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HOUSEHOLD FOOD INSECURITY, DEPRESSION, AND DISORDERED EATING  
SYMPTOMS IN ADOLESCENTS WITH SEVERE OBESITY

by

MEREDITH BISHOP

Under the Direction of Lindsey Cohen, PhD

ABSTRACT

As rates of severe pediatric obesity have increased, bariatric surgery has become more common in adolescents. Disordered eating symptoms may interfere with an adolescent's ability to effectively adhere to dietary requirements and hinder weight loss. The purpose of this study was to examine the relations between household food insecurity, depression, and disordered eating in a sample of adolescents seeking bariatric surgery. Participants ( $N = 73$ ) were adolescents presenting to the pre-surgical psychological evaluation. Household food insecurity was not related to disordered eating or any disordered eating subscales but was significantly higher in Black households compared to White households. Depression was associated with total disordered eating and subscales binge/loss of control eating and emotional eating. Depression and disordered eating, particularly binge/loss of control eating and emotional eating, may be potential treatment targets for adolescents seeking bariatric surgery. Findings also highlight the importance of screening for household food insecurity in this high-risk population.

INDEX WORDS: Obesity, Disordered eating, Depression, Food insecurity

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SYMPTOMS IN ADOLESCENTS WITH SEVERE OBESITY

by

MEREDITH BISHOP

A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy

in the College of Arts and Sciences

Georgia State University

2020

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Meredith Norman Bishop  
2020

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SYMPTOMS IN ADOLESCENTS WITH SEVERE OBESITY

by

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## INTRODUCTION

Childhood obesity is a significant public health concern, with rates of severe obesity in adolescents increasing over the last three decades. Individuals with obesity often have disordered eating behaviors, which are associated with excess adiposity. Disordered eating is especially common in adolescents with obesity (He, Cai, & Fan, 2017); and disordered eating is related to greater weight (Stice, Presnell, & Spangler, 2002) and physical and psychological health consequences during adolescence (Bulik & Reichborn-Kjennerud, 2003; Glasofer et al., 2007; Tanofsky-Kraff et al., 2011). Thus, disordered eating is an important treatment target for adolescents with obesity. Understanding the environmental and individual factors that may contribute to disordered eating symptoms is crucial in developing and delivering effective interventions to adolescents with obesity and disordered eating symptoms. Household food insecurity (Becker, 2017) and depression (Kidwell, Nelson, Nelson, & Espy, 2017) have each been associated with disordered eating symptoms. Zickgraf et al. (2019) found that depressive symptoms mediate the relation between household food insecurity and disordered eating in adults with severe obesity. However, these constructs have yet to be examined in adolescents with severe obesity. The current study proposes to examine the relation between household food insecurity, depression, and disordered eating symptoms and to determine whether depression mediates the relation between household food insecurity and disordered eating symptoms in a sample of adolescents with severe obesity.

### **Pediatric Obesity**

Rates of obesity in the United States have increased dramatically in the last three decades, posing a significant public health concern (Ng et al., 2014). Obesity is defined as excess body weight relative to height. Obesity is measured using body mass index (BMI), an

individual's weight adjusted for height (kilograms/meters<sup>2</sup>). Given developmental changes in body composition throughout childhood and adolescence, the Center for Disease Control and Prevention (CDC) created age- and sex-specific BMI percentiles for children ages 2-19 years (Kuczmarski et al., 2000). A BMI greater than the 95<sup>th</sup> percentile is considered obese, and a BMI greater than the 99<sup>th</sup> percentile is considered severely obese. Approximately 20% of youth in the United States are obese (Ogden et al., 2016), and 4-6% of youth meet criteria for severe obesity (Kelly et al., 2013; Koebnick et al., 2010), which is the most rapidly increasing subcategory of obesity (Skinner & Skelton, 2014). This escalation is concerning given longitudinal data that suggest that 90% of adolescents with severe obesity will remain obese into adulthood (Freedman, Mei, Srinivasan, Berenson, Dietz, 2007).

Obesity in youth is associated with premature onset of physical comorbidities such as type 2 diabetes mellitus, asthma, obstructive sleep apnea syndrome, cardiovascular disease, metabolic change, nonalcoholic fatty liver disease, dental health issues, and musculoskeletal and orthopedic complications (e.g., Kelly et al., 2013; Pulgarón, 2013). These disorders often persist into adulthood (Morales, 2019). Obesity is also associated with psychological, social, and behavioral comorbidities such as internalizing and externalizing disorders, poor executive functioning, impaired quality of life, and social stigmatization and isolation (Strauss & Pollack, 2003). Additionally, obesity is associated with increased healthcare utilization and financial burden (Trasande & Chatterjee, 2009). Evidence suggests physical and mental health risks increase with the severity of obesity (Lenders, Gorman, Lim-Miller, Puklin, & Pratt, 2011); thus, adolescents with severe obesity are at the highest risk for complications and comorbidities.

Obesity is recognized as a heterogeneous condition caused by a complex interplay among genetic, environmental, socioeconomic, and individual behavioral components (National Heart,

Lung, and Blood Institute, 2004). As obesity is the result of chronic caloric imbalance, an individual's disordered eating patterns may play an important role in the development and maintenance of obesity.

### **Disordered Eating**

Disordered eating symptoms include a range of subclinical, abnormal, or irregular eating-related attitudes or behaviors that alone do not necessarily meet criteria for an eating disorder diagnosis. However, disordered eating is associated with psychological distress (Glasofer et al., 2007) and increased risk for several adverse health outcomes in pre-adolescents and adolescents, including clinically significant eating disorders (Hilbert et al., 2013, Tanofsky-Kraff et al., 2011), chronic medical conditions (Bulik & Reichborn-Kjennerud, 2003), and obesity (Stice, Presnell, & Spangler, 2002; Tanofsky et al., 2009). Disordered eating behaviors may include binge or loss of control eating (LOC; the tendency to exhibit disinhibited eating behavior when exposed to food cues), emotional eating, preoccupation with food or weight, maladaptive attitudes or beliefs about eating, or unhealthy weight-loss or management strategies. Given the range of disordered eating behaviors characterized in the literature, the following definitions are provided to define specific disordered eating symptoms related to overconsumption:

- 1) Binge eating is typically characterized as the consumption of an objectively larger amount of food than is typical in a discrete period of time while experiencing a LOC of food intake. However, given the challenge of distinguishing an “objectively” large amount of food in developing youth with differing energy needs (Tanofsky, 2008), LOC eating (regardless of the amount of food consumed) has been considered a clinically relevant and developmentally-appropriate indicator of binge eating in youth (e.g., Schlüter et al., 2016; Shomaker et al., 2010; Tanofsky-Kraff, 2008).

- 2) Emotional eating is conceptualized as eating to regulate negative affect or stress rather than in response to physical hunger cues (Thayer, 2001).
- 3) Preoccupation with food is characterized as obsessive thinking about food and eating (Njis et al., 2007).
- 4) Positive outcome expectancy is defined as the belief or expectation that eating is positively or negatively reinforcing (Njis et al., 2007). A related term, food reinforcement is also used in the literature.

Most theoretical models of disordered eating pathology assume that eating serves to regulate unpleasant emotions. Disordered eating symptoms are theorized to be cognitive, emotional, or behavioral responses to defend against stress and negative mood states in the absence of more adaptive and effective coping strategies (Evers, Stok, & de Ridder, 2010). The emotion regulation model posits that binge/LOC eating is a means of coping with negative affect (Berg et al., 2015; Polivy & Herman, 1993). In an alternative yet similar theory, the escape from self-awareness theory, Heatherton and Baumeister (1991) propose eating may be used to narrow an individual's cognitive focus away from their current emotional distress and negative self-perception to the immediate environment (i.e., food consumption). Both models emphasize that negative emotions trigger disordered eating, and eating provides at least some temporary relief (Leehr et al., 2015). A meta-analysis of studies using ecological momentary data assessment found increased negative affect prior to binge/LOC eating episodes (Haedt-Matt & Keel, 2011). Additionally, youth with binge/LOC eating were more likely to report experiencing a sense of emotional "numbing" while eating compared to youth without binge/LOC eating (Tanofsky-Kraff et al., 2007). Ample observational and laboratory evidence also suggest that negative affect and low self-esteem are associated with binge/LOC eating and that binge/LOC eating may

provide temporary relief from negative affect (Berg et al., 2015; Eichen, Chen, Boutelle, & McCloskey, 2017; Leehr et al., 2015; Pasold et al., 2013). Finally, disordered eating symptoms have been associated with stress-management deficits (Loro & Orleans, 1981).

