill, & Holland, 1993). As a result, social networks may play a particularly powerful role in influencing weight-related attitudes and behavior among these individuals (Nilchaikovit, Hill, & Holland, 1993). Furthermore, social networks may be modifiable and have the potential to be used advantageously in the development of obesity interventions (Koehly & Loscalzo, 2009). If individuals are influenced by their peers, then modifying the behavior of one individual in a group may affect everyone in that group. This phenomenon is known as a social multiplier effect, wherein the aggregate effect is greater than the individual effect (Glaser, Sacerdote, & Scheinkman, 2002; Renna, Grafova, & Thakur, 2008).

Social Network Analysis

A powerful methodology for the exploration of social dynamics is offered by social network analysis. Social network analysis (SNA) focuses on the relationships between individuals embedded in a larger system (Borgatti, Everett, & Johnson, 2013; Hanneman & Riddle, 2005). The constraints and opportunities that an individual will encounter are determined, in part, by his or her position in a network (Borgatti et al., 2013). Therefore, identifying an individual’s position within a social network plays an important role in predicting outcomes such as behavior and beliefs (Borgatti et al., 2013). This methodology has been applied to studies in many disciplines including economics, information technology, politics, and epidemiology (Easley & Kleinberg, 2010). In the field of weight research, this technique has the potential to offer a fresh lens with which to reexamine some of the well-explored territory of
obesity etiology. In the present study, SNA will be used to examine the influence of social dynamics on weight, weight-related behaviors, and weight-related attitudes within the friendship networks of ethnically diverse college students in a single residence hall at the University of Hawai‘i at Mānoa (UH Mānoa).

**BMI Homophily**

BMI Homophily, the notion that we tend to be similar to our friends, is one of the most fundamental principles governing the structure of social networks (Easley & Kleinberg, 2010). One challenge in this area of research is distinguishing between potential mechanisms for homophily. The social interactions literature identifies three types of social effects that one might find within a social group: endogenous effects, contextual effects, and correlated effects (Manski, 1993). Endogenous effects occur when an individual is likely to behave in a given way as a result of the behavior of a reference group, while contextual effects occur when the behavior varies with the exogenous (external) characteristics of the reference group (Fletcher, 2009). Correlated effects, however, occur simply because individuals in the same group tend to have similar characteristics and face similar environments (Fletcher, 2009).

For example, if an individual is more likely to eat a high fat diet because his friend eats a high fat diet, this suggests that endogenous effects are at play. Alternatively, the individual might be more likely to eat a high fat diet because he and his friends come from low SES households and observe the consumption of high fat diets at home, suggesting contextual effects. The behavior similarity may also occur because these individuals became friends due to a shared love for eating high fat foods or because both individuals attend a school within close proximity to several fast food restaurants, indicating the presence of correlated effects. While distinguishing
among these types of effects has important implications for the application of SNA research to policy, it is beyond the scope of the present cross-sectional study.

Lazarsfeld and Merton (1954) distinguish between two types of homophily: status homophily and value homophily. Status homophily describes similarities based on formal, informal, or ascribed status and includes major sociodemographic dimensions and acquired personal characteristics. Value homophily is based on values, attitudes and beliefs, and includes a wide range of internal states and orientations that shape our behavior. The presence of both status and value homophily in social groups is a well-supported phenomenon in social sciences research. A comprehensive review by McPherson, Smith-Lovin and Cook (2001) finds evidence of homophily in social groups across dimensions such as race and ethnicity, gender, age, religion, education, occupation, and social class. There are also examples of homophily in behaviors such as drug use, sexual behavior, and attitudes and beliefs regarding domains such as political orientation and the value of education.

A robust body of literature supports the existence of homophily in weight. In 2007, Christakis and Fowler published results from their seminal study on the spread of obesity in a large social network over 32 years. In this study, the authors used longitudinal statistical models to examine whether weight gain in one person was associated with weight gain among friends, family, and neighbors in 12,067 participants enrolled in the Framingham Heart Study from 1971 to 2003. They found that across examinations, the risk of obesity among individuals who were connected to an obese individual at one degree of separation (e.g., a friend) was about 45% higher than might be expected in a random network. Furthermore, they found a risk of obesity that was about 20% higher than expected at two degrees of separation (friends of friends), and 10% higher than expected at three degrees of separation. Christakis and Fowler conclude that
their findings provide evidence of endogenous peer effects in the spread of obesity within this social network. While this study was enormously influential in the field, several researchers have subsequently called into question the accuracy of this conclusion based on the research design and statistical models used by the authors. Namely, some authors have argued that Christakis and Fowler did not adequately disentangle endogenous, correlated, and contextual effects in the spread of obesity (Cohen-Cole & Fletcher, 2008a; Cohen-Cole & Fletcher, 2008b; Halliday & Kwak, 2007; Lyons, 2011).

Though disagreement persists regarding the mechanism underlying weight homophily, the existence of this phenomenon has been supported by many authors, including some of those critical of Christakis and Fowler’s (2007) methodology. Halliday and Kwak (2007), for example, were able to replicate many of the key findings from Christakis and Fowler’s (2007) study using data from the National Longitudinal Study of Adolescent Health (Add Health). Add Health provides comprehensive information on the health-related behaviors of adolescents in a nationally representative sample of students in grades 7 through 12 (Harris, 2013). Data collected in four waves from 1994 to 2008 includes longitudinal information on height, weight, and friendship nominations, among many other factors (Harris, 2013). Using this dataset, Halliday and Kwak found a significant relationship between peer-group weight outcomes and individual outcomes when using the original variable definitions as defined by Christakis and Fowler (BMI represented as a binary variable identifying individuals as overweight or not). Importantly, Halliday and Kwak note that these findings are not robust to alternative specifications of the dependent variable, such as change in level of BMI or percent change in BMI.

Renna, Grafova, and Thakur (2008) found that higher BMI of close friends was related to a higher BMI of the respondent adolescent. In this study, an increase of approximately six points
in the average BMI of friends was associated with a one point increase in the BMI of the respondent. For two 5’6” individuals both weighing around 140 pounds, this would be the equivalent of a 37 pound gain for the friend and a 6 pound weight gain for the respondent. Other researchers have found similar results using a variety of statistical approaches to analyze the Add Health dataset (Simpkins, Schaefer, Price, & Vest, 2013; Trogdon, Nonnemaker, & Pais, 2008). Studies utilizing primary data collection have provided further support for the presence of homophily in weight among friends. Valente, Fujimoto, Chou, & Spruijt-Metz (2009) examined the friendship choices and BMI of 617 adolescents (age 12-14 years) and found that overweight youths were twice as likely to have overweight friends. De la Haye, Robins, Mohr, & Wilson (2011) collected four waves of data over the course of two years on a cohort of 156 adolescents (mean age = 13.6 years) and also found significant weight-based similarities among adolescent friends.

It has long been recognized that race and ethnicity play an important role in organizing social groups across different types of relationships, including friendships (McPherson, Smith-Lovin & Cook, 2001). Both adolescents and adults are significantly more likely to report that their closest confidants and best friends are of the same race than a different race (Kao, & Joyner, 2004; McPherson, Smith-Lovin & Cook, 2001). Research also suggests that weight is perceived differently by different ethnic groups (Strauss, & Pollack, 2003). For example, the social marginalization of overweight children in this sample was most pronounced among non-Hispanic whites. The interaction between the racial/ethnic composition of friendship networks and weight is largely unexplored among AAPI individuals using SNA methodology.
**Weight-Related Behavior**

*Evidence of Homophily in Weight-Related Behaviors*

Shared weight-related behaviors within social groups may play an important role in explaining the existence of weight homophily. Choices about what to eat and whether to engage in physical activity are often made in a social context (e.g., friends deciding what restaurant to go to or whether to join a gym together). Sedentary behavior and poor diet choices have been consistently associated with a risk of weight gain and adiposity (Pereira et al., 2005; Hu, Li, Colditz, Willett, & Manson, 2003; Wareham, van Sluijs, & Ekelund, 2005). Much research employing SNA techniques has been conducted on physical activity and eating behavior among elementary and high-school aged children. A recent study of physical activity among school-aged children (n = 81; mean age = 7.96) participating in aftercare found that children did not form or dissolve friendships based on physical activity levels, but that existing friendships heavily influenced children’s physical activity levels (Gesell, Tesdahl, & Ruchman, 2012). Researchers found that the children consistently made adjustments to their activity level to more closely emulate that of their closest friends over the 12-week course of the study. Another recent study of physical activity among school-aged children (n = 986, aged 10-11) examined accelerometer counts per minute and mean minutes of moderate to vigorous physical activity per day among children and their friends (Macdonald-Wallis, Jago, Page, Brockman, & Thompson, 2011). For both indices, they found that children clustered in friendship groups with similar levels of physical activity.

Similar trends have been found among adolescent samples. Simpkins and colleagues (2013) found that adolescents (mean age = 15.97) in the Add Health study were more likely to be friends with peers who engaged in greater physical activity and who were similar to one another.
in BMI and physical activity. Using the same dataset, Fortin and Yazbeck (2011) investigated whether the effects of adolescent weight gain may result from shared eating habits. The authors found that an increase in a friends’ mean fast food consumption induced adolescent respondents to increase their own fast food consumption. This shared increase in fast food consumption was associated with a related increase in BMI.

Ali, Amialchuk, & Heiland (2011) considered eight weight-related behaviors in their analysis of the Add Health database: exercise frequency, sports participation, hours of screen viewing per week, hours of sleep, breakfast consumption, fast food consumption, fruit and vegetable consumption, and calorie-dense snack consumption. A significant positive association was found between individuals’ and friends’ behaviors in sports, exercise, and fast food consumption. There was no consistent evidence of peer effects on TV viewing, hours of sleep, or eating of breakfast, fruits and vegetables, and calorie dense snacks. The authors theorize that the lack of association in these areas may be a result of differences in the social context in which they are performed. Television viewing, eating breakfast, sleeping and much snack eating occurs primarily in the parents’ home, limiting the extent to which these behaviors are self-determined and observable by friends. In this respect, the college dormitory provides a unique environment wherein more aspects of health behavior are both self-directed and observable to peers than was previously possible for adolescents living at home.

Two notable studies have used innovative research designs to look at weight-related behaviors among college students living in dormitories. Madan, Moturu, Lazer & Pentland (2010) used co-location and communication sensors in mobile phones to model the diffusion of health-related behaviors among residents in an undergraduate residence hall. They found that the health behaviors of participants were correlated with the behaviors of peers to whom they were
exposed over long durations. Specifically, they found that frequent exposure (as determined using Bluetooth proximity measures) to peers who were overweight and obese or who had unhealthy dietary and physical activity habits influenced weight change.

To overcome some of the common confounds of observational SNA research, Yakusheva, Kapinos, & Weiss (2011) exploited the randomization of female freshman roommates to create a natural experiment examining peer effects in weight gain among roommates. Their findings indicated that the amount of weight gained during the freshman year was strongly, negatively correlated to the roommate’s initial weight. Though this finding may seem counterintuitive, the authors posit that it suggests female students who weigh slightly more may already be engaging in weight management behaviors, prior to college entry. Those behaviors may then influence their roommate and cause them to gain less weight. This is supported by their finding that female students tend to adopt some of their roommates’ weight-loss behaviors.