### ***Disordered eating during adolescence.***

Disordered eating behaviors typically emerge during adolescence (Swanson et al., 2011; van strien, 2018), although symptoms may not meet criteria for an eating disorder diagnosis. The adolescent period is characterized by major psychosocial and physical changes that leave adolescents vulnerable to eating disorder pathology. Psychosocial challenges include increased exposure to stressors, elevated emotionality, the challenge of identity development, heightened concern with body image, and increased autonomy regarding mealtime and food choice (Annayagari, Kishore, Pathki, & Binukumar, 2017; Bassett, Chapman, & Beagan, 2008). Biologically, adolescence is a period of significant physical and hormonal development. Advanced pubertal stage has been identified as a risk factor for binge/LOC eating in adolescents (Klump et al., 2017; Lee-Winn et al., 2016). Evidence suggests some individuals may be at higher genetic risk for disordered eating, and this risk increases during adolescence (Klump et al., 2017). Van strien et al. (2010) found that polymorphisms in the serotonin transporter gene moderated the relation between depressive symptoms and the emergence of emotional eating in adolescents (Klump et al., 2017). As these behaviors develop and typically continue to increase throughout adolescence and often persist into adulthood (Neumark-Sztainer et al., 2011), adolescents are a particularly vulnerable and important group to study.

### ***Disordered eating and weight gain.***

Although the prevalence of disordered eating symptoms during adolescence is high (Neumark-Sztainer & Hannan, 2000), these behaviors are especially common in adolescents with

obesity and severe obesity (Goldschmidt et al., 2008). Not surprisingly, disordered eating symptoms related to overconsumption contribute to excess caloric intake, energy imbalance, and weight gain associated with obesity. Prospective longitudinal studies support that binge/LOC eating, emotional eating, and positive expectancy of the reinforcing value of food are risk factors for excessive weight gain over time (Hill et al., 2009; Stice, Presnell, & Spangler, 2002; van Strien, Herman, & Verheijden, 2012). Studies indicate that adults with obesity report significantly greater preoccupation with food (Houben & Jansen, 2017) and find food more reinforcing (Epstein et al., 2007) compared to healthy-weight adults. Youth who report binge/LOC eating are more likely to be obese and have greater amounts of adipose tissue compared to youth without binge/LOC eating (Jääskeläinen et al., 2014; Schlüter et al., 2016; Tanofsky et al., 2009), likely due to the frequency of overeating and the nutritional content of the food consumed during binge episodes.

Vannucci et al. (2013) reported that during an observed mealtime, youth characterized as emotional eaters consumed significantly more food than those who did not endorse emotional eating. Similarly, in a laboratory ad libitum eating task in which individuals were allowed to eat as much as desired, individuals who find food more reinforcing consumed significantly greater energy than those lower in food reinforcement (Epstein et al., 2007). However, evidence suggests that the risk for excessive weight gain and increased adiposity are not only due to the amount of food intake, but also the type of food typically consumed when overeating. Adolescent self-report and laboratory observation studies describe adolescents' preference for calorically-dense foods like carbohydrates, desserts, and snack foods when binge eating (Hartmann, Rief, & Hilbert, 2012). Similarly, emotional eating has been associated with



consumption of highly palatable foods (Croker, Cooke, & Wardle, 2011; van Strien, Engels, van Leeuwe, & Snoek, 2005).

### ***Combined effect of disordered eating and obesity.***

The combination of obesity and disordered eating is associated with more severe negative physical and psychosocial health outcomes compared to obesity without disordered eating (Hsu et al., 2002; Neumark-Sztainer et al., 2002). Individuals with obesity and disordered eating are more likely to consume a greater amount of calories and fat in a laboratory setting (Raymond, Bartholome, Lee, Peterson, & Raatz, 2007), typically have higher BMIs and greater amounts of adipose tissue (Morgan et al., 2002; Tanofsky et al., 2009), and are more likely to be severely obese than individuals with obesity that do not endorse disordered eating (Faulconbridge & Bechtel, 2014).

Significant differences in psychosocial risk exist between adolescents with obesity who endorse disordered eating and those with obesity who do not endorse disordered eating. Adolescents with binge/LOC eating and obesity report greater anxiety and depression (Jarvholm et al., 2018), social anxiety and fear of negative evaluation (Pasold et al., 2013), and preoccupation or concern with body weight and shape (Van Vlierberghe et al., 2009). In two studies with adolescents with severe obesity seeking bariatric surgery, binge eaters reported lower self-esteem than non-binge eaters (Jarvholm et al., 2018; Utzinger et al., 2016).

### ***Disordered eating symptoms and weight loss treatment outcomes.***

In addition to the numerous adverse health outcomes associated with disordered eating, these symptoms may complicate weight loss treatment for adolescents with obesity. Excess caloric intake as a result of disordered eating may contribute to weight gain and hinder weight-loss treatment. Emotional eating was associated with poorer weight-loss outcomes in a diet-

based weight loss program for adults with obesity (Canetti, Berry, & Elizur, 2009). Consistent with the adult literature (Fitzgibbon & Kirshenbaum, 1991), Wildes et al. (2010) found that in samples of treatment-seeking adolescents with obesity, binge/LOC eating was associated with poorer treatment outcomes in family-based pediatric obesity treatment in comparison to treatment-seeking adolescents without binge/LOC eating.

***Disordered eating symptoms and bariatric treatment outcomes.***

The available evidence suggests that behavioral/lifestyle interventions may be less effective for adolescents with severe obesity compared to lower subcategories of overweight or obesity (Danielsson, Kowalski, Ekblom, & Marcus, 2012). Evidence from a Cochrane review suggests that although participation in behavioral interventions focused on exercise and nutrition has been associated with some weight loss for adolescents with severe obesity, these adolescents remained in the subcategory of severe obesity even following weight loss (Oude et al., 2009). In recent decades, the safety and effectiveness of bariatric surgical procedures, designed to cause weight loss by physically restricting the amount of food the stomach can hold, have been well-established with adults (Chang et al., 2014). Bariatric surgery has been associated with significant improvements in weight, weight-related quality of life, and remission of diabetes after 3 years in adult samples (Inge et al., 2016). Mounting evidence from multi-site, longitudinal studies suggest bariatric surgery appears to be similarly viable for adolescents with obesity (Durking & Desai, 2017).

Given the poor prognosis for adolescents with severe obesity and the safety and effectiveness of the bariatric surgical procedures, bariatric surgery is now indicated for carefully selected adolescents with severe obesity (Whitlock, Williams, Gold, Smith, & Shipman, 2005). To receive bariatric surgery, patients must undergo a multidisciplinary, outpatient bariatric

program prior to and following surgery. Bariatric surgery programs generally receive referrals from primary care providers and assess for an adolescent's surgical eligibility based on BMI and the presence of an obesity-related comorbid disease (Michalsky et al., 2013). According to a review of adolescent bariatric surgery programs, adolescents seeking bariatric surgery attend programs for an average of 10 months prior to undergoing surgery (Michalsky et al., 2013). Throughout the program, patients receive educational resources and attend regularly scheduled educational sessions with information regarding bariatric surgery. Although pre-operative requirements vary between bariatric surgery sites, requirements generally include diagnostic testing, a pre-operative evaluation with a clinical psychologist to assess mental health, and several scheduled visits with a dietician to assess current dietary intake and set post-operative goals (Bauchowitz et al., 2005). Several visits are scheduled during the first post-operative year to monitor health and weight loss.

For bariatric surgery to be effective for weight loss, patients must adhere to strict dietary requirements and nutritional supplementation during their bariatric program. Evidence suggests that poor weight loss following surgery is associated with non-adherence to dietary recommendations (Sarwer, Dilks, & West-Smith, 2011). Disordered eating symptoms may interfere with an adolescent's ability to effectively adhere to this program and hinder weight loss. A recent review by Chesler (2012) reports that if left untreated, emotional eating is a risk factor for poor postoperative weight loss. Emotional eating has been associated with increased grazing (Saunders, 2004), uncontrolled eating, and snacking (Rusch & Andris, 2007) following bariatric surgery. Canetti, Berry, and Elizur (2009) reported that preoperative emotional eating was predictive of poor postoperative weight loss in bariatric patients. A systematic review of adults undergoing bariatric surgery reported that individuals who reported binge eating prior to bariatric

surgery had worse weight loss outcomes following surgery compared to individuals without binge eating (Niego, Kofman, Weiss, Geliebter, 2007).

Taken together, these data highlight the important nature of disordered eating within adolescent populations with obesity, and particularly those seeking bariatric surgery. Disordered eating is associated with negative physical issues and psychosocial problems and may hinder weight loss for adolescents with obesity. Given the high prevalence and harmful effects associated with disordered eating behaviors in adolescents with obesity, it is important to identify factors related to disordered eating to help inform targeted interventions for this particularly vulnerable group of adolescents (Croll, Neumark-Sztainer, Story, & Ireland, 2002). According to a socio-ecological model, both environmental (e.g., availability of family resources) and individual (e.g., mood) factors may impact an adolescent's vulnerability to symptoms of disordered eating (Glass & McAtee, 2006).

### **Household Food Insecurity**

Nationwide, a growing number of households experience food insecurity, defined as a social and economic condition in which there is limited or uncertain availability of nutritionally adequate and safe food (Coleman-Jensen, Rabbitt, Gregory, & Singh, 2018). Lack of financial or other resources may hinder a family's ability to maintain consistent access to an adequate quantity and quality of food. Household food insecurity may include either a) an insufficient amount of food or b) the worry that food will run out. In 2017, approximately 13% of Americans, including 12 million youth, experienced household food insecurity (Coleman-Jensen, 2018). Food insecurity is more likely to impact households of low socioeconomic status (SES), households in southern states, ethnic minorities, female led households, and households with multiple children (Franklin et al., 2012; Jones & Frongillo, 2006; Price, Zickgraf, & Rigby,

2019; Veldheer, Zickgraf, Stefano, & Rigby, 2019). Rates as high as 49.9% of low SES, female-led households with children have been reported (Nord, Coleman-Jensen, Andrews, & Carlson, 2010). According to a United States Department of Agriculture (USDA) report, food insecurity is twice as common in households with adolescents compared to young children, suggesting risk for household food insecurity may increase as children age, presumably due to adolescents requiring a greater amount of food (Coleman-Jensen, McFall, & Nord, 2013). Additionally, approximately one in four American children come from a family that relies on food assistance programs each month (e.g., Supplemental Nutrition Assistance Program [SNAP]), which may necessitate buying energy-dense, low-cost foods to prevent shortages (United States Food and Nutrition Service Office of Research and Analysis, Supplemental Nutrition Assistance Program, & Mathematica Policy Research, 2015).

Household food insecurity has been associated with poor physical, psychological, and behavioral outcomes in youth. Longitudinal evidence suggests household food insecurity is associated with risk for several negative physical health outcomes including chronic illnesses, vitamin deficiencies, developmental deficits, and obesity (Siefert, Heflin, Corcoran, & Williams, 2004; Townsend et al., 2001). Household food insecurity negatively impacts academic performance, executive functioning, and interpersonal skills (Grineski, Morales, Collins, & Rubio, 2018) and is associated with internalizing and externalizing problems in youth (Slopen, Fitzmaurice, Williams, & Gilman, 2010).

The existing literature on household food insecurity relies generally on parent-report. Although some evidence suggests parents may protect their children from the effects of household food insecurity (Coleman-Jensen et al., 2019), especially young children (Coleman-Jensen, McFall, & Nord, 2013), other evidence suggests there is an agreement in ratings of

household food insecurity in parent-child dyads (Bernard et al., 2018). Bernard et al. (2018) reported agreement between parent and child self-report household food insecurity and significantly elevated child self-report worry regarding food shortage, suggesting children are aware of and impacted by the reality of their family's food insecurity. Although adolescents are relatively understudied in the food insecurity literature compared to children and adults (Dush, 2020), Lachance et al. (2014) indicated that adolescents reported stress, shame, worry, anger, and perceived stigma associated with the experience of household food insecurity (Lachance et al., 2014).

### ***Household food insecurity and obesity.***

Although individuals from food insecure households might be expected to have reduced access to food and therefore reduced food intake, in developed nations like the United States, food insecurity and obesity often co-exist within the context of economic disadvantage. Evidence from recent systematic reviews consistently supports this food insecurity-obesity paradox in adult women, indicating that food insecurity is associated with higher BMI (Dinour, Bergen, & Yeh, 2007; Franklin et al., 2012). Although mixed findings were reported for children, one of these systematic reviews indicates a positive relation between household food insecurity and obesity in adolescents (Franklin et al., 2012). Additional studies conducted since the systematic review was published provide data that household food insecurity is positively associated with obesity in adolescents (Au et al., 2019, Holden & Taylor, 2015). Holden and Taylor (2015) found adolescents from households that reported food insecurity were 1.5 times more likely to be obese compared to adolescents from food secure households (Holden & Taylor, 2015). Similarly, Au et al. (2019) found that adolescents, but not children, from food insecure households had higher BMI and were more likely to be obese than their food secure peers. They posited that

adolescents may be more cognitively and socially aware of the chronic stress of household food insecurity compared to children, who also may be more parentally protected. This growing literature highlights the importance of the home environment on the development of eating behaviors and obesity, especially during the period of adolescence.

It has been proposed that household food insecurity may lead to weight gain through multiple pathways (Christiansen, Hardman, Spinosa, Dickson, & Lorenzetti, 2019; Polivy, 1996). Members of households characterized by food insecurity may engage in cycles of deprivation when resources (e.g., financial, transportation, food assistance) are scarce and overconsumption when food becomes available, which has been associated with changes in metabolism, increased storage of fat, and preoccupation with food (Polivy, 1996). Animal studies indicate that rats exposed to random, intermittent fasting and binge periods gain more weight (Zhang et al., 2012) and display reduced satiety compared to rats with predictable food schedules (Ahn & Phillips, 2012). This cycle of deprivation and overeating may be similar to cycles of chronic intentional dieting, which are associated with negative emotions toward food and weight gain (Neumark-Sztainer et al., 2006). Reduced household food security is also associated with consumption of low-cost foods high in carbohydrates and fats commonly associated with excessive weight gain. However, recent evidence strongly suggests that household food insecurity may also be associated with excessive weight gain and obesity through psychosocial pathways involving mood and disordered eating behaviors (Christiansen, Hardman, Spinosa, Dickson, & Lorenzetti, 2019).

### ***Household food insecurity and disordered eating.***

Although the literature describing household food insecurity and disordered eating symptoms remains relatively scarce, household food insecurity has been positively associated

with disordered eating symptoms, including binge and loss of control eating (Becker, 2017; Rasmussen, Lydecker, Coffino, White, & Grilo, 2019), preoccupation with food (Polivy, 1996), night eating (Veldheer, Zickgraf, Stefano, & Rigby, 2019), and emotional eating in adults (Dressler & Smith, 2015). However, the mechanistic effect of household food insecurity on disordered eating symptoms is not well understood. It has been proposed that household food insecurity impacts eating-related behaviors through stress-related mechanisms (Laraia, Vinikoor-Imler, & Siega-Riz, 2015; Zickgraf et al., 2019). The stress of household food insecurity may exacerbate or contribute to disordered eating. Longitudinally, baseline household food insecurity has been positively associated with perceived stress and disordered eating symptoms after 12 months in pregnant mothers (Laraia, Vinikoor-Imler, & Siega-Riz, 2015). Becker et al. (2017) found that in adults seeking food from food pantries, as household food insecurity severity increased, worry and binge eating frequency also increased. Hooper et al., 2020, recently reported that household food insecurity was associated with disordered eating in a population-based sample of low-income adolescents. Only one study to date has examined the relation between household food insecurity and disordered eating in adult patients with severe obesity seeking bariatric surgery and found that household food insecurity was associated with binge eating and night eating behaviors (Zickgraf et al., 2019). Data indicated that the mechanism in the relation between household food insecurity and disordered eating was depression, highlighting the importance of mood and emotions in this process.

## **Depression**

Given the physical and social transitions and the potential for increased exposure to psychosocial stressors during adolescence (Nelson, Leibenluft, McClure, & Pine, 2005), youth are particularly vulnerable to depression. According to the National Comorbidity Survey



Replication, nearly 8% of adolescents have a diagnosis of depression (Kessler et al., 2005), with a greater percentage experiencing subclinical depressive symptoms. Depressive symptoms in adolescents may include emotional or behavioral changes including feelings of sadness, anger, or frustration, loss of interest in activities, fatigue, low self-esteem, decreased concentration, sleep disturbance, and changes in appetite. Depressive symptoms are associated with several negative physical and psychological outcomes including social and educational impairment (Fergusson & Woodward, 2002), risk for substance abuse, increased risk for a range of mental health disorders during adulthood, and current and future risk for obesity (Blaine, 2008; Dockray, Susman, & Dorn, 2008). A meta-analysis of longitudinal studies of depression and weight control in adolescents found that depressed adolescents were at significantly higher risk of developing obesity compared to non-depressed adolescents (Blaine, 2008). Depression appears to be more common in adolescents with obesity compared to national averages (Mojtabai, Olfson, & Han, 2016; Zeller et al., 2006). In a study of adolescents with severe obesity presenting for bariatric surgery, Zeller et al. (2006) reported a prevalence of depression of 30%, considerably higher than the 11.3% national prevalence for adolescents in the United States (Mojtabai, Olfson, & Han, 2016).