Using a randomized controlled trial, Centola (2011) has provided further evidence of endogenous peer effects in the adoption of health behavior in an internet-based social network. In this novel experiment, researchers manipulated the level of homophily in participants’ social networks by constructing two types of online social networking communities: homophilously structured populations in which individual traits (e.g., age, gender, BMI) were clustered, and unstructured populations in which participants were mixed at random, regardless of their individual characteristics. Results indicated that the adoption of a desired health behavior introduced by the researchers (the use of an online diet diary) was more than three times greater in the homophilously structured network than the unstructured network. Furthermore, within the homophilous condition, the fraction of obese adopters was significantly greater than the fraction
of non-obese adopters. This suggests that relative to their population sizes, homophilous networks promoted greater uptake of the behavior among obese individuals. This trend was not found, however, in the unstructured network. Indeed, no obese individuals in the unstructured network signed up for the diary.

Evidence suggests that AAPI cultures are more collectivist (emphasizing group cohesion and prioritizing group goals over individual goals) than Western cultures (McLaughlin & Braun, 1998). In the interdependent cultural outlook of many AAPI, social networks may play an especially important role in decisions about health behaviors (Nilchaikovit, Hill, & Holland, 1993). In collectivist societies, many decisions (including those related to health) are made not by individual, but by families and groups (McLaughlin & Braun, 1998). This difference in outlook may have an important impact on weight-related behavior among AAPI.

Furthermore, the acculturation process for AAPI living in the U.S. has a significant impact on weight, diet, and exercise (Davis et al., 2004). For example, the body mass indexes (BMIs) of immigrants from South and East Asia, as well as Polynesia, are generally higher than those of their counterparts in their countries of origin (Davis et al., 2004). There is clear evidence of differences in the environment and social norms surrounding food and exercise in “Westernized” cultures. In the face of aggressive food marketing and a lack of reinforcement of traditional diets, immigrant dietary patterns tend to change rapidly (Davis et al., 2004). Similar trends occur in physical activity as immigrants move toward the sedentary lifestyle common in the U.S. Indeed, research suggests that by the second generation, immigrants usually exhibit the same pattern of risk factors and diseases common to their new environment (Harrison et al., 2005). Further research is needed to better understand the mechanisms by which friendship networks influence weight-related behaviors among diverse ethnic groups.
Predictors of Weight Gain

To assess shared weight-related behaviors in social groups, the current study utilized evidence-based predictors of weight gain. To identify participants who are failing to meet guidelines for engagement in weight-related health behaviors, cutoff values for the recommended frequency and duration of each behavior were identified. Strong and consistent evidence has been found for both children and adults suggesting an association between screen time (viewing of television, movies, video games, computer use, etc.) and increased overweight and obesity (US Department of Agriculture and Health and Human Services [USDA/HHS], 2010). This relationship was especially strong for television viewing (USDA/HHS, 2010). A recent policy statement from the American Academy of Pediatrics on children, adolescents, and the media, recommends that adolescents limit their total entertainment screen to less than two hours per day (American Academy of Pediatrics, 2013).

A recent meta-analysis has also supported an association between sleep duration and weight (Patel & Hu, 2008). Across a sample of 36 cross-sectional and prospective studies in adults and children, the authors found a positive association between sleep duration and increased weight. Among adults, several studies have found a curvilinear association in which both very short and very long sleep durations were associated with obesity. Potential mechanisms for an association between long sleep duration and obesity include depression, low SES and societal isolation. A number of causal pathways are hypothesized linking short sleep duration and obesity, including increased hunger, increased opportunity to eat, altered thermoregulation, and increased fatigue. The National Heart, Lung, and Blood Institute (2011) recommends that adolescents sleep for eight to nine hours per day and that adults sleep for seven to eight hours per day. There is also strong evidence to support a relationship between physical
activity and the prevention of weight gain and regain (Saris et al., 2003). Adolescent physical activity may be particularly important in reducing the likelihood of transitioning to overweight as an adult (Menschik, Ahmed, Alexander, Blum, 2008). The Department of Health and Human Services (2008) recommends that adults engage in at least 150 minutes of moderate-intensity aerobic activity per week.

There is moderate evidence to support a relationship between skipping breakfast and increased risk for overweight and obesity (Niemeier, Raynor, Lloyd-Richardson, Rogers, & Wing, 2006; Timlin, Pereira, Story, & Neumark-Sztainer, 2008; USDA/HHS, 2010). Though support has been less consistent among young children and adults, there is considerable evidence of a strong relationship among adolescents and emerging adults (Niemeier et al., 2006; Timlin et al., 2008; USDA/HHS, 2010). Recent research has found that daily breakfast intake is strongly associated with reduced risk for a variety of metabolic conditions (Odegaard et al., 2013). Furthermore, there is strong and consistent evidence indicating that adults and children who regularly eat fast food are at increased risk of weight gain, overweight, and obesity (Niemeier et al., 2006; USDA/HHS, 2010). Fast food consumption more than twice per week has been associated with weight gain and insulin resistance in otherwise healthy young adults (Pereira et al., 2005). There is moderate evidence of an association between increased fruit and vegetable intake and lower body weight (USDA/HHS, 2010). The American Heart Association recommends that adults consume approximately four to five servings each of fruits and vegetables per day (Eckel et al., 2013). The consumption of sugar-sweetened beverages, conversely, is associated with increased body weight in adults (USDA/HHS, 2010). Consumption of one eight ounce sugar-sweetened beverage per day has been associated with an
increased risk for a variety of conditions including diabetes, coronary heart disease, and gout (de Koning et al., 2012; Fung et al., 2009; Malik et al., 2010).

Based on this evidence, the following areas of weight-related behavior were assessed: screen time, sleep, physical activity, breakfast consumption, fruit and vegetable consumption, fast food consumption, and sugar-sweetened beverage consumption.

Social Marginalization and Weight Stigma

Valente et al. (2009) and de la Haye et al. (2011) both cite the social marginalization of overweight peers as important factors contributing to the presence of weight-based similarities in social groups. De la Haye et al. notes that participants tended to nominate friends whose weight status was the same as their own and that non-overweight participants were particularly averse to befriending overweight peers. Two independent research groups examining the Add Health dataset provide further evidence of the social marginalization of overweight adolescents. These researchers found that although overweight adolescents listed similar (or greater) numbers of friends as normal weight adolescents, overweight adolescents received significantly fewer friendship nominations from others than were received by normal weight peers (Apolloni, Marathe, & Pan, 2011; Strauss & Pollack, 2003). Taken together, these findings suggest that weight-based similarities are commonly found within social groups and that social discrimination against overweight peers may play a role in this process.

From 1995 to 2006, self-reported discrimination based on body size increased 66% in the United States (Andreyeva, Puhl, & Brownell, 2008). Weight-based discrimination is theorized to result from widespread obesity stigma (negative attitudes and beliefs about obesity) and is known to result in a range of negative psychosocial outcomes (Schafer & Ferrero, 2011). In Goffman’s (1963) seminal work on stigma theory he describes stigma as an undesirable,
discrediting attribute that is incongruous with stereotypes of normality and thus disqualifies the individual from full social acceptance. This devaluing characteristic is often so powerful that it overshadows all other traits in one’s identity (Goffman, 1963). Thus, possessing a stigmatizing trait, such as being overweight, has the potential to significantly shape the process of identity formation.

Social identity theory, which explores the relationship between self-conception and group membership, group processes, and intergroup relationship, explicitly highlights the evaluative nature of identity formation (Hogg, 2006; Luhtanen & Crocker, 1992). One of the fundamental components of social identity is the notion of an “in-group bias” that leads individuals in distinct groups to view themselves in a positive (sometimes preferential) light when compared with “out-groups” (Crocker & Major, 1989). While research has supported the existence of in-group bias among many stigmatized groups, overweight individuals have been found to lack in-group preference (Tajfel & Turner, 1986). Indeed, a growing body of research has found that many overweight individuals exhibit significant anti-fat bias on both implicit and explicit measures (Grover, Keel, & Mitchell, 2003; Wang, Brownell, & Wadden, 2004).

Little research has explored the social dynamics of weight-based stigma and discrimination in a social network analysis framework. A recent study conducted by Hruschka, Brewis, Wutich, and Morin (2011) tested the hypothesis that shared body size norms plays a role in the “social contagion” of body size and obesity. In this study, the authors collected data from 101 adult women and 812 of their social ties in order to assess the indirect effect of social norms on shared BMI. Opinions about body size and the acceptability of obesity were measured using the Figural Rating Scale as well as an anti-obesity preference measure and an anti-fat stigma measure developed for use in this study. Results revealed that body size norms accounted for
only 20% of variation in social clustering of BMI and obesity. A major limitation noted by the investigators, however, is the use of measures of stigma and anti-obesity attitudes that may be “unreliable or inappropriate.” Further research is needed in this area using reliable and validated measures of weight-related stigma and discrimination.

There is evidence of differences in weight-based social marginalization between ethnic minority groups. In a study conducted by Strauss and Pollack (2003), the marginalization of overweight children was most pronounced among non-Hispanic Whites. An extensive body of research also supports the notion that there may be significant differences in body ideal and body image among ethnic groups in the United States. Native Hawaiians and other Pacific Islanders, for example, have historically valued a larger body ideal than is common in Western culture (Schembre, Nigg, & Albright, 2011). Such differences may play an important role in the perceived acceptability of overweight and obesity in these groups, and thus impact tolerance for the discrimination and marginalization of overweight peers. Research also suggests that ideas about weight and body image may be significantly impacted by acculturation. A notable qualitative study conducted by Anne Becker (2004) demonstrated a dramatic and rapid shift in ideas expressed about weight, body shape, and body disparagement among Fijian girls following the introduction of Western television. However, our understanding of the social dynamics of weight-based stigma and discrimination among ethnically diverse young adults is incomplete.

**College Student Obesity**

Emerging adulthood, the period of development from age 18 to 25, has been cited by some researchers as a time of particular vulnerability to negative changes in diet, physical activity, and weight (Nelson, Story, Larson, Neumark-Sztainer, & Lytle, 2008). Several national surveys and longitudinal studies have provided evidence of an increased risk for excess weight
gain in this age group (Burke et al., 1996; Gordon-Larsen, Adair, Nelson, & Popkin, 2004; Mokdad et al., 1999). Analyses of the Add Health dataset, for example, have shown that a high proportion of adolescents become obese and stay obese into adulthood (Gordon-Larsen et al., 2004). The 5-year incidence of becoming obese in this age group was nearly 13% while only 1.6% of participants transitioned from obesity to non-obesity. Cohort data from Add Health also shows a decrease in individuals meeting national guidelines for physical activity from 33.6% as adolescents to only 12.7% as young adults. Furthermore, declines have been shown in overall diet quality and variety. Results from national survey data indicate that young adults are among the highest consumers of fast food, a behavior linked with poor diet quality and weight gain (Paeratakul, Ferdinand, Champagne, Ryan, & Bray, 2003).

Forty-two percent of Americans in this critical age group are enrolled in postsecondary education (Snyder & Dillow, 2012). Much research has indicated that trends toward unhealthy behavior and weight gain may be exacerbated by college enrollment (Desai, Miller, Staples, & Bravender, 2008; Nelson et al., 2008; Pliner & Saunders, 2008). A recent meta-analysis of 24 studies of weight gain during the first year of college revealed a mean weight gain of 3.86 pounds across studies (Vella-Zarb & Elgar, 2008). Female students may be particularly vulnerable to these effects according to one study that found young women who leave home for college are 3-5 times more likely to gain 15% or more of their ideal body weight as compared to females who did not leave home (Hovell, Mewborn, Randle, & Fowler-Johnson, 1985). Pliner & Saunders (2008) found that among freshmen at the University of Toronto, those living on campus and those who indicated that they were restrained eaters (individuals who chronically attempt to restrict the amount they eat) were the most vulnerable to weight gain. The apparent susceptibility of college students (particularly those living on campus) to weight gain suggests
that further research is needed on this population to fully understand the etiological factors contributing to this trend.

**Summary and Aims**

Overweight and obesity in the United States presents a substantial public health concern. Some evidence suggests that there may be differences in weight, weight-related behaviors, and weight-related attitudes among different ethnic minority groups, but this area is need of further research. Asian Americans and Pacific Islanders represent an understudied but growing population in the U.S. that is vulnerable to the harmful effects of overweight and obesity. To address this significant problem, there is a clear need for effective physiological and psychological interventions. A necessary precursor to the development of such interventions is a complete and accurate understanding of the causal and maintenance factors connected with weight gain. Social network analysis is a powerful methodology for the examination of the social factors associated with many facets of weight gain.

The purpose of this study is to use social network analysis to examine the influence of social dynamics on weight, weight-related behaviors, and weight-related attitudes within the friendship networks of college dorm residents at UH Mānoa. The examination of ethnically diverse friendship networks may offer key insights into the social features associated with weight gain and how they may be utilized to effectively develop and disseminate culturally-sensitive interventions. The specific aims for this research project are as follows:

*Specific Aim 1:* To examine the distribution of body mass index (BMI; kg/m²) within the ethnically diverse social network of students living in a University of Hawai‘i residence hall. It is hypothesized that participants will (1) interact most frequently with and (2)
perceive themselves as being closest to individuals of a similar BMI to their own. We further hypothesize that BMI will vary by race/ethnicity.

Specific Aim 2: To examine weight-related behavior in the social network of students living in a residence hall. We will assess eating disordered behavior and student engagement in empirically-supported behaviors predictive of weight gain, overweight and obesity. It is hypothesized that participants will (1) interact most frequently with and (2) perceive themselves as being closest to individuals who share similar weight-related behavior patterns. We further hypothesize that weight-related behaviors will vary by race/ethnicity.

Specific Aim 3: To examine attitudes about overweight and obesity within the social network of students living in a residence hall. We will assess the degree to which respondents believe negative stereotypes and statements about overweight and obese individuals. It is hypothesized that participants will (1) interact most frequently with and (2) perceive themselves as being closest to individuals who share similar beliefs about the acceptability of overweight and obesity. We further hypothesize that negative attitudes about weight will vary by race/ethnicity.

Methods

Participants

Approximately 25% of UH Mānoa’s 19,507 enrolled students live in on-campus housing (U.S. News & World Report, 2014). The campus’s seven residence halls comprise roughly two-thirds of all on-campus accommodations. Participants were recruited from the Hale Laulima residence hall, a coeducational facility that housed 131 graduate and undergraduate students in Fall 2014. Hale Laulima has four floors of student residences. Each floor houses students of both
genders. Roommates that are cohabitating must be of the same gender. With the cooperation of the residence director, the residents of the dormitory were invited to participate in the study. All student residents were eligible to participate. Participants completed a battery of web-based questionnaires and were given a five-dollar Amazon gift card. One hundred and five surveys were initiated by participants. Of these, 94 surveys were completed. Four of these completed surveys were identified as duplicate entries by the same students. Ninety participants were included in the final analyses, representing 69% of all the students living in the residence hall. Mean age of participants was 21.30 years ($SD=2.46$) and the mean BMI was 24.53 ($SD=6.48$). The distribution of participants’ gender, ethnicity, BMI category, and grade level are reported in Table 1.

**Table 1. Demographic characteristics of participants**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>52 (58%)</td>
</tr>
<tr>
<td>Male</td>
<td>38 (42%)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>37 (41%)</td>
</tr>
<tr>
<td>Asian</td>
<td>26 (29%)</td>
</tr>
<tr>
<td>Mixed Ethnicity</td>
<td>10 (11%)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>5 (6%)</td>
</tr>
<tr>
<td>Native Hawaiian/Other Pacific Islander</td>
<td>6 (7%)</td>
</tr>
<tr>
<td>Black/African American</td>
<td>2 (2%)</td>
</tr>
<tr>
<td>Other</td>
<td>1 (1%)</td>
</tr>
<tr>
<td>Missing</td>
<td>3 (3%)</td>
</tr>
<tr>
<td>BMI Category</td>
<td></td>
</tr>
<tr>
<td>Underweight</td>
<td>3 (3%)</td>
</tr>
<tr>
<td>Normal Weight</td>
<td>59 (66%)</td>
</tr>
<tr>
<td>Overweight</td>
<td>18 (20%)</td>
</tr>
<tr>
<td>Obese</td>
<td>10 (11%)</td>
</tr>
<tr>
<td>Grade Level</td>
<td></td>
</tr>
<tr>
<td>Sophomore</td>
<td>32 (36%)</td>
</tr>
<tr>
<td>Junior</td>
<td>32 (36%)</td>
</tr>
<tr>
<td>Senior</td>
<td>21 (23%)</td>
</tr>
<tr>
<td>Graduate Student</td>
<td>4 (4%)</td>
</tr>
<tr>
<td>Unclassified</td>
<td>1 (1%)</td>
</tr>
</tbody>
</table>
Measures

Demographic Questionnaire. A 17-item questionnaire was administered to gather demographic information from participants on background characteristics including age, gender, race/ethnicity, height, weight, and grade level. BMI was calculated using participants’ self-reported height and weight.

Acculturation. Acculturation was measured with two items on the demographics questionnaire assessing what language is spoken in the home and which generation (1st through 5th) best applies to the respondent. Items were adapted from the Acculturation Rating Scale for Mexican Americans-II (ARSMA; Cuellar, Arnold, & Maldonado, 1995). These items were adapted from the Mexican Orientation Subscale of the ARSMA, which has demonstrated good internal reliability (Cronbach’s Alpha = .88) and construct validity in a sample of 379 Mexican Americans of mixed generations (Cuellar, Arnold, & Maldonado, 1995).

Sociometric Questionnaire. A sociometric questionnaire was administered to gather information on each participant’s social network. This 8-item measure asks participants to list the first and last names of every student resident in Hale Laulima whom they consider to be an acquaintance (defined here as a person they would recognize and have spoken with at least once). For each person identified, the respondent was asked to describe the closeness of their relationship on three dimensions: a binary measure indicating whether they consider the person to be an acquaintance or a friend, an ordinal measure indicating the closeness of their relationship (1 = I do not feel close to this person, 4 = I feel very close to this person), and an ordinal measure of interaction frequency over the past 6 months (1 = Not at all, 5 = About daily). For analyses, the interaction frequency measure was converted into a binary measure where 0 = Infrequent Interaction (Not at all to Monthly) and 1 = Frequent Interaction (About weekly to
Respondents were also be asked to identify individuals with whom they commonly eat meals or engage in physical activity. Items were developed based on a review of SNA literature and recommendations for SNA data collection methods suggested by Borgatti et al. (2013).

*The Eating Attitudes Test-26 (EAT-26).* The EAT-26 (Garner, Olmstead, Bohr, & Garfinkel, 1982) is a 26-item self-report questionnaire derived from the Eating Attitudes Test (Garner & Garfinkel, 1979), assessing general eating disorder pathology. Items assess the frequency of eating disorder-related thoughts and behaviors using a 6-point Likert-type scale (1 = *Never*, 6 = *Always*), with higher scores reflecting greater symptomology (e.g., “I am terrified about being overweight”). Scores may range from 0 to 78, with a cutoff score of 20 used to identify persons with problematic attitudes and behaviors toward eating (Garner et al., 1982). Garner and colleagues (1982) have published norms for the EAT-26 based on a sample of anorexic participants and healthy female controls. The mean total scores were 33.7 (SD=18.7) for anorexic-restricting subtype participants, 38.5 (SD=15.0) for anorexic-binge/purge subtype participants, and 9.9 (SD=9.2) for healthy female comparison participants (Garner et al., 1982).

Measures of internal consistency from several studies have found Cronbach’s alpha coefficients ranging from .87 to .90 (Banasiak, Wertheim, Koerner, & Voudouris, 2001; Miller, Schmidt, Vaillancourt, McDougall, & Voudouris, 2001; Russell & Keel, 2002). Banasiak and colleagues (2001) found a 4 to 5 week test-retest reliability coefficient of .89 (Banasiak et al., 2001). Total scores on the EAT-26 correlate strongly with eating disorder status (Mintz & Halloran, 2002) and the Drive for Thinness and Bulimia subscales of the EDI (Brookings & Wilson, 1994; Miller et al., 2001). Assessments of discriminant validity have established the EAT-26 as solely a measure of disturbed eating behavior and not a measure of associated
psychopathology (Garfinkel & Newman, 2001). As eating disorder symptomology may affect participants’ weight, weight-related behavior, and views on obesity, the EAT-26 was used to identify participants with disturbed eating behavior.

The Anti-Fat Attitudes Questionnaire (AAQ). The AAQ is a 13-item scale designed to measure personal negative attitudes related to fat (Crandall, 1994). Items assess agreement with statements about fat using a 10-point Likert-type scale (0 = Very strongly disagree, 9 = Very strongly agree), with higher scores reflecting greater anti-fat attitudes (e.g., “I really don’t like fat people much”). Total scores range from 0 to 117. The measure is comprised of three subscales: Dislike of Fat People, Fear of Fat (i.e., individual’s concern about weight), and Willpower (i.e., individual’s belief in the controllability of weight). For the current research, only the total score was used in analyses. In a sample of undergraduate psychology students, mean scores for the Dislike subscale ranged from 1.85 to 2.47, from 5.65 to 6.12 on Willpower and 3.55 to 6.78 on Fear of Fat (Crandall, 1994). The scale has demonstrated adequate validity and reliability with subscale alpha coefficients ranging from .66 to .84 (Crandall, 1994). The AAQ was used to assess general obesity stigma.

The Weight Bias Internalization Scale-Modified (WBIS-M). The original WBIS is an 11-item measure of the degree to which overweight respondents believe that negative stereotypes and statements about overweight and obese individuals apply to themselves (Durso & Latner, 2008). For the current study, a modified version of the WBIS (WBIS-M) was used that has been validated for use among individuals across different body weight statuses (Pearl & Puhl, 2013). Items assess agreement with self-directed statements about weight and weight stereotypes on a 7-point Likert scale (1 = Strongly disagree, 7 = Strongly agree), with higher scores reflecting greater weight bias internalization (e.g., “I feel anxious about my weight because of what people
might think of me”). Scores on the WBIS-M were found to be higher among participant with higher BMIs and higher self-perceived weight statuses. Total scores may range from 11 to 77. The WBIS-M was validated in a sample of 150 U.S. adults of varying body weights. Pearl & Puhl’s (2013) analysis found psychometric properties of the WBIS-M that are comparable to the original WBIS. The mean score on the WBIS-M was 3.27 (SD=1.50). The WBIS-M demonstrated good predictive value for outcomes such as body dissatisfaction, drive for thinness, and binge eating. The WBIS-M was also found to have predictive value above AAQ scores, indicating the discriminant value of self-directed stigma versus stigmatizing attitudes toward others.