### ***Depression and obesity.***

In a recent systematic review and meta-analysis of longitudinal studies, Mannan, Mamun, Doi, and Clavarino (2016) established a bi-directional relation between depression and obesity in adolescents. Results indicated that depressed adolescents have a 70% increased risk for obesity, and adolescents with obesity have a 40% increased risk for depression. Adolescents with obesity are at high risk for teasing and peer victimization (Janssen et al., 2004), which may contribute to depression. A meta-analysis by Hawker (2000) found a strong relation between teasing and

victimization and depression in youth. Adams and Bukowski (2008) reported that adolescents with obesity experience significantly greater peer victimization than their non-obese peers, and the relation between victimization and depression was mediated by self-concept. Further, obesity has been associated with low self-esteem (de Sousa, 2008) and body dissatisfaction (Coelho, Fonseca, Pinto, & Mourão-Carvalho, 2016) in adolescents, which have been found to prospectively predict depression in adolescents (Paxton, Neumark-Sztainer, Hannan, & Eisenberg, 2006). Physical impairments and sleep disturbances associated with obesity may also increase an adolescent's vulnerability to depression. Additionally, adolescents who are depressed may engage in more sedentary behavior, exhibit poorer sleep hygiene, and experience changes in appetite that may contribute to weight gain and obesity. Consistent with the adult literature (e.g., Onyike, Crum, Lee, Lyketsos, & Eaton, 2003), the relation between depression and obesity is strongest in adolescents with the most severe obesity (Fox, Gross, Rudser, Foy, & Kelly, 2016). Treatment-seeking adolescents with depression were 3.5 times more likely to have severe obesity than those without depression, suggesting adolescents with severe obesity may be especially vulnerable to depression.

### ***Depression and disordered eating.***

Ample evidence suggests that depressive symptoms are associated with disordered eating symptoms. The lifetime comorbidity of depression and eating disorder pathology is high (50-70%; American Psychiatric Association Workgroup on Eating Disorders, 2000). Longitudinal data show that depressive symptoms have been found to predict onset and increases in binge/LOC eating (Spoor et al., 2006; Stice, Presnell, & Spangler, 2002) and emotional eating (Kidwell, Nelson, Nelson, & Espy, 2017) in adolescents. However, depression also appears to increase as a result of disordered eating, potentially given increases in body dissatisfaction,

shame, or social isolation following disordered eating episodes (Stice, Hayward, Cameron, Killen, & Taylor, 2000). Underlying negative affectivity and shared genetic factors may predispose individuals to both depressive and disordered eating symptoms (Czaja, Rief, & Hilbert, 2009). In one study, van Strien et al. (2010) reported that adolescent depressive symptoms were associated with emotional eating, especially in adolescents with genetic predisposition for low levels of serotonin.

Furthermore, the relation between depression and disordered eating has been established in adolescents with obesity. Depression has been associated with emotional eating (d'Autume et al., 2012) and binge/LOC eating in samples of adolescents with obesity (Glasofer et al., 2007) and in adolescents with severe obesity seeking bariatric surgery (Utzinger et al., 2016).

### **Household Food Insecurity, Depression, and Disordered Eating**

There are several proposed mechanisms of the relation between household food insecurity and disordered eating symptoms. One proposed mechanism includes a reliance on highly palatable, inexpensive foods. In animal models, inconsistent access to highly palatable foods triggers disordered eating (Corwin, 2004). These foods may promote disordered eating through increased food cravings or appetite dysregulation. Another hypothesis is that the restriction of food, similar to dietary restriction driven by shape or weight concerns, triggers disordered eating through cycles of dietary restriction and overeating or binge behaviors (Polivy, 1996). However, the evidence also supports that mood symptoms may at least partially explain the relation between household food insecurity and disordered eating symptoms. In a study of household food insecurity, depression, and binge eating in adults with severe obesity seeking bariatric surgery, Zickgraf et al. (2019) reported that depression mediated the relation between household food insecurity and binge eating. This suggests that the stress of household food

insecurity may cause or exacerbate – via psychological and physical pathways – depressive symptoms, which in turn contribute to disordered eating symptoms. The evidence suggests that household food insecurity is associated with many symptoms of depression, including fatigue, hopelessness, and sleep disturbance (Leung et al., 2015; Silverman et al., 2015) even after controlling for other aspects of low SES (McLaughlin et al., 2012). Naturalistic experimental and longitudinal evidence also support that household food insecurity is associated with subsequent mood changes (Hadley & Patil, 2008; Huddlestone-Casas, Charnigo, & Simmons, 2009). In adults presenting for bariatric surgery, household food insecurity has been associated with higher depression scores (Veldheer, Zickgraf, Stefano, & Rigby, 2019). Data support that depression is related to disordered eating in adolescents with obesity (Glasofer et al., 2007;) and in adolescents with severe obesity seeking bariatric surgery (Utzing et al., 2016).

### **Current Study**

In summary, rates of obesity and severe obesity in adolescents have increased dramatically in recent decades. Disordered eating behaviors are associated with excess adiposity and are common in adolescents with obesity. Given the established associations between household food insecurity and depressive symptoms with disordered eating symptoms, there remains a dearth of literature on these constructs in adolescents with severe obesity. This study will examine the relations between household food insecurity and disordered eating symptoms, and depressive symptoms and disordered eating symptoms. I will also examine the indirect effect of household food insecurity on disordered eating through depressive symptoms in adolescents with severe obesity seeking bariatric surgery. The findings may provide implications for targeting barriers to physical and mental health in adolescents with severe obesity.

## **Primary Aims and Hypotheses**

The purpose of the current study is to explore the relation between household food insecurity, depressive symptoms, and disordered eating symptoms in adolescents with severe obesity seeking bariatric surgery. Specifically, I aimed to assess whether and to what extent household food insecurity and depressive symptoms uniquely contribute to disordered eating in adolescents with severe obesity. It was hypothesized that positive linear relationships would exist between each of household food insecurity and depressive symptoms with disordered eating symptoms. Additionally, I aimed to determine if depression mediated the relation between household food insecurity and disordered eating in adolescents with severe obesity seeking bariatric surgery. Based on prior literature with a sample of adults with severe obesity seeking bariatric surgery (Zickgraf et al., 2019), it was hypothesized that there would be a significant indirect effect of household food insecurity on disordered eating through the variable depression.

These data will contribute to the existing literature regarding the relations among household food insecurity, depression, and disordered eating in adolescents with severe obesity. Furthermore, although cross-sectional, this is the first step in exploring the importance of household food insecurity and its association with disordered eating in adolescents seeking bariatric surgery. The results of the study may have implications for treatment of severe obesity and inform recommendations for pre- and postoperative bariatric care for adolescent patients.

## **METHOD**

### **Participants**

Study participants included 73 adolescents who were enrolled in the bariatric surgery program at Children's Healthcare of Atlanta Strong4Life Clinic between 2012 and 2019, and who completed the bariatric pre-surgical program and psychological evaluation. Inclusion

criteria were having a BMI at the 140<sup>th</sup> percent of the 95<sup>th</sup> percentile or 130<sup>th</sup> percent of the 95<sup>th</sup> percentile with a weight-related comorbidity (e.g., hypertension, diabetes). Participants were between the ages of 14 and 19 years ( $M = 16.68$ ,  $SD = 1.35$ ); this age group is representative of the age range of adolescents participating in the bariatric program. Participants were primarily female (78%) and racially diverse (approximately 52% Black). All patients completing the program were fluent in English.

### **Power Analysis**

An a priori power analysis using the software package G\*Power 3.1.3 calculated that a sample size of at least 125 participants would provide 80% power to detect a small to medium effect size ( $f^2 = 0.10$ ; Faul, Erdfelder, Buchner, & Lang, 2009). This computation was based on a multiple regression model using four predictor variables; however, in the final analyses six predictor variables were entered. The significance level was set to  $\alpha < 0.05$  and error probability  $1-\beta$  was set to 0.80. The final sample size obtained from the bariatric clinic was 73, yielding power of 0.15. Thus, the current study is underpowered to detect small effect sizes.

### **Procedures**

As part of a larger study examining psychosocial and physical variables at each bariatric program clinic visit, data for the current study was collected during patients' routine preoperative bariatric psychological evaluation with a psychologist following approximately 6-10 months of clinic attendance. The evaluation was scheduled when an adolescent finished the preoperative bariatric program and qualified for bariatric surgery. Adolescents attended the evaluation with a parent and both filled out self-report measures. Height and weight were measured by clinic staff at the visit to calculate BMI percentile. As part of the larger study, the psychologist explained that study procedures would not differ from the routine preoperative care. They reviewed

potential benefits and risks of participating in the study and the methods to ensure the participants' privacy and confidentiality were maintained. Participants were informed that participation was voluntary and they could choose to discontinue and remove their information from the database at any time without changes to their preoperative care. Participant consent was obtained if the patient wished to participate.

Participants completed a demographic questionnaire and brief battery of questionnaires regarding depression and disordered eating symptoms as part of their preoperative psychological evaluation. Parents completed a measure of household food insecurity. Questionnaires took approximately 10 minutes to complete.