**Negative Health Behavior Questionnaire (NHBQ).** A health behavior questionnaire was administered to assess engagement in weight-related behaviors. Items for this measure were selected to reflect current literature on behavioral predictors of weight gain, overweight and obesity. Items were included to assess the following areas: screen time, sleep, physical activity, breakfast consumption, fruit and vegetable consumption, fast food consumption, and sugar-sweetened beverage consumption. To address each of these predictors, 9 items were adapted from two nationally administered surveys of behavioral health risk factors: the Behavioral Risk Factor Surveillance System (BRFSS) and the Youth Risk Behavior Surveillance System (YRBSS) (Centers for Disease Control and Prevention, 2013a; Centers for Disease Control and Prevention, 2013b). Participants were asked to indicate their frequency of engaging in each health behavior in terms of hours per day (e.g., hours of television viewing), number of times per day (e.g., number of times eating fruit per day), or number of days per week (e.g., number of days breakfast was eaten in the past seven days).
For analytic purposes, each variable was dichotomized to indicate whether the participant’s reported behavior was consistent with the evidence-based health guidelines discussed previously. Respondents received a one if their response was below recommended standards and a zero if their behavior met recommended standards. This produced an NHBQ Total Score ranging from 0 to 8, where higher scores indicate poorer compliance with recommended health behaviors. The scoring guidelines used to dichotomize NHBQ variables are described in Table 2.

**Table 2.** NHBQ scoring guidelines

<table>
<thead>
<tr>
<th>Health Behavior</th>
<th>Scoring Cut-Off Value¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screen time</td>
<td>≥ 2 hours per day</td>
</tr>
<tr>
<td>Sleep</td>
<td>&lt; 7 hours per day or &gt; 9 hours per day</td>
</tr>
<tr>
<td>Physical activity</td>
<td>&lt; 135 minutes per week</td>
</tr>
<tr>
<td>Breakfast consumption</td>
<td>&lt; 5 days per week</td>
</tr>
<tr>
<td>Fruit consumption</td>
<td>&lt; 4 servings per day</td>
</tr>
<tr>
<td>Vegetable consumption</td>
<td>&lt; 4 servings per day</td>
</tr>
<tr>
<td>Fast food consumption</td>
<td>&gt; 3 times per week</td>
</tr>
<tr>
<td>Sugar-sweetened beverage consumption</td>
<td>≥ 1 time per day</td>
</tr>
</tbody>
</table>

¹ Values meeting these cut-off criteria were scored as a 1, values outside of this range were scored as a 0. Higher values on this measure = poorer health guideline compliance

The Center for Epidemiological Studies-Depressed Mood Scale (CES-D). The CES-D is a 20-item scale designed to measure depression in general and clinical populations (Radloff, 1977). Items assess the frequency of thoughts and behaviors in the past week using a 4-point Likert-type scale (1 = Rarely or none of the time [less than 1 day], 4 = Most or all of the time [5-7 days]), with higher scores reflecting greater symptomology (e.g., “During the past week, I was bothered by things that usually don’t bother me”). Scores range from 0 to 60, with a cutoff score of 16 used to identify persons at risk for clinical depression. Radloff (1977) has published norms for the CES-D based on a sample of both clinical and community participants. The mean total scores for respondents from the general population ranged from 7.94 to 9.25. The mean score for psychiatric patients was 24.42.
Measures of internal consistency have found Cronbach’s alpha coefficients of approximately .85 for the general population and .90 for the psychiatric population. Test-retest coefficients for the CES-D range from .51 to .67 (tested from two to eight weeks) and .32 to .54 (tested over 3 months to one year). The CES-D correlates significantly with a number of other depression and mood scales. The CES-D discriminates well between individuals in the general population who state that they “need help” and those that did not. As depression may cause changes in appetite and lead to weight change, the CES-D was used to identify participants with symptoms of depression (Blaine, 2008).

Statistical Analyses

Statistical analyses were conducted with UCINET (Borgatti, Everett, & Freeman, 2002), a software package for the analysis of social network data. Additional analyses were performed using SPSS 20.0. Residence hall acquaintances (alters) identified by participants (actors) in a free-response format were prepared for analysis by identifying the full name of each alter and assigning him or her an alphanumerical code. Alters that could not be identified or matched with a complete name were excluded from analyses. Of the 388 non-unique alters listed in response to the sociometric questionnaire, 29 (7.4%) could not be identified and were excluded. In total, 90 of the 131 (69%) student residents completed the questionnaire battery. Current literature suggests that a minimum of 70% of network members is considered acceptable for most analyses that are robust to missingness (Honeycutt, 2014). As our sample represents approximately 70% of the residence hall population, the decision was made to use the data in their original form without imputation.

Using data gathered from the sociometric questionnaire, three matrices were created to describe the closeness of relationships within the residence hall: a friendship network (a binary
variable identifying alters who are considered friends), a tie strength network (a weighted
variable identifying the self-reported closeness of relationships with alters on a 1-4 scale), and an
interaction frequency network (a binary variable identifying alters with whom the respondent
interacts frequently [weekly to daily] or infrequently [monthly to <monthly]). BMI was
measured using self-reported height and weight data from the demographic survey. Weight-
related attitudes and eating pathology were measured by calculating a total score for the AAQ,
WBIS, and EAT. Weight-related behaviors were measured by calculating a total score on the
NHBQ. Descriptive statistics were calculated for all attribute variables and an independent
sample t-test was used to examine whether any significant differences by gender were present in
the mean scores. To examine the hypothesis that outcomes would vary by ethnicity, a one-way
between subjects ANOVA was conducted to compare the effect of ethnicity on BMI, weight-
related behaviors and weight-related attitudes.

Descriptive network analyses were performed to characterize the nature of the friendship
network as a whole. Measures of centrality and cohesion were calculated, including mean degree
centrality, network density, mean geodesic distance, network diameter, a weighted clustering
coefficient, number of cliques, and arc and dyad reciprocity. Centrality, a measure of an
individual’s social power, is one of the fundamental properties of social network structures
(Hanneman & Riddle, 2005). Degree centrality measures social power by counting the number
of ties each actor has to other members of the network. The friendship network in this research is
considered to be a “directed” network as opposed to an “undirected” network because each tie
cannot be assumed to be reciprocal. For example, Jane may consider John to be a friend, but
John may only think of Jane as an acquaintance. Therefore, degree centrality can be measured in
both in-degree (how many people listed this individual as a friend) and out-degree (how many people did this individual list as a friend).

Another important metric for characterizing networks is cohesion, how well connected are network members with one another. The density of a network is the proportion of all possible ties that are actually present (Hanneman & Riddle, 2005). Another way of assessing network cohesion is through geodesic distance, the number of relations in the shortest possible walk from one actor to another. For example, if Jane were directly friends with John, the geodesic distance between them would be one. If Jane were friends with Donna, who is friends with John, the geodesic distance between Jane and John would be two. The diameter of the network refers to the longest geodesic distance between any two actors. The overall network clustering coefficient refers to the average density of all neighborhoods (the dyads and triads in which each actor is involved) of all actors (Hanneman & Riddle, 2005). It describes the extent to which members of a given network tend to cluster together into smaller groups.

A weighted clustering coefficient assigns weight to the neighborhood densities according to their size such that actors with larger neighborhoods are given more weight in computing the average density (Hanneman & Riddle, 2005). Another way of looking at a tendency toward clustering is to identify the number of cliques within a network. The strictest definition of a clique refers to a network substructure wherein all members have all possible ties to one another present (Hanneman & Riddle, 2005). The smallest possible unit for a clique would be two actors (a dyad). More commonly, however, one is interested in groups of three (a triad) or more. The final cohesion metric that was calculated is reciprocity, which examines the extent to which directed ties are reciprocated. Reciprocity can be considered in terms of arc reciprocity (what
percentage of all possible ties are part of reciprocated structures?) or dyad reciprocity (what proportion of pairs have a reciprocated tie between them?).

The extent to which BMI, weight-related behaviors, and weight-related attitudes, were related to measures of closeness was assessed using network autocorrelation. Coefficients of Moran’s $I$ describe the autocorrelation between actors’ scores on attribute measures and the network distance between them (Hanneman & Riddle, 2005). Moran’s $I$ coefficients range from -1.0 to 1.0, with -1.0 indicating a perfect negative correlation, 0 indicating no correlation, and 1.0 indicating a perfect positive correlation. Positive autocorrelations exist when actors who share a similar attribute value tend to be adjacent. Moran statistics are sensitive to “global” differences (i.e., how similar or dissimilar each pair is to the overall average; Hanneman & Riddle, 2005).

Multiple Regression-Quadratic Assignment Procedure (MR-QAP) was used to assess the impact of measures of closeness on BMI, weight-related behaviors, and weight-related attitudes. Control variables incorporated in the model included gender and ethnicity. QAP regression employs matrices of relations to represent variables. Unlike in a standard regression where the unit of analysis is an individual observation, the unit of analysis for a QAP regression is a dyad (a pair of individuals who may or may not be connected; Krackhardt, 1987). Information about individual attributes can be analyzed by representing them in a relational format. For example, to examine the relationship between BMI and measures of closeness, BMI was represented in a matrix format where each cell indicates the absolute difference in BMI between the individuals in that dyad. A measure of absolute difference was also used to analyze scores on the AAQ, WBIS, EAT, and CES-D. An exact matching procedure was used for categorical variables, in which a 1 is assigned if the dyad shares the same variable category and a 0 is assigned if they do not. This approach was used to represent gender and ethnicity in matrix format. A Relational
Contingency Table (RCT) analysis was performed to test the autocorrelation for the friendship adjacency matrix when partitioned by gender. An RCT analysis is analogous to a standard chi squared test except that the underlying distribution is constructed using a randomization procedure instead of traditional chi squared distribution (Borgatti, Everett, & Freeman, 2002). In the present research, this analysis was used to examine whether patterns of friendships within and between genders were significant different than expected under a model of independence. Based on the results of this analysis, additional analyses were conducted wherein the closeness matrices were partitioned into subgraphs representing only within-gender friendships.

For all inferential analyses, significance testing was performed using permutation tests. When analyzing network data, traditional significance testing is generally not appropriate. Classical significance testing is based on an assumption of statistical independence that is violated by the relational nature of network data (Borgatti, Everett, & Johnson, 2013). Network data also often violates the assumption of a normal distribution of data (Borgatti, Everett, & Johnson, 2013). An alternative approach uses the methodology of randomization tests (permutation tests) to modify standard methods like correlation and regression. For example, a permutation test for a correlation would produce thousands of random variations of possible outcomes for the observed data. The test would answer the question of how likely it is to see the observed correlation even if the values of the variable had been assigned independently of one another (Borgatti, Everett, & Johnson, 2013). Permutation tests produce a $p$-value that can be interpreted analogously to a traditional significance test.

**Results**

Descriptive statistics for the valid data are shown for the overall population and separated by gender in Table 3. Independent sample $t$-tests found that women had a higher average BMI
(25.59 vs. 23.09, p=0.045) and scored significantly higher on average than men on the EAT (9.49 vs. 5.56, p=0.034) and the WBIS (34.18 vs. 23.68, p<0.001).

**Table 3.** Descriptive statistics for participants with valid data

<table>
<thead>
<tr>
<th>Measure</th>
<th>All (n = 90)</th>
<th>Men (n = 38)</th>
<th>Women (n = 52)</th>
<th>p$^1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAQ Total Score</td>
<td>36.13</td>
<td>32.70</td>
<td>38.83</td>
<td>25.60</td>
</tr>
<tr>
<td>WBIS Total Score</td>
<td>29.66</td>
<td>23.68</td>
<td>34.18</td>
<td>16.07</td>
</tr>
<tr>
<td>EAT Total Score</td>
<td>7.78</td>
<td>5.93</td>
<td>9.49</td>
<td>10.48</td>
</tr>
<tr>
<td>CES-D Total Score</td>
<td>14.81</td>
<td>13.00</td>
<td>16.13</td>
<td>11.21</td>
</tr>
<tr>
<td>NHBQ Total Score</td>
<td>4.08</td>
<td>4.39</td>
<td>3.86</td>
<td>1.32</td>
</tr>
<tr>
<td>BMI</td>
<td>24.53</td>
<td>23.09</td>
<td>25.59</td>
<td>7.90</td>
</tr>
</tbody>
</table>

Bolded values = $p \leq 0.05$

$^1$ independent sample t-tests for difference by gender.

A one-way ANOVA was conducted to assess the effects of ethnicity on BMI, weight-related behaviors, and weight related attitudes. Results demonstrated a significant effect of ethnicity on BMI (F[6, 80]=5.84, p<0.001). Post hoc comparisons using the Tukey HSD test indicated that the mean BMI for Pacific Islanders/Native Hawaiians (M=37.22, SD=15.31) was significantly higher than the mean BMI of Asian (M=22.61, SD=4.61), White (M=23.36, SD=4.00), Mixed Race (M=25.61, SD=4.46), and Latino (M=24.88, SD=3.12) participants. No significant differences by ethnicity were found for any measures of weight-related behaviors or attitudes.

**Table 4.** Friendship network descriptive characteristics

<table>
<thead>
<tr>
<th>Network Characteristic</th>
<th>Value</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Out-Degree</td>
<td>1.558</td>
<td>2.229</td>
</tr>
<tr>
<td>Mean In-Degree</td>
<td>1.558</td>
<td>1.725</td>
</tr>
<tr>
<td>Network Density</td>
<td>0.017</td>
<td>0.131</td>
</tr>
<tr>
<td>Mean Geodesic Distance</td>
<td>5.000</td>
<td>2.800</td>
</tr>
<tr>
<td>Network Diameter</td>
<td>15.000</td>
<td>N/A</td>
</tr>
<tr>
<td>Weighted Clustering Coefficient</td>
<td>0.244</td>
<td>N/A</td>
</tr>
<tr>
<td>Cliques of size 3+</td>
<td>33.000</td>
<td>N/A</td>
</tr>
<tr>
<td>Arc Reciprocity</td>
<td>0.428</td>
<td>N/A</td>
</tr>
<tr>
<td>Dyad Reciprocity</td>
<td>0.272</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Figure 1 displays the acquaintanceship network of Hale Laulima. Basic measures of cohesion and centrality for the friendship network are reported in Table 4. The mean in-degree and out-degree for this network are both small with a low standard deviation, indicating that most network members have relatively few ties in either direction. The density of this friendship network shows that 1.7% of all possible ties are present. The mean geodesic distance of this network (M=5.000, SD=2.800) indicates that on average the optimal path between any two actors involves five other individuals. The overall weighted clustering coefficient of 0.244 represents the average of the densities of the neighborhood of all of the egos. Thirty-three cliques with a minimum size of three were identified in this network. The largest cliques identified contained only five members per group. The reciprocity statistics indicate that 43% of all relations within the network are parts of reciprocated ties, while only 27% of the pairs have a reciprocated connection.

**Table 5. Moran’s I autocorrelation of actor attributes and closeness networks**

<table>
<thead>
<tr>
<th>Actor Attribute</th>
<th>Moran’s I (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Friendship Network</strong></td>
<td></td>
</tr>
<tr>
<td>AAQ Total Score</td>
<td>0.004 (0.419)</td>
</tr>
<tr>
<td>NHBQ Total Score</td>
<td><strong>0.242 (0.003)</strong></td>
</tr>
<tr>
<td>BMI</td>
<td><strong>0.169 (0.026)</strong></td>
</tr>
<tr>
<td><strong>Tie Strength Network</strong></td>
<td></td>
</tr>
<tr>
<td>AAQ Total Score</td>
<td><strong>0.134 (0.019)</strong></td>
</tr>
<tr>
<td>NHBQ Total Score</td>
<td><strong>0.230 (0.001)</strong></td>
</tr>
<tr>
<td>BMI</td>
<td><strong>0.201 (0.010)</strong></td>
</tr>
<tr>
<td><strong>Interaction Frequency Network</strong></td>
<td></td>
</tr>
<tr>
<td>AAQ Total Score</td>
<td><strong>0.104 (0.043)</strong></td>
</tr>
<tr>
<td>NHBQ Total Score</td>
<td><strong>0.219 (0.003)</strong></td>
</tr>
<tr>
<td>BMI</td>
<td><strong>0.138 (0.025)</strong></td>
</tr>
</tbody>
</table>

Bolded values = \( p \leq 0.05 \)

Moran’s I statistics for BMI, weight-related attitudes, and weight related behaviors and measures of closeness are displayed in Table 5. Moran’s I autocorrelation analyses found a positive, statistically significant relationship between closeness and the AAQ, NHBQ, and BMI.
across all closeness networks, with the exception of the correlation between the AAQ and friendship network \((p = 0.419)\).

### Table 6. QAP Regression coefficients with friendship as an independent variable

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Predictor</th>
<th>(B)</th>
<th>(SEB)</th>
<th>(\beta^1)</th>
<th>(R^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AAQ Total Score</strong></td>
<td>Friendship</td>
<td>0.80440</td>
<td>2.88541</td>
<td>0.00578</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>Gender(^b)</td>
<td>0.39584</td>
<td>0.65614</td>
<td>0.01059</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ethnicity(^b)</td>
<td>1.24682</td>
<td>1.57135</td>
<td>0.03007</td>
<td></td>
</tr>
<tr>
<td><strong>WBIS Total Score</strong></td>
<td>Friendship</td>
<td>0.12193</td>
<td>2.14095</td>
<td>0.00120</td>
<td>0.002</td>
</tr>
<tr>
<td></td>
<td>Gender(^b)</td>
<td>-1.23316</td>
<td>0.52363</td>
<td>-0.04602*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ethnicity(^b)</td>
<td>0.31402</td>
<td>1.11071</td>
<td>0.01064</td>
<td></td>
</tr>
<tr>
<td><strong>EAT Total Score</strong></td>
<td>Friendship</td>
<td>-0.41025</td>
<td>1.68475</td>
<td>-0.00554</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Gender(^b)</td>
<td>0.33432</td>
<td>0.38114</td>
<td>0.01749</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ethnicity(^b)</td>
<td>0.14055</td>
<td>0.98326</td>
<td>0.00672</td>
<td></td>
</tr>
<tr>
<td><strong>NHBQ Total Score</strong></td>
<td>Friendship</td>
<td>-0.14610</td>
<td>0.18608</td>
<td>-0.01594</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Gender(^b)</td>
<td>-0.02355</td>
<td>0.05283</td>
<td>-0.00968</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ethnicity(^b)</td>
<td>-0.00346</td>
<td>0.10302</td>
<td>-0.00129</td>
<td></td>
</tr>
<tr>
<td><strong>BMI</strong></td>
<td>Friendship</td>
<td>-0.88293</td>
<td>1.16431</td>
<td>-0.01606</td>
<td>0.019</td>
</tr>
<tr>
<td></td>
<td>Gender(^b)</td>
<td>0.45683</td>
<td>0.31821</td>
<td>0.03168**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ethnicity(^b)</td>
<td>-2.17148</td>
<td>0.73609</td>
<td>-0.13550**</td>
<td></td>
</tr>
</tbody>
</table>

\(^a\)Variable = absolute difference in total score, \(^b\)Variable = presence or absence of an exact match on variable category.

\(^1\)Negative coefficients = positive relationship between variables (increased similarity on IV predicts a smaller absolute difference in the DV), \(* = p \leq 0.05, ** = p \leq 0.01, *** = p \leq 0.001\)

A QAP regression was run to examine the relationship between closeness and being roommates. Being roommates was found to significantly predict friendship \((\beta = 0.36195, p=0.005)\). QAP regressions were run to determine if BMI, weight-related behaviors, and weight-related attitudes were predicted by familiarity with alters as indicated by three different measures of closeness: friendship, tie strength, and interaction frequency. Separate regression analyses were run for each measure of closeness and weight-related variable. Gender and ethnicity were entered as control variables. Results from these regressions are presented in Table 6, 7, and 8. Across all models, only gender and ethnicity were found to be significant predictors of weight-related variables. A significant, negative relationship was found between exact match on both
gender and ethnicity and the absolute difference in WBIS score across all measures of closeness.

A significant, positive relationship was found between exact match on both gender and BMI across all measures of closeness.

**Table 7. QAP Regression coefficients with tie strength as an independent variable**

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Predictor</th>
<th>B</th>
<th>SEB</th>
<th>β²</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AAQ Total Score</strong>a</td>
<td>Tie Strength</td>
<td>-0.20024</td>
<td>1.03779</td>
<td>-0.00419</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>Genderb</td>
<td>0.41291</td>
<td>0.66807</td>
<td>0.01105</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ethnicityb</td>
<td>1.24757</td>
<td>1.48490</td>
<td>0.03009</td>
<td></td>
</tr>
<tr>
<td><strong>WBIS Total Score</strong>a</td>
<td>Tie Strength</td>
<td>-0.33880</td>
<td>0.73227</td>
<td>-0.00970</td>
<td>0.002</td>
</tr>
<tr>
<td></td>
<td>Genderb</td>
<td>-1.22020</td>
<td>0.51568</td>
<td>-0.04554*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ethnicityb</td>
<td>0.31614</td>
<td>1.16124</td>
<td>0.01071</td>
<td></td>
</tr>
<tr>
<td><strong>EAT Total Score</strong>a</td>
<td>Tie Strength</td>
<td>-0.28040</td>
<td>0.58494</td>
<td>-0.01110</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Genderb</td>
<td>0.34147</td>
<td>0.37380</td>
<td>0.01786</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ethnicityb</td>
<td>0.14187</td>
<td>1.01637</td>
<td>0.00678</td>
<td></td>
</tr>
<tr>
<td><strong>NHBQ Total Score</strong>a</td>
<td>Tie Strength</td>
<td>-0.04698</td>
<td>0.06655</td>
<td>-0.01501</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Genderb</td>
<td>-0.02355</td>
<td>0.05195</td>
<td>-0.00968</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ethnicityb</td>
<td>-0.00343</td>
<td>0.10238</td>
<td>-0.00128</td>
<td></td>
</tr>
<tr>
<td><strong>BMI</strong>b</td>
<td>Tie Strength</td>
<td>-0.28759</td>
<td>0.39784</td>
<td>-0.01547</td>
<td>0.019</td>
</tr>
<tr>
<td></td>
<td>Genderb</td>
<td>0.45761</td>
<td>0.32145</td>
<td>0.03174**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ethnicityb</td>
<td>-2.17116</td>
<td>0.75025</td>
<td>-0.13548**</td>
<td></td>
</tr>
</tbody>
</table>