## **Measures**

### ***Demographic information.***

Child and family demographic data were collected using a demographic measure to assess information about the family (e.g., parent education) and the child (e.g., age, sex, race). Demographic variables were described and included as covariates in the analysis based on bivariate correlation with study variables.

### ***Medical information.***

Patients' electronic medical records were accessed to obtain BMI and weight-related comorbidities.

### ***Household food insecurity.***

The Hunger Vital Sign (Hager et al., 2010) is a self-report, 2-item measure of household food insecurity over the past 12 months. The questions were completed by parents and included, "Within the past 12 months we worried whether our food would run out before we got money to buy more," and "Within the past 12 months the food we bought just didn't last and we didn't

have money to get more” on a 3-point scale (“never,” “sometimes,” “often”). Households were considered food secure if they endorsed “never” for both items. Households were considered food insecure if they endorsed “sometimes” or “often” on either item. Compared to the Household Food Security Survey (HFSS), it demonstrated high sensitivity (97%) and adequate specificity (83%) for identifying household food insecurity in families with young children (Hager et al., 2010).

### ***Depression.***

The Quick Inventory of Depressive Symptomatology (QIDS; Rush et al., 2003) is a self-report questionnaire that measures depressive symptoms within symptom domains (i.e., sad mood, concentration, self-criticism, suicidal ideation, interest, energy/fatigue, sleep disturbance, appetite/weight change, and psychomotor agitation/retardation). The QIDS rates symptom domains during the past 7 days. The QIDS is a 16-item measure with items scored on a 4-point scale with individual items specifically matched to the domain area. The QIDS has demonstrated adequate internal consistency (Cronbach’s  $\alpha = .86$ ; Rush et al., 2003). The QIDS demonstrated concurrent validity with the 30-item Inventory of Depressive Symptomatology (IDS-SR30; .96).

### ***Disordered eating symptoms.***

The General Food Craving Questionnaire-Trait (GFCQ-T) is a self-report questionnaire that measures disordered eating (Nijs, Franken, & Muris, 2007) and is a modification of the original measure the Trait Food Craving Questionnaire (TFCQ; Cepeda-Benito, Gleaves, Williams, & Erath, 2000), which measures cravings for specific types of foods. The modified measure consists of 21 items that reflect disordered eating symptoms within the four subscales of binge/loss of control eating, emotional eating, preoccupation with food, and positive expectancy of eating craved foods. Items are scored on a 6-point Likert-type scale ranging from “never/not



applicable” to “always.” The GFCQ-T has good internal consistency (Cronbach’s  $\alpha = .94$ ; Nijs et al., 2007) and construct validity with disinhibited eating when emotional or exposed to food (Dutch Eating Behavior Questionnaire (DEBQ); van strien, Frijters, Bergers, & Defares, 1986). The total GFCQ-T score will be used as the dependent variable in analyses.

## RESULTS

Descriptive statistics were generated to characterize the sample and determine frequency and range of adolescent and family demographic variables (Table 1). Means and standard deviations of study variables (i.e., household food insecurity, depression, disordered eating) are presented in Table 2. Zero-order correlations between predictor and outcome variables are presented in Table 3. A series of preliminary analyses were conducted to determine associations among demographic variables and participant characteristics (race, age, BMI) and the main variables of interest (household food insecurity, depression, and disordered eating). Zero-order correlations among primary study variables and demographic variables are presented in Table 4.

*Table 1: Participant Demographic Characteristics (N = 73)*

	<i>M (SD)</i>	<i>Range</i>
<b>Age</b>	16.78 (1.35)	14-19
<b>Weight (lbs)</b>	320.41 (64.76)	198 -487
<b>BMI</b>	51.77 (9.60)	37.6 -87.9
<b>Percent body fat</b>	53.01 (5.27)	41-84.5
	<i>N</i>	<i>Percentile</i>
<b>Gender</b>		
Male	16	22
Female	57	78
<b>Race</b>		
Black/African American	38	52
White/Caucasian	33	45

Table 2: Descriptive Data of Study Variables

Variable	<i>N</i>	<i>Percentage</i>
1. Household Food Insecurity (Hunger Vital Sign) endorsed	20	27.4%

  

Variable	<i>M (SD)</i>	<i>Range</i>
2. Depression (Quick Inventory of Depressive Symptomatology)	6.49 (3.66)	1 - 18
3. Disordered Eating (General Food Craving Questionnaire)	41.44 (16.31)	21 - 105

Note. Quick Inventory of Depressive Symptomatology scores range from 0 to 27, with higher scores indicative of higher levels of depression. General Food Craving Questionnaire scores range from 21 to 126, with higher scores indicative of higher levels of disordered eating.

Table 3: Intercorrelations among Primary Study Variables

Variables	1.	2.	3.	4.	5.	6.	7.
1. Household Food Insecurity	---	---	---	---	---	---	---
2. Depression	-.024	---	---	---	---	---	---
3. Disordered Eating	.014	.263*	---	---	---	---	---
4. Loss of Control	-.055	.244*	.898**	---	---	---	---
5. Emotional Eating	.033	.267*	.795**	.631**	---	---	---
6. Preoccupation with Eating	.078	.177	.854**	.526**	.526**	---	---
7. Positive Expectancy Eating	.000	.200	.850**	.674**	.528**	.669**	---

Note. \*Denotes correlation significant at  $p < .05$  (2-tailed). \*\* Denotes correlation significant at  $p < .001$  (2-tailed). Note that loss of control eating, emotional eating, preoccupation with eating, and positive expectancy of eating are individual subscales of the disordered eating total.

*Table 4: Intercorrelations among Demographic and Primary Study Variables*

Variables	1.	2.	3.	4.	5.	6.	7.
1. Household Food Insecurity	---	---	---	---	---	---	---
2. Depression	-.024	---	---	---	---	---	---
3. Disordered Eating	.014	.263*	---	---	---	---	---
4. Age	-.014	-.037	-.042	---	---	---	---
5. Sex	-.028	.056	.202	-.087	---	---	---
6. Race	.313**	.028	-.062	.107	-.145	---	---
7. BMI	.012	.008	-.126	.231	.141	-.049	---

Note. \*Denotes correlation significant at  $p < .05$  (2-tailed). \*\* Denotes correlation significant at  $p < .001$  (2-tailed). Note that loss of control eating, emotional eating, preoccupation with eating, and positive expectancy of eating are individual subscales of the disordered eating total.

Independent samples *t* tests revealed that mean food insecurity was significantly higher for “Black/African American” participants ( $M = .378, SD = .491$ ) compared to “White” participants ( $M = .1471, SD = .359$ ). No significant differences in household food insecurity, depression, or disordered eating existed between any other demographic groups.

Regression assumptions (i.e., assumptions of normality, independence, linearity, homoscedasticity, and outliers) were checked for violations (Field, 2009). Primary predictor and outcome variables were tested for normality using Shapiro-Wilk and skewness coefficients. Violations in normality were revealed for the variable disordered eating ( $W = .892, p < .000$ ). Disordered eating was highly positively skewed (skewness = 1.409). A log data transformation was used to create a normally distributed variable for statistical analyses. The variable depression also violated assumptions of normality ( $W = .930, p < .001$ ), and was moderately positively skewed (skewness = .956). A square root transformation was used to create a normally distributed variable for statistical analyses. Violations in normality were revealed for the subscale loss of control ( $W = .845, p < .000$ ). Loss of control was highly positively skewed (skewness = 1.72). Violations in normality were revealed for the subscale emotional eating ( $W = .863, p < .000$ ). Emotional eating was moderately positively skewed (skewness = 0.99). Violations in normality were revealed for the subscale preoccupation with eating ( $W = .915, p < .000$ ). Preoccupation with eating was highly positively skewed (skewness = 1.06). Violations in normality were revealed for the subscale positive expectancy of eating ( $W = .881, p < .000$ ). Positive expectancy of eating was highly positively skewed (skewness = 1.31). Log transformations were used to create normally distributed subscale variables for exploratory statistical analyses. The Durbin-Watson statistic was within the acceptable range between 1.4 and 2.6 satisfying the assumption of independence of errors. Tolerance and VIF scores were used

to assess for the presence of multicollinearity; scores were in the acceptable range for all variables. Assumptions of homoscedasticity and normality of the error distributions were satisfied as residuals were normally distributed across levels of the predictor.

### **Primary analyses.**

A hierarchical regression analysis was conducted to test the unique predictive value of household food insecurity and depression on adolescent disordered eating. Based on conceptual relevance or significant correlations with predictor or outcome variables, race, BMI (Lenders, Gorman, Lim-Miller, Puklin, & Pratt, 2011), age (Coleman-Jensen, McFall, & Nord, 2013, Neumark-Sztainer et al., 2011), and gender (Striegel-Moore et al., 2019) were entered into the first step of the regression as covariates, explaining 6% of the variance in disordered eating. After entering household food insecurity and depression into the second step of the model, the total variance in disordered eating explained by the model as a whole was 17.4%,  $R^2 = 0.174$ ,  $F(6,66) = 2.325$ ,  $p = .043$ . Food insecurity and depression explained an additional 11% of the variance in disordered eating after controlling for BMI, race, age, and gender, R squared change = .112,  $F$  change (2,66) = 4.48,  $p < .05$ . In the final model, depression,  $\beta = 0.334$ ,  $t(68) = 2.987$ ,  $p = 0.004$ , was the only statistically significant predictor of disordered eating in the final model. Household food insecurity,  $\beta = .034$ ,  $t(68) = .285$ ,  $p = 0.776$ , was not a statistically significant predictor of disordered eating in the final model. As household food insecurity was not associated with depression or disordered eating, the potential mediation model was not tested.

*Table 5: Regression Analysis for Variables Predicting Disordered Eating*

Variable	<i>t</i>	$\beta$	<i>p</i>
Race	-.573	-.069	.569
Sex	1.57	.180	.121
Age	.096	.011	.924
BMI	-1.56	-.183	.123
Household Food Insecurity	.285	.034	.776
Depression	2.987	2.99	.004

### **Exploratory analyses.**

Hierarchical regression analyses were conducted to test the unique predictive value of household food insecurity and depression on each of the subscales of adolescent disordered eating including loss of control eating, emotional eating, preoccupation with eating, and positive expectancy of eating. Given the low statistical power to conduct multiple regression analyses, these analyses are considered exploratory.

To test the unique predictive value of household food insecurity and depression on loss of control eating, race, BMI, age, and gender were entered into the first step of the regression as covariates, explaining 10 percent of the variance in loss of control eating. After entering household food insecurity and depression into the second step of the model, the total variance in loss of control eating explained by the model as a whole was 18.4%,  $R^2 = 0.184$ ,  $F(6,66) = 2.48$   $p = .03$ . Food insecurity and depression explained an additional 8% of the variance in loss of control eating after controlling for BMI, race, age, and gender,  $R$  squared change = .077,  $F$  change (2,66) = 3.105,  $p < .05$ . In the final model, depression,  $\beta = 0.277$ ,  $t(68) = 2.49$ ,  $p = 0.015$ , was the only statistically significant predictor of loss of control eating in the final model.

*Table 6: Regression Analysis for Variables Predicting Disordered Eating Subscale Loss of Control Eating*

Variable	<i>t</i>	$\beta$	<i>p</i>
Race	-1.86	-.223	.066
Sex	1.61	.184	.111
Age	-.318	-.037	.751
BMI	-.790	-.092	.432
Household Food Insecurity	.012	.001	.990
Depression	2.49	.277	.015

To test the unique predictive value of household food insecurity and depression on emotional eating, race, BMI, age, and gender were entered into the first step of the regression as covariates, explaining 5% of the variance in loss of control eating. After entering household food insecurity and depression into the second step of the model, the total variance in loss of control eating explained by the model as a whole was 16.7%,  $R^2 = 0.167$ ,  $F(6,66) = 2.21$ ,  $p = .05$ . Food insecurity and depression explained an additional 12% of the variance in emotional eating after controlling for BMI, race, age, and gender,  $R$  squared change = .115,  $F$  change (2,66) = 4.55,  $p < .05$ . In the final model, depression,  $\beta = 0.339$ ,  $t(68) = 3.02$ ,  $p = 0.004$ , was the only statistically significant predictor of emotional eating in the final model.

*Table 7: Regression Analysis for Variables Predicting Disordered Eating Subscale Emotional Eating*

Variable	<i>t</i>	$\beta$	<i>p</i>
Race	-.328	-.040	.744
Sex	1.62	.187	.109
Age	.766	.090	.446
BMI	-1.334	-.157	.187
Household Food Insecurity	.176	.021	.861
Depression	3.015	.339	.004

To test the unique predictive value of household food insecurity and depression on preoccupation with eating, race, BMI, age, and gender were entered into the first step of the regression as covariates, explaining 5% of the variance in preoccupation with eating. After entering household food insecurity and depression into the second step of the model, the total variance in preoccupation with eating explained by the model as a whole was 10%,  $R^2 = 0.101$ ,  $F(6,66) = 1.23$ ,  $p = .30$ . Consequently, household food insecurity and depression do not significantly predict preoccupation with eating.

*Table 8: Regression Analysis for Variables Predicting Disordered Eating Subscale Preoccupation with Eating*

Variable	<i>t</i>	$\beta$	<i>p</i>
Race	-.433	-.054	.667
Sex	1.11	.133	.271
Age	-.143	-.017	.887
BMI	-1.51	-.184	.135
Household Food Insecurity	1.009	.124	.317
Depression	1.718	.201	.090



To test the unique predictive value of household food insecurity and depression on positive outcome expectancy of eating, race, BMI, age, and gender were entered into the first step of the regression as covariates, explaining 4% of the variance in positive expectancy of eating. After entering household food insecurity and depression into the second step of the model, the total variance in positive expectancy of eating explained by the model as a whole was 12.2%,  $R^2 = 0.122$ ,  $F(6,66) = 1.54$ ,  $p = .181$ . Consequently, household food insecurity and depression do not significantly predict positive outcome expectancy of eating after controlling for the covariates.

*Table 9: Regression Analysis for Variables Predicting Disordered Eating Subscale Positive Expectancy of Eating*

Variable	<i>t</i>	$\beta$	<i>p</i>
Race	.419	.052	.677
Sex	.833	.099	.408
Age	.189	.023	.851
BMI	-1.455	-.175	.151
Household Food Insecurity	-.145	-.018	0.89
Depression	2.55	0.294	0.013

## DISCUSSION

The purpose of the current study was to examine the extent to which household food insecurity and depressive symptoms related to disordered eating and whether depressive symptoms partially mediate the relation between household food insecurity and disordered eating in adolescents with severe obesity undergoing bariatric surgery. It was hypothesized that positive linear relations would exist between both household food insecurity and depressive symptoms with disordered eating behaviors. In addition, it was hypothesized that depressive symptoms would partially mediate the relation between household food insecurity and disordered eating.

Given the lack of the essential relation between household food insecurity and depressive symptoms necessary to conduct the mediation analysis, this analysis was not pursued.

Exploratory regression analyses examining the relation between household food insecurity and depressive symptoms with disordered eating subscales (i.e., loss of control, emotional eating, preoccupation with eating, and positive expectancy of eating) were conducted. Although the literature supports a link between depressive symptoms and disordered eating behaviors in this population (e.g., Utzinger et al., 2016), there is a dearth of research on the prevalence and psychosocial impact of household food insecurity in adolescents undergoing bariatric surgery. This is the first exploration of household food insecurity in an adolescent pre-bariatric surgery sample.

Household food insecurity was relatively common in this sample, with 27% of the sample endorsing food insecurity. This is significantly higher than the national average for families with children in the household (13.9%; Coleman-Jensen, Rabbitt, Gregory, & Singh, 2018). However, this percentage is similar to the prevalence of food insecurity found in adults in weight management and bariatric surgery programs (Price, Zickgraf, & Rigby, 2019) and that of families with an adult participating in a weight management or bariatric surgery program (Brown, Skelton, Palakshappa, & Pratt, 2020).

Additionally, household food insecurity was found to be significantly higher for families of Black adolescents compared to families of White adolescents, which is consistent with recent literature on health disparities, including food insecurity, in the United States (Dush, 2020; Nord, Andrews, & Carlson, 2007). A survey from 2000 to 2016 reported that Black households were twice as likely to experience food insecurity than White households (Coleman, Gregory, & Singh, 2017). Nationally representative longitudinal data show that Black households with

children are at significantly higher risk than White households with children to experience persistent household food insecurity (Burke, Jones, Fram, & Frongillo, 2012), suggesting Black households may be at higher risk for the cumulative effects of chronic food insecurity. The race/ethnicity and food insecurity relation is clearly complex, and reflects broader structural disadvantage and marginalization experienced by minority groups in this country. Household food insecurity has been considered a marker of poverty and low socioeconomic status. In the United States, a significant gap in wealth exists between racial groups, with data suggesting the wealth of White American households is 10 times that of Black American households (Dettling et al., 2017). Furthermore, data suggest that racial/ethnic minorities are more likely to reside in areas considered “food deserts,” which are characterized as locales where people do not have access to healthy and affordable food (Cummins & McIntyre, 2002).