*a Variable = absolute difference in total score, b Variable = presence or absence of an exact match on variable category,* Negative coefficients = positive relationship between variables (increased similarity on IV predicts a smaller absolute difference in the DV), * = p ≤ 0.05, ** = p ≤ 0.01, *** = p ≤ 0.001

An RCT analysis was performed to examine patterns of friendships between and within genders. This analysis demonstrated that the patterns of friendship between and across genders were significantly (p=0.02) different from what would be expected in a model of independence. The odd of students being friends with individuals of the same gender was 2.36 times that of the odds of being friends with another gender. The pattern demonstrates that residents are significantly more likely to be friends with other residents of the same gender. Figure 2 shows friendships in Hale Laulima by gender.
Table 8. QAP Regression coefficients with interaction frequency as an independent variable

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Predictor</th>
<th>B</th>
<th>SEB</th>
<th>β(^1)</th>
<th>R(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AAQ Total Score</strong>(^a)</td>
<td>Interaction Freq.</td>
<td>0.98114</td>
<td>2.54743</td>
<td>0.00822</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>Gender(^b)</td>
<td>0.39296</td>
<td>0.64688</td>
<td>0.01051</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ethnicity(^b)</td>
<td>1.25085</td>
<td>1.57224</td>
<td>0.03017</td>
<td></td>
</tr>
<tr>
<td><strong>WBIS Total Score</strong>(^a)</td>
<td>Interaction Freq.</td>
<td>-0.78389</td>
<td>1.80653</td>
<td>-0.00892</td>
<td>0.002</td>
</tr>
<tr>
<td></td>
<td>Gender(^b)</td>
<td>-1.22227</td>
<td>0.50108</td>
<td>-0.04561*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ethnicity(^b)</td>
<td>0.31202</td>
<td>1.15019</td>
<td>0.01057</td>
<td></td>
</tr>
<tr>
<td><strong>EAT Total Score</strong>(^a)</td>
<td>Interaction Freq.</td>
<td>-0.18234</td>
<td>1.46116</td>
<td>-0.00282</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Gender(^b)</td>
<td>0.33149</td>
<td>0.38703</td>
<td>0.01734</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ethnicity(^b)</td>
<td>0.13958</td>
<td>1.02591</td>
<td>0.00667</td>
<td></td>
</tr>
<tr>
<td><strong>NHBQ Total Score</strong>(^a)</td>
<td>Interaction Freq.</td>
<td>-0.13205</td>
<td>0.16299</td>
<td>-0.01680</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Gender(^b)</td>
<td>-0.02359</td>
<td>0.05150</td>
<td>-0.00970</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ethnicity(^b)</td>
<td>-0.00405</td>
<td>0.09938</td>
<td>-0.00151</td>
<td></td>
</tr>
<tr>
<td><strong>BMI</strong>(^a)</td>
<td>Interaction Freq.</td>
<td>-0.80488</td>
<td>1.05679</td>
<td>-0.01701</td>
<td>0.019</td>
</tr>
<tr>
<td></td>
<td>Gender(^b)</td>
<td>0.45698</td>
<td>0.31458</td>
<td>0.03169**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ethnicity(^b)</td>
<td>-2.17501</td>
<td>0.75251</td>
<td>-0.13572**</td>
<td></td>
</tr>
</tbody>
</table>

\(^a\)Variable = absolute difference in total score, \(^b\)Variable = presence or absence of an exact match on variable category, \(^1\)Negative coefficients = positive relationship between variables (increased similarity on IV predicts a smaller absolute difference in the DV), * = p ≤ 0.05, ** = p ≤ 0.01, *** = p ≤ 0.001

Given that the social processes underlying friendship selection may be different for inter- and intra-gender friendships, separate analyses were run to examine male and female friendship networks separately. Ethnicity was included as a control variable in all analyses. The results of these analyses are presented in Table 9. Increased interaction frequency was found to predict a smaller absolute difference in EAT scores among men, but not among women. Increased tie strength and interaction frequency both predicted a smaller absolute difference in NHBQ scores among men, but not among women. For men, greater similarity in closeness across all measures was predictive of a greater absolute difference in BMI. Sharing ethnicity predicted BMI similarity among both men and women across all measures of closeness.
Table 9. QAP Regression coefficients for actor attributes and closeness networks separated by gender

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Predictor</th>
<th>Men (n = 38)</th>
<th></th>
<th>Women (n = 52)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>B</td>
<td>SEB</td>
<td>(\beta^1)</td>
<td>R^2</td>
</tr>
<tr>
<td>AAQ Total Score</td>
<td>Friendship</td>
<td>-0.72222</td>
<td>3.37045</td>
<td>-0.01013</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Ethnicity</td>
<td>0.02592</td>
<td>1.77121</td>
<td>0.00094</td>
<td>-1.62125</td>
</tr>
<tr>
<td>WBIS Total Score</td>
<td>Friendship</td>
<td>2.74618</td>
<td>2.43900</td>
<td>0.05118</td>
<td>0.004</td>
</tr>
<tr>
<td></td>
<td>Ethnicity</td>
<td>-0.90245</td>
<td>1.26024</td>
<td>-0.04270</td>
<td>1.20097</td>
</tr>
<tr>
<td>EAT Total Score</td>
<td>Friendship</td>
<td>-2.17420</td>
<td>1.79426</td>
<td>-0.06564</td>
<td>0.014</td>
</tr>
<tr>
<td></td>
<td>Ethnicity</td>
<td>-1.24219</td>
<td>0.97379</td>
<td>-0.09429</td>
<td>-0.76959</td>
</tr>
<tr>
<td>NHBQ Total Score</td>
<td>Friendship</td>
<td>-0.47331</td>
<td>0.36590</td>
<td>-0.06775</td>
<td>0.005</td>
</tr>
<tr>
<td></td>
<td>Ethnicity</td>
<td>0.06267</td>
<td>0.20130</td>
<td>0.02192</td>
<td>-0.04365</td>
</tr>
<tr>
<td>BMI</td>
<td>Friendship</td>
<td>1.68637</td>
<td>0.82120</td>
<td>0.09758**</td>
<td>0.040</td>
</tr>
<tr>
<td></td>
<td>Ethnicity</td>
<td>-1.19773</td>
<td>0.44261</td>
<td>-0.17905*</td>
<td></td>
</tr>
<tr>
<td>AAQ Total Score</td>
<td>Tie Strength</td>
<td>0.14797</td>
<td>1.14223</td>
<td>0.00620</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Ethnicity</td>
<td>0.00571</td>
<td>1.75758</td>
<td>0.00021</td>
<td></td>
</tr>
<tr>
<td>WBIS Total Score</td>
<td>Tie Strength</td>
<td>0.28170</td>
<td>0.83439</td>
<td>0.01541</td>
<td>0.002</td>
</tr>
<tr>
<td></td>
<td>Ethnicity</td>
<td>-0.85994</td>
<td>1.29978</td>
<td>-0.04069</td>
<td>1.20861</td>
</tr>
<tr>
<td>EAT Total Score</td>
<td>Tie Strength</td>
<td>-0.84072</td>
<td>0.61013</td>
<td>-0.07404</td>
<td>0.015</td>
</tr>
<tr>
<td></td>
<td>Ethnicity</td>
<td>-1.24782</td>
<td>0.97354</td>
<td>-0.09472</td>
<td>-0.77124</td>
</tr>
<tr>
<td>NHBQ Total Score</td>
<td>Tie Strength</td>
<td>-0.19313</td>
<td>0.12611</td>
<td>-0.08103*</td>
<td>0.007</td>
</tr>
<tr>
<td></td>
<td>Ethnicity</td>
<td>0.06073</td>
<td>0.19826</td>
<td>0.02125</td>
<td>-0.04360</td>
</tr>
<tr>
<td>BMI</td>
<td>Tie Strength</td>
<td>0.47707</td>
<td>0.28033</td>
<td>0.08110*</td>
<td>0.037</td>
</tr>
<tr>
<td></td>
<td>Ethnicity</td>
<td>-1.18510</td>
<td>0.44859</td>
<td>-0.17716**</td>
<td></td>
</tr>
<tr>
<td>AAQ Total Score</td>
<td>Interaction Freq.</td>
<td>-0.11690</td>
<td>2.62652</td>
<td>-0.00190</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Ethnicity</td>
<td>0.01300</td>
<td>1.77709</td>
<td>0.00047</td>
<td></td>
</tr>
<tr>
<td>WBIS Total Score</td>
<td>Interaction Freq.</td>
<td>1.50848</td>
<td>1.92743</td>
<td>0.03199</td>
<td>0.004</td>
</tr>
<tr>
<td></td>
<td>Ethnicity</td>
<td>-0.86485</td>
<td>1.24370</td>
<td>-0.04092</td>
<td>1.19759</td>
</tr>
<tr>
<td>EAT Total Score</td>
<td>Interaction Freq.</td>
<td>-2.20042</td>
<td>1.47334</td>
<td>-0.07267*</td>
<td>0.015</td>
</tr>
<tr>
<td></td>
<td>Ethnicity</td>
<td>-1.25297</td>
<td>0.97198</td>
<td>-0.09511</td>
<td>-0.76415</td>
</tr>
<tr>
<td>NHBQ Total Score</td>
<td>Interaction Freq.</td>
<td>-0.41977</td>
<td>0.29029</td>
<td>-0.06835*</td>
<td>0.005</td>
</tr>
<tr>
<td></td>
<td>Ethnicity</td>
<td>0.05765</td>
<td>0.19968</td>
<td>0.02017</td>
<td>-0.04440</td>
</tr>
<tr>
<td>BMI</td>
<td>Interaction Freq.</td>
<td>0.99054</td>
<td>0.64044</td>
<td>0.06505</td>
<td>0.035</td>
</tr>
<tr>
<td></td>
<td>Ethnicity</td>
<td>-1.17753</td>
<td>0.44113</td>
<td>-0.17603**</td>
<td></td>
</tr>
</tbody>
</table>

*Variable = absolute difference in total score, *Variable = presence or absence of an exact match on variable category, Negative coefficients = positive relationship between variables (increased similarity on IV predicts a smaller absolute difference in the DV), * = \(p \leq 0.05\), ** = \(p \leq 0.01\), *** = \(p \leq 0.001\)
Discussion

The goal of this research was to explore the social network of students living in a shared environment (a college residence hall). Specifically, we evaluated whether these students would demonstrate similarity in weight-related characteristics based on the closeness of their social relationship. An additional aim was to investigate the relationship between ethnicity and differences in weight-related characteristics among a sample of commonly underrepresented minorities.

The friendship network of students living in Hale Laulima was found to be relatively sparsely connected. The overall density of the network was low, as many of the potential connections between students are not present. On average, each student had only 1.5 incoming and outgoing connections to other peers. The large mean geodesic distance of this network suggests that information may not flow easily through the network, as there are many places along the path where the flow may break down (Hanneman & Riddle, 2005). Given the low overall density of the network, however, the clustering coefficient was relatively high. This tendency toward clustering was supported by the large number of cliques identified in the network, which tended to be small in size. Though information may not pass easily across the network as a whole, it is possible that information may be passed within these strongly connected cliques. The friendship network of students within Hale Laulima appeared to be one in which small, relatively isolated groups of students interacted with one another often and felt close to each other.