The high rate of food insecurity as well as the racial disparities in household food insecurity in this sample are concerning given the association between household food insecurity and a host of negative behavioral and health outcomes during adolescence (Dush, 2020; Shankar, Chung, & Frank, 2017). According to a recent adolescent-focused review of household food insecurity (Dush, 2020), adolescents in food insecure households are more likely to drop out of school and have poor academic performance (Grineski, Morales, Collins, & Rubio, 2018), engage in unhealthy behaviors like smoking and drinking (Robson et al., 2017), skip breakfast (Bruening et al., 2012), and sleep fewer than 8 hours per night (Robson et al., 2017). Data suggest that household food insecurity is also associated with negative health outcomes in adolescents, including overall poorer general health (Kirkpatrick, McIntyre, & Potestio, 2010), poor glycemic control in adolescents with diabetes (Mendoza et al., 2018), vitamin deficiencies (Eicher-Miller, Mason, Weaver, McCabe, & Boushey, 2009), and higher rates of obesity

(Franklin et al., 2012; Holde & Taylor, 2015). Additionally, household food insecurity is linked to a food environment that promotes childhood obesity, including more obesity-promoting foods (e.g., fast food, high-sugar beverages) and less access to healthful foods (Nackers & Appelhans, 2013). In a systematic review of household food insecurity and key dietary outcomes in children and adolescents, Eicher-Miller and Zhao (2018) reported that although adolescent-focused studies were limited, evidence suggests adolescence may be a particularly important time in which food insecurity has the greatest potential to negatively impact diet. This may be detrimental to adolescents' ability to adhere to bariatric pre- and postoperative dietary recommendations.

In the current study, 49% of adolescents did not report depression, 36% reported depressive symptoms that correspond to a mild severity of depression, 12% reported moderate depression, and 3% reported severe depression (Rush et al., 2003). Moderate to severe depressive symptoms are typically considered clinically relevant. According to a systematic review of the prevalence of depressive symptoms in adolescents prior to bariatric surgery, 27-68% of adolescents endorsed moderate to severe depression (Herget, Rudolph, Hilbert, & Bluber, 2014). It is not clear why the current sample is endorsing less depression, but it could be related to differences in study methodology (e.g., measurement, use of clinical interview). Another explanation is that the systematic review included studies from 2006-2014 with only 25 to 40 adolescents per study. Bariatric surgery has become more common in recent years. Thus, patients seeking the relatively rarer surgery over 10 years ago may have had significantly more challenges, including depression.

## Primary findings

As hypothesized, depression was associated with disordered eating behaviors. In addition, exploratory analyses revealed that depression was also associated with the subscales loss of control eating and emotional eating in this sample. These findings are consistent with other data that suggest depression is related to binge/loss of control eating in adolescents with obesity (Glasofer et al., 2007; Isnard et al., 2003) and in adolescents with severe obesity seeking bariatric surgery (Jarvolm et al., 2018; Utzinger et al., 2016). According to a latent class analysis of psychiatric symptoms and eating disorder pathology in adolescents in a bariatric surgery program, adolescents in the highest risk of three categories, the “eating pathology” class, exhibited high levels of both depression and disordered eating, including binge eating (Sysko, Zakarin, Devlin, Bush, & Walsh, 2011). Depression has also been associated with emotional eating in samples of adolescents with obesity (d’Autume et al., 2012).

The data from the current study are consistent with the theory that disordered eating symptoms are cognitive, emotional, or behavioral responses to stress and negative mood states in the absence of more adaptive and effective coping strategies (Evers, Stok, & de Ridder, 2010; Loro & Orleans, 1981). Adolescents may engage in disordered eating behaviors to emotionally regulate difficult emotions (e.g., sadness, worthlessness, loneliness). Observational and laboratory studies have shown that binge eating may provide temporary relief from negative affect (Eichen, Chen, Boutelle, & McCloskey, 2017; Leehr et al., 2015). Depressive symptoms have also been found to predict the onset and increase of binge/LOC eating (Spoor et al., 2006; Stice, Presnell, & Spangler, 2002) and emotional eating (Kidwell, Nelson, Nelson, & Espy, 2017) in adolescents.

Given the correlational nature of the findings, the directionality of causality cannot be established. It could be that disordered eating symptoms contribute to depressive symptoms. Some longitudinal evidence supports the proposition that disordered eating predicts the onset of depression in female adolescents, potentially given increases in body dissatisfaction, shame, or social isolation associated with disordered eating (Stice, Hayward, Cameron, Killen, & Taylor, 2000). Underlying negative affectivity or shared genetic factors may predispose individuals to both depressive and disordered eating symptoms (Czaja, Rief, & Hilbert, 2009). Along these lines, other variables could account for the correlation between depressive symptoms and disordered eating. For example, studies have found that peer victimization (Lee & Vaillancourt, 2018) or family discord (Williams, Benson, Belford-Cohen, & Layne, 2015) are associated with depression as well as disordered eating in youth with obesity.

It should be noted that associations among depression and disordered eating can be at least partially explained by some overlapping symptomatology. Specifically, symptoms of depression include questions about appetite and weight gain, which might be included in indices focused on disordered eating behaviors. Although the measures in the current study contained minimal overlap, research in this area should be cognizant of the similarities in some aspects of the constructs of depression and disordered eating.

Contrary to the literature, household food insecurity was not associated with disordered eating in this study. The current literature describing the relation between household food insecurity and disordered eating symptoms is relatively limited. However, household food insecurity has been positively associated with disordered eating symptoms in adults (Becker, 2017; Dressler & Smith, 2015; Polivy, 1996), including those with obesity (Rasmusson, Lydecker, Coffino, White, & Grilo, 2019), and those seeking bariatric surgery (Veldheer,

Zickgraf, Stefano, & Rigby, 2019; Zickgraf et al., 2019). Hooper et al. (2020) recently reported that household food insecurity was associated with disordered eating in a population-based sample of low-income adolescents. However, the current study is the first to examine the relation between household food insecurity and disordered eating in adolescents seeking bariatric surgery. In adults, the proposed mechanisms of the relation between household food insecurity and disordered eating are not well understood. Some suggested explanations are that an increase in negative affect or depression (Zickgraf et al., 2019) or periods of dietary restriction (Polivy, 1996) contribute to disordered eating. It is possible that the driving mechanisms between household food insecurity and disordered eating in adults may not be activated in adolescents.

When a household is experiencing food insecurity, parents and caregivers may be able to effectively protect their children from the stressful effects of food insecurity. Few studies have compared household food insecurity ratings between adolescents and their parents; however, Bernard et al. (2018) reported 64% agreement between parent and child (age 8-17) self-report household food insecurity. However, the sample size was relatively small in that study ( $N = 58$ ), and other evidence suggests that in the presence of household food insecurity, low income mothers may change buying habits to include energy-dense, low-cost foods (Burke et al., 2017) or limit their own intake and compromise their own health to prevent their children from experiencing hunger (McIntyre, Glanville, & Raine, 2003). According to the USDA, nearly 14% of households with children report household food insecurity; however, in about half of these instances, only the adults are food insecure due to parents protecting their children from food insecurity (Coleman-Jensen et al., 2019). In a qualitative analysis of parents' who experience household food insecurity, major themes included feeding the child before eating themselves and attempting to protect children from what they perceived to be toxic stress (Knowles,

Rabinowich, Ettinger, Becker, Cutts, & Chilton, 2015). In the current study, although household food insecurity is present in a large percentage of the sample, it may have a less direct effect on adolescents. As the Hunger Vital Sign assesses both objective (i.e., running out of food) and subjective worry regarding running out of food, it may be that worrying about food shortages is critical in the relation between household food insecurity and negative outcomes found in adult samples (Becker et al., 2017). Direct assessment of adolescents' perception of household food insecurity and their appraisal of it would be necessary to determine how adolescents are experiencing household food insecurity.

It should be noted that the current sample has a much higher percentage of Black adolescents compared to the findings of a national retrospective analysis of adolescents who underwent bariatric surgery from 2007-2014 (Nunez Lopez, Jupiter, Bohanon, Radhakrishnan, & Bowen-Jallow, 2017). It reported that White adolescents underwent bariatric surgery 2.5 times more than Black adolescents. It's possible that some cultural factors may have been protective of depression and contributed to the lack of relations between household food insecurity and disordered eating and depression found in other samples.

### **Limitations and Future Directions**

A key consideration is that the current study was significantly underpowered, which limits the interpretation of findings. A larger sample size would be needed to sufficiently power multiple regression analyses with six predictor variables with the given effect sizes. A larger sample size would also allow for more advanced and robust statistical analyses to understand the interactions and mechanisms between household food insecurity and depression and their contribution to disordered eating. That said, a posthoc power analysis indicated that a sample of 461 would have been needed to find significance with the small effect size obtained in this



sample, which highlights issues about the clinical significance of findings with small effects.