This network structure was not entirely unexpected given that many residents appeared to interact primarily with and feel closest to their roommates. Many students may have chosen an existing friend as their roommate and may therefore have felt less motivation to create
connections with other individuals in the residence hall. Structural divisions in the building may also account for some of the partitions seen in the network. The residence hall has four floors of student rooms. Students may have been more likely to interact frequently with and feel closer to those students on their own floor. Moreover, each floor has its own Resident Assistant who may organize social events for the students on his or her floor. These events may have contributed to a tendency toward preferential social interactions by floor.

Another trend identified within the friendship network was a tendency for residents to be friends with individuals of the same gender. An RCT found that the odd of students being friends with individuals of the same gender was more than twice that of the odds of being friends with another gender. This trend may be explained by natural gender homophily. It may also be influenced by the fact that most individuals in the residence hall shared a room with another student of the same gender. A substantial body of research supports the notion that social dynamics may differ in same-sex friendships between men and women (Hall, 2011). A recent meta-analysis of friendship expectations by gender indicates that women have a greater expectation of symmetrical reciprocity (defined as loyalty, mutual regard, and support), communion (emotional availability, self-disclosure, and empathy), and agency (ability to provide instrumental support) than men (Hall, 2011). Such differences could be reasonably expected to impact the nature of communication and shared ideas within inter-gender friendships. Moreover, significant differences by gender were found in the weight-related outcome variables. Given these variations by gender, the decision was made to explore male and female inter-gender friendships separately from one another through an additional series of QAP regressions.

**BMI.** Variations in BMI were found by gender and ethnicity. Women in this sample had a higher average BMI than men. Native Hawaiians and Pacific Islanders were also found to have a
significantly higher mean BMI than most other ethnic groups. This finding is consistent with evidence suggesting that Native Hawaiians and Pacific Islanders in the state of Hawai‘i have a greater tendency toward overweight and obesity than other ethnic groups (Davis et al., 2004). Spatial auto-correlation analyses found a positive association between all measures of closeness and BMI similarity. QAP regression analyses, however, did not find any measure of closeness to be a significant predictor of BMI similarity. Indeed, when analyses were performed on same-sex friendships, an inverse relationship was found between closeness and BMI similarity among males.

This finding is surprising and not consistent with most previous literature. It is possible that this finding represents a statistical artifact related to the degree of missing data in our sample. Another possibility, however, is presented by previous research conducted by Yuksheva, Kapinos, and Weiss (2011). In their research on college freshman roommates, the authors found a strong negative correlation between weight gained over the course of the year and the roommate’s initial weight. The authors hypothesized that this effect occurred because students who weighed more prior to college entry may have brought weight management behaviors with them to school, which were then adopted by their roommates. These preventative behaviors may, in turn, have influenced the roommate to gain less weight. It is possible that our cross-sectional research is providing a snapshot of a similar pattern occurring over time in this residence hall. This hypothesis is supported by the positive relationship that was found between tie strength and shared health behaviors in men, but not in women. Perhaps the counterintuitive results for BMI found in our sample are a reflection of a pattern among males wherein friends with preexisting differences in weight adopted similar weight-related behaviors with differential outcomes in BMI.
**Weight-related behavior.** No differences in NHBQ scores were found by gender or ethnicity. As with BMI, spatial auto-correlation analyses found a positive association between all measures of closeness and NHBQ score similarity. In QAP regression analyses on the sample as a whole, closeness did not emerge as a significant predictor of NHBQ scores. When QAP regressions were run on inter-gender friendships only, however, tie strength and interaction frequency were both found to be significant predictors of similarity in NHBQ scores among men. This suggests that men who interacted more often and felt closer to one another were more likely to engage in similar weight-related behaviors. As discussed previously, this convergence of behavior may interact with weight change and affect BMI within friend groups.

**Weight-related attitudes.** No significant differences in weight-related attitudes were found by ethnicity. Women in this sample scored higher on average on the EAT and WBIS than men. These score differences on the EAT and WBIS are consistent with previous research on gender-specific norms for these measures (Hilbert, Baldofski, Zenger, Löwe, Kersting, & Braehler, 2014; Rosen, Silberg, & Gross, 1988). In spatial auto-correlation analyses, AAQ scores were found to be positively correlated with all measures of closeness. This indicates a relationship between closeness and a shared degree of anti-fat attitudes. In regression analyses, however, closeness was not found to significantly predict either AAQ or WBIS score concordance. In inter-gender friendships among men, however, increased interaction frequency was found to predict similarity in scores on the EAT, a measure of eating pathology. This suggests that males who spent more time together were more likely to share a similar degree of eating-related pathology.
Strengths

One notable strength of the present research is the application of a social network analysis methodology, which allows for an exploration of the influence of social factors on weight-related variables in way that cannot be accomplished using traditional methods. With this approach, we have the potential to identify and understand powerful social mechanisms that can be translated into more effective interventions. Moreover, to the investigator’s knowledge, this is the first study to use a full network analysis and validated measures to explore the relationship between friendship and weight-related stigma. The use of a full network approach provides the opportunity to examine the network more holistically than an ego-centric approach could allow. Another important component of this research is the use of a diverse sample in which several ethnic minority groups are present. The inclusion of these groups offers insight into the weight-related social dynamics of a population that is not typically well represented in research of this kind.

The setting for this research also represents a strength of this study. The college residence hall provided a physically and theoretically bounded environment with unique opportunities for social interaction. In Ali, Amialchuk, & Heiland’s 2011 study of the school friendships of adolescents living with their parents, the authors noted that some health-related behaviors may not be shared between peers because they are not typically performed in their presence. Living in a college dormitory puts students in an environment where more health behaviors related to eating, exercising, and recreation habits are visible to and often shared with peers. This arrangement provides an opportunity for peer influence in areas of life not previously exposed to friends.
Limitations

One of the major limitations of this research is data missing due to respondent inaccuracy and survey non-response. The data collection method used in this research was restricted by privacy concerns put forth by the residence hall administration. As a result, participants were required to list the names of their acquaintances in a free response format with no roster of residents provided to the investigator for reference. Many of the responses were incomplete (e.g., first names only, nicknames) or incorrect (i.e., individuals not living in the residence hall). Approximately 7% of the names identified on the sociometric questionnaire could not be matched with a complete, known name and had to be excluded from final analyses. In addition to this respondent-level missingness, approximately 31% of student residents chose not to participate in this research, contributing to significant non-response missingness.

While some of the effects of missing data might have been addressed with sophisticated imputation methods and additional corroborating information on the demographic characteristics of this population, these analyses were beyond the scope of this paper. Moreover, such imputation methods are often based on the assumption that data are missing completely at random, which could not be definitively determined in this case without more information on non-participants. Furthermore, many of the relationships of interest in this research are directed (i.e., not all ties can be assumed to be reciprocated) in nature and cannot be reasonably symmetrized without losing or misrepresenting the data. For these reasons, the decision was made to use the data in an unimputed format. This decision may have affected the results in a variety of ways. Individual students that did not participate in the study may have been “socially powerful” components of the network. Their absence could have created gaps in the social map of the network and bias outcomes. Furthermore, research by Kossinets (2006) has found that
actor non-response may cause assortatively mixed networks to appear disassortative. This may have contributed to our inability to fully replicate the clustering on shared BMI and weight-related behaviors found in other research.

Another area of limitation of this study is its generalizability. Though the representation of ethnic minorities in this sample can be considered a strength in some respects, it also limits the extent to which results can applied to other populations. While AAPI account for only 5.6% of the population of the United States as a whole, they represent approximately 36% of the present sample (United States Census Bureau, 2015). The patterns found in this sample, therefore, may reflect different ethnicity-related social mechanisms than would have been found in research using a sample more similar to ethnic distribution of the mainland United States. Furthermore, the culture of on-campus living at UH Mānoa may vary from the typical college experience due to the unique characteristics of island life. Sixty-six percent of students attending UH Mānoa come from Hawai‘i (Mānoa Institutional Research Office, 2014). It is common for local students attending the university to continue living at home with family for reasons of convenience, economy, and the cultural value placed on the family unit. Indeed, seventy-five percent of students attending the university do not live on campus (U.S. News & World Report, 2014). Given this preference for off-campus living, the culture of social connectivity on campus may not be as rich as some other schools. This difference in culture may have contributed to the lack of cohesion within the residence hall friendship network.

The low density of the observed network may also have been influenced by the timing of data collection. Data for this study were collected at the beginning of the school year between September and December of the fall semester. It is possible that if data had been collected later
in the school year, residents may have had a greater opportunity to build social connections within the dormitory that would have influenced their degree of shared behaviors and attitudes.

Additionally, this research may have benefited from the use of a validated measure of health behaviors. The measure used in this study was adapted from other validated and widely used measures to address the specific health behaviors of interest in this study. The scoring of this measure based on evidence-based health guidelines, however, was developed for use in this research and requires further study and replication.

**Implications and Future Directions**

The results of the present study demonstrate that health behaviors and eating-related attitudes may be shared within friend groups. Moreover, the degree to which they are shared may increase with perceived closeness and interaction frequency. The lack of significant findings on weight-related stigma indicates that subsequent studies may benefit from further evaluation with a more complete sample. Additionally, it may be beneficial to explore the ego-centric friendship networks (using a “snowball method”) of college students. This approach would allow students to identify their closest (and therefore perhaps most influential) friends, rather than being limited to those friends living in the same residence hall. It is possible that the residence hall network is simply not a socially significant construct for these college students and therefore is less influential on their attitudes and behaviors. An egocentric data collection method would allow for a more exploratory approach to identify the social affiliations that are relevant for these students. For example, in Hawai‘i, considerable cultural significance is attached to which high school local residents attended (Pape, 2014). It may be that connections from high school and other community affiliations are more influential than those established in college.
Future research may also focus on establishing a causal relationship between these factors through a longitudinal research design. The determination of directionality is critically important to the development of appropriate interventions. If peer effects are responsible for the sharing of weight-related behaviors and attitudes, the potential exists for a social multiplier effect to compound the effects of any intervention spread through social networks. This approach could be a powerful tool in overcoming resistance to change and widely disseminating information.
Figure 1. Social network graph of acquaintanceship among dormitory residents. Node size corresponds to degree.
Figure 2. Social network graph of the main component of friendship among dormitory residents. Purple triangle nodes = females, green circle nodes = males, dark gray lines = friendship ties, light gray = acquaintanceship.
Appendix A: Demographic Questionnaire

1. What is your current age? ________

2. What is your gender?
   a. Male
   b. Female
   c. Other, please specify ________________

3. Are you Hispanic, Latino/a, or Spanish origin?
   □ Yes
   □ No

4. Select all racial groups that best describe you. (You may select multiple boxes)
   □ American Indian or Alaska Native
   □ Asian Indian
   □ Black or African American
   □ Chinese
   □ Filipino
   □ Japanese
   □ Korean
   □ Native Hawaiian
   □ Pacific Islander
   □ Vietnamese
   □ White
   □ Other _________________________

5. Select the one racial group with which you most identify. (Select only one option)
   □ American Indian or Alaska Native
   □ Asian Indian
   □ Black or African American
   □ Chinese
   □ Filipino
   □ Japanese
   □ Korean
   □ Native Hawaiian
   □ Pacific Islander
   □ Vietnamese
   □ White
   □ Other _________________________
   □ I do not identify with a single racial group
6. Do you speak a language other than English at home?
   a. Yes
   b. No

7. What is this language? ________________________________

8. How well do you speak English?
   a. Very well
   b. Well
   c. Not well

9. Select the generation that best applies to you. Select only one:
   □ 1st generation = you were born in another country.
   □ 2nd generation = you were born in the USA; either parent was born in another country.
   □ 3rd generation = you were born in the USA, both parents born in USA and all grandparents born in another country.
   □ 4th generation – you and your parents were born in US and at least one grandparent was born in another country with remainder born in the US
   □ 5th generation = you and your parents born in the USA and all grandparents born in the USA

10. What is your marital status?
    □ Never married
    □ Living with a partner
    □ Married or in a domestic partnership
    □ Widowed
    □ Divorced
    □ Separated

11. How tall are you? _____ft _____in

12. How much do you weigh? _______lbs

13. How would you describe your current weight?
    □ Extremely underweight
    □ Underweight
    □ Slightly underweight
    □ Normal weight
    □ Slightly overweight
    □ Overweight
    □ Extremely overweight
14. Are you currently pregnant?
   - Yes
   - No
   - Not applicable

15. What is your current employment status?
   - Employed full-time
   - Employed part-time
   - Not employed
   - Retired

16. What is your current student status?
   - Full-time student
   - Part-time student
   - Not a student

17. What is your current grade level?
   - Freshman
   - Sophomore
   - Junior
   - Senior
   - Unclassified
   - Graduate
Appendix B: Sociometric Questionnaire

Please respond to the following questions about your relationships with other students living in Hale Laulima. Thank you!

1. Do the friends with whom you spend the most time live in Hale Laulima?
   - Yes
   - No

2. Below is a list of all the student residents in Hale Laulima. Please place a check mark next to any student with whom you are acquainted (You would recognize this person if you saw him/her and have spoken with this person at least once).
   - Student 1
   - Student 2
   - Student 3
   - ...

3. Please select any person listed below who is your current roommate.
   - Student 1
   - Student 2
   - Student 3
   - ...

4. For each person listed below, please indicate the nature of your relationship.

<table>
<thead>
<tr>
<th>Acquaintance</th>
<th>Friend</th>
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</thead>
<tbody>
<tr>
<td>Student 1</td>
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<tr>
<td>Student 2</td>
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<tr>
<td>Student 3</td>
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<td>...</td>
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</tbody>
</table>

5. For each person listed below, please indicate the closeness of your relationship. For example, how comfortable are you sharing private thoughts with this person? How comfortable are you seeking help and support from this person?

   1 = I do not feel close to this person.
   2 = I feel somewhat close to this person.
   3 = I feel close to this person.
   4 = I feel very close to this person.

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<tr>
<th>1</th>
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<tbody>
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<td>Student 2</td>
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<tr>
<td>Student 3</td>
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<td>...</td>
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</tbody>
</table>
6. How often have you interacted with each person listed below in the last 6 months (for example: in writing, in person, over the phone)?

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<th>1</th>
<th>2</th>
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<th>4</th>
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<tbody>
<tr>
<td></td>
<td>Not at all</td>
<td>Less than monthly</td>
<td>About monthly</td>
<td>About weekly</td>
<td>About daily</td>
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<tr>
<td><strong>Student 1</strong></td>
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<td><strong>Student 2</strong></td>
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<td><strong>Student 3</strong></td>
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</table>

7. Select the people listed below with whom you eat meals?
   - ☐ None of these individuals
   - ☐ Student 1
   - ☐ Student 2
   - ☐ Student 3
   - ☐ ...

8. With which of the people listed below do you engage in physical activities (for example: exercise, sports)?
   - ☐ None of these individuals
   - ☐ Student 1
   - ☐ Student 2
   - ☐ Student 3
   - ☐ ...


Appendix C: Eating Attitudes Test-26 (EAT-26)

Please choose one response by marking a check to the right for each of the following statements:

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<tr>
<th></th>
<th>Always</th>
<th>Usually</th>
<th>Often</th>
<th>Sometimes</th>
<th>Rarely</th>
<th>Never</th>
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<tr>
<td>18. I feel that food controls my life.</td>
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<td>19. I display self-control around food.</td>
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<td>20. I feel that others pressure me to eat.</td>
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<td>21. I give too much time and thought to food.</td>
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<td>22. I feel uncomfortable after eating sweets.</td>
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<td>23. I engage in dieting behavior.</td>
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<td>24. I like my stomach to be empty.</td>
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<td>25. I have the impulse to vomit after meals.</td>
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<td>26. I enjoy trying new rich foods.</td>
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Appendix D: The Anti-Fat Attitudes Questionnaire (AAQ)

Directions: For the following questions, circle a number between 0 and 9 to indicate how much you agree or disagree with each of the following statements.

0 = Very strongly disagree……………………..……9 = Very strongly agree

1. I really don’t like fat people much. 0 1 2 3 4 5 6 7 8 9
2. I don’t have many friends that are fat. 0 1 2 3 4 5 6 7 8 9
3. I tend to think that people who are overweight are a little untrustworthy. 0 1 2 3 4 5 6 7 8 9
4. Although some fat people are surely smart, in general, I think they tend not to be quite as bright as normal weight people. 0 1 2 3 4 5 6 7 8 9
5. I have a hard time taking fat people too seriously. 0 1 2 3 4 5 6 7 8 9
6. Fat people make me somewhat uncomfortable. 0 1 2 3 4 5 6 7 8 9
7. If I were an employer looking to hire, I might avoid hiring a fat person. 0 1 2 3 4 5 6 7 8 9
8. I feel disgusted with myself when I gain weight. 0 1 2 3 4 5 6 7 8 9
9. One of the worst things that could happen to me would be if I gained 25 pounds of fat. 0 1 2 3 4 5 6 7 8 9
10. I worry about becoming fat. 0 1 2 3 4 5 6 7 8 9
11. People who weigh too much could lose at least some part of their weight through a little exercise. 0 1 2 3 4 5 6 7 8 9
12. Some people are fat because they have no willpower. 0 1 2 3 4 5 6 7 8 9
13. Fat people tend to be fat pretty much through their own fault. 0 1 2 3 4 5 6 7 8 9
Appendix E: The Weight Bias Internalization Scale-Modified (WBIS-M)

Please answer the following questions using this scale:

<table>
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<th>1</th>
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<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strongly disagree</td>
<td>Disagree</td>
<td>Slightly disagree</td>
<td>Neutral</td>
<td>Slightly agree</td>
<td>Agree</td>
<td>Strongly agree</td>
</tr>
</tbody>
</table>

1. At my weight, I feel that I am just as competent as anyone.
2. I am less attractive than most other people because of my weight.
3. I feel anxious about my weight because of what people might think of me.
4. I wish I could drastically change my weight.
5. Whenever I think a lot about my weight, I feel depressed.
6. I hate myself for my weight.
7. My weight is a major way that I judge my value as a person.
8. I don’t feel that I deserve to have a really fulfilling social life, because of my weight.
9. I am OK being the weight that I am.
10. Because of my weight, I don’t feel like my true self.
11. Because of my weight, I don't understand how anyone attractive would want to date me.
Appendix F: Negative Health Behavior Questionnaire

This survey asks about your diet, physical activity, sleep habits, and screen viewing habits. Please read each question carefully and select the best-fitting answer.

1. On an average day, how many hours of TV do you watch?
   - I do not watch TV on an average day
   - Less than 1 hour per day
   - 1 hour per day
   - 2 hours per day
   - 3 hours per day
   - 4 hours per day
   - 5 hours per day

2. On an average day, how many hours do you play video or computer games or use a computer for something that is not schoolwork? Count time spent using gaming systems such as Xbox or PlayStation, mobile devices such as an iPod, tablet, or smartphone, and websites such as YouTube and Facebook.
   - I do not play video or computer games or use a computer for something that is not schoolwork
   - Less than 1 hour per day
   - 1 hour per day
   - 2 hours per day
   - 3 hours per day
   - 4 hours per day
   - 5 hours per day

3. On an average day, how many hours of sleep do you get in a 24-hour period?
   ____________ hours

4. During the past 7 days, on how many days did you engage in moderate to vigorous physical activity for a total of at least 45 minutes per day (for example: brisk walking, jogging, biking, swimming)? Add up all the time you spent in any kind of physical activity that increased your heart rate and made you breathe hard some of the time.
   - 0 days
   - 1 day
   - 2 days
   - 3 days
   - 4 days
   - 5 days
   - 6 days
   - 7 days

5. During the past 7 days, on how many days did you eat breakfast?
   - 0 days
   - 1 day
6. During the past 7 days, how many times did you eat fruit? (Do not count fruit juice).
   - 2 days
   - 3 days
   - 4 days
   - 5 days
   - 6 days
   - 7 days

   - I did not eat fruit during the past 7 days
   - 1 – 3 times during the past 7 days
   - 4 – 6 times during the past 7 days
   - 1 time per day
   - 2 times per day
   - 3 times per day
   - 4 or more times per day

7. During the past 7 days, how many times did you eat vegetables?
   - I did not eat vegetables during the past 7 days
   - 1 – 3 times during the past 7 days
   - 4 – 6 times during the past 7 days
   - 1 time per day
   - 2 times per day
   - 3 times per day
   - 4 or more times per day

8. During the past 7 days, how many times did you eat fast food (McDonald’s, Pizza Hut, Taco Bell, Zippy’s, etc.)?
   - I did not eat fast food during the past 7 days
   - 1 – 3 times during the past 7 days
   - 4 – 6 times during the past 7 days
   - 1 time per day
   - 2 times per day
   - 3 times per day
   - 4 or more times per day

9. During the past 7 days, how many times did you drink a can, bottle, or glass of soda or pop, such as Coke, Pepsi, or Sprite? (Do not count diet soda or diet pop).
   - I did not drink soda during the past 7 days
   - 1 – 3 times during the past 7 days
   - 4 – 6 times during the past 7 days
   - 1 time per day
   - 2 times per day
   - 3 times per day
   - 4 or more times per day
Appendix G: Center for Epidemiologic Studies Depression Scale (CES-D)

Below is a list of the ways you might have felt or behaved. Please tell me how often you have felt this way during the past week.

*During the past week...*

<table>
<thead>
<tr>
<th></th>
<th>Rarely or none of the time (less than 1 day)</th>
<th>Some or a little of the time (1-2 days)</th>
<th>Occasionally or a moderate amount of the time (3-4 days)</th>
<th>Most or all of the time (5-7 days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>I was bothered by things that usually don’t bother me.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2.</td>
<td>I did not feel like eating; my appetite was poor.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>3.</td>
<td>I felt that I could not shake off the blues even with help from my family or friends.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>4.</td>
<td>I felt I was just as good as other people.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>5.</td>
<td>I had trouble keeping my mind on what I was doing.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>6.</td>
<td>I felt depressed.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>7.</td>
<td>I felt that everything I did was an effort.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>8.</td>
<td>I felt hopeful about the future.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>9.</td>
<td>I thought my life had been a failure.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>10.</td>
<td>I felt fearful.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>11.</td>
<td>My sleep was restless.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>12.</td>
<td>I was happy.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>13.</td>
<td>I talked less than usual.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>15.</td>
<td>People were</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
unfriendly.
16. I enjoyed life. ☐ ☐ ☐ ☐ ☐
17. I had crying spells. ☐ ☐ ☐ ☐ ☐
18. I felt sad. ☐ ☐ ☐ ☐ ☐
19. I felt that people dislike me. ☐ ☐ ☐ ☐ ☐
20. I could not get “going.” ☐ ☐ ☐ ☐ ☐
References