Potential methodological issues should also be considered when interpreting findings from the current study. The measurement of constructs may have impacted the findings and should be considered in future research. Household food insecurity was rated by adolescents' parent or caregiver using the Hunger Vital Sign, a commonly-used, two-question assessment of whether the respondent had either worried about running out of food or had run out of food. Although the Hunger Vital Sign is frequently used for the measurement of household food insecurity (e.g., Gattu et al., 2019; Makelarski, Abramsohn, Benjamin, Senxi Du, & Lindau, 2017), this 2-item measurement of household food insecurity may have significantly underrepresented the construct. Other more robust measures of household food insecurity exist and include items from the Hunger Vital Sign and items reflecting severity and frequency of food insecurity as well as impact on various family members (Carlson, Andrews, & Bickel, 1999). A more comprehensive and nuanced assessment may be required to understand the complexities of household food insecurity (e.g., acute vs. chronic food insecurity) and the impact on each member of the household. Incorporating an adolescent rating of household food insecurity may clarify how adolescents perceive or understand the food insecurity their household is experiencing. Additionally, further study of household food insecurity is necessary to determine the impact of this critical construct on mental health and bariatric weight outcomes in adolescents undergoing bariatric surgery.

Given the sensitive nature of the household food insecurity, parents may have underreported its presence. Demographic information collected in the current study did not include any other measures of socioeconomic status. A one-time measure of family income would have aided in the description of the sample and may have identified families at the highest

risk for household food insecurity and negative outcomes, even if food insecurity was not endorsed.

In the current study, depression was measured at the psychological evaluation, following participation in the bariatric program. The psychologist had assessed for and treated symptoms of depression throughout the program. Therefore, depressive symptoms at the time of psychological evaluation may have been lower than at the beginning of the bariatric program. As adolescents were being assessed for surgery readiness, they may have underreported symptoms of depression. Additionally, although the QIDS-SR16 has been validated on adolescents (Bernstein et al., 2010), it's unclear if it has been validated on a racially diverse sample. Evidence suggests that Black adolescents may be more likely to express depressive symptoms through interpersonal conflict and physical complaints (Lu, Lindsey, Irsheid, & Nebbitt, 2017). Therefore, depressive symptoms may have been underreported using this measure.

The current study used a measure of disordered eating with subscales that included symptoms across behavioral (i.e., binge/loss of control), cognitive (i.e., positive expectancy, preoccupation with food), and emotional factors (i.e., emotional eating). The combined subscales represent a disordered eating construct characterized by overconsumption. Previous studies typically examined either binge/loss of control eating or emotional eating as the primary outcome. Although this study did not use a typical eating disorder measure, given the typically sub-threshold nature of eating disorder symptoms in this population, disordered eating behaviors may be of greater relevance to adolescents undergoing bariatric surgery.

Disordered eating in this study was assessed without a specified time frame, compared to depression that was assessed within the “past 7 days” and household food insecurity “over the past 12 months.” A systematic review of the measurement of disordered eating in adult bariatric

surgery candidates (Parker & Brennan, 2014) highlighted the inconsistency and variability in assessment of disordered eating constructs within the literature on bariatric surgery. They reported that disordered eating constructs were measured with a variety of measurement tools that assessed behavioral, cognitive, and emotional eating factors and were not previously validated on bariatric samples, making direct comparison of findings difficult. Future research should continue to focus on the standardization of the assessment of disordered eating.

### **Clinical Implications**

The relation between depression and disordered eating behaviors highlights the importance of identifying patients who require additional psychosocial intervention throughout the bariatric process to ensure well-being and health outcomes. Given the negative weight loss outcomes associated with pre-surgery disordered eating (Chesler, 2012; Niego, Kofman, Weiss, Geliebter, 2007), depression in adolescents seeking bariatric surgery may negatively impact an adolescent's ability to maintain necessary dietary requirements pre- and post-surgery. Screening and monitoring of depression and disordered eating are necessary to identify adolescents at the highest risk. Targeted intervention to teach more adaptive coping skills to manage and respond to difficult emotions may be necessary to reduce disordered eating behaviors in high-risk adolescents. Evidence from a systematic review suggests psychosocial interventions, particularly cognitive behavioral therapy, decrease disordered eating behaviors and improve psychological functioning in adult bariatric surgery patients (David, Sijercic, & Cassin, 2020). Evidence suggests cognitive behavioral therapy based interventions are associated with decreased binge eating in adolescent females (DeBar et al., 2013) and adolescents with overweight and obesity (Wilfley, Kolko, & Kass, 2011). However, literature on evidence-based psychological interventions to treat depression and disordered eating specifically in adolescent bariatric patients

is limited. Romirowsky et al., (2015) presented a case report of an adolescent participating in an evidence-based psychological intervention delivered over 11 months pre- and post-bariatric surgery (Romirowsky, Kushner, Matherne, Nadler, & Mackey (2015). Results indicated improvements in depression and binge eating behaviors.

Although food insecurity was not related to disordered eating behaviors in this sample, the high percentage of families reporting household food insecurity compared to the national average as well as the racial disparities in household food insecurity warrant attention. To combat household food insecurity, providers must focus on implementing screening and providing individual family support for high-risk families at the hospital, as well as promoting structural changes to target underlying social inequities that contribute to household food insecurity.

For patients undergoing bariatric surgery, post-surgical weight loss outcomes are dependent on adherence to the surgical team's recommendations for food intake and eating behaviors (Sarwer et al., 2008.). Price, Zickgraf, and Rigby (2020) reported that adult bariatric surgery candidates who endorsed food insecurity also perceived recommended post-surgical bariatric supplies (e.g., protein shakes) and food to be inaccessible and endorsed food shopping behaviors that could interfere with adherence to dietary recommendations. A household's lack of access to healthy foods may interfere with an adolescent's ability to maintain the prescribed diet, putting them at risk for negative post-surgical outcomes. This highlights the need for regular screening of household food insecurity of all families and targeted efforts to address food insecurity in high-risk patients in adolescent bariatric programs. This may include connecting families with local emergency food resources such as food banks or pantries to address immediate needs, existing federal food and nutrition services (e.g., Supplemental Nutrition

Assistance Program) for ongoing support in acquiring food, or other federal services to increase financial resources more broadly (Temporary Assistance for Needy Families). Hospitals or clinics should maintain updated internal databases of social service-related resources to provide to patients in the absence of a social worker or patient navigator. Furthermore, several hospitals have implemented promising active referral systems in which social service representatives or organizations follow-up directly with families to reduce the burden placed on families to seek services (Healthcare Without Harm, 2018).

Given the persistence and magnitude of class and racial inequities contributing to household food insecurity, solutions to address household food insecurity and racial disparities in access to healthy foods must be addressed more broadly at a systemic level and include other social determinants of health. Food security advocates argue the necessity of incorporating approaches that address structural racism and discrimination when combatting food insecurity on a systemic level (Bailey et al., 2017; Gee and Ford, 2011; Odoms-Young, 2018). The root causes of household food insecurity in the United States can be seen in the class and racial disparities that have historically and presently exist across social determinants of health (e.g., economic stability, housing, education, access to healthy foods). Efforts to address inequity in food access also require focus on inequities within other domains that contribute to poverty and household food insecurity. For example, Baer et al. (2015) found that in adolescents and young adults, food insecurity was strongly associated with housing insecurity, healthcare access, income insecurity, and substance use (Baer, Scherer, Fleegler, & Hassan, 2015). These inequities must be addressed and prioritized by institutions as well as promoted through policy change.

## Conclusions

This was the first study to examine household food insecurity in adolescents seeking bariatric surgery. Household food insecurity in this sample was significantly higher than the national average for families with children in the household (13.9%; Coleman-Jensen, Rabbitt, Gregory, & Singh, 2018) but similar to the prevalence of food insecurity found in adults in weight management and bariatric surgery programs (Brown, Skelton, Palakshappa, & Pratt, 2020; Price, Zickgraf, & Rigby, 2019). Additionally, household food insecurity was found to be significantly higher for Black adolescents compared to White adolescents, which is consistent with recent literature on health disparities. Household food insecurity was surprisingly not related to depression or disordered eating. Given the lack of relation between household food insecurity and depression, we could not entertain the idea that depression would mediate the relation between household food insecurity and disordered eating, and therefore the mediation analysis was not pursued. That said, the high rate of food insecurity as well as the racial disparities in household food insecurity are concerning given the association between household food insecurity and a host of negative behavioral and health outcomes during adolescence (Dush, 2020; Shankar, Chung, & Frank, 2017). Household food insecurity may be detrimental to adolescents' ability to adhere to bariatric pre- and postoperative dietary recommendations.

Although a smaller percentage of the sample reported depressive symptoms compared to previous literature of adolescents seeking bariatric surgery (Herget, Rudolph, Hilbert, & Bluber, 2014), depression was associated with disordered eating and the subscales loss of control eating and emotional eating in this sample. These data provide some initial evidence to support screening for household food insecurity and developing interventions that incorporate depression

and disordered eating, particularly binge/loss of control eating and emotional eating, in adolescents seeking bariatric surgery.

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## APPENDIX A. BACKGROUND INFORMATION

<i>Background Information Form</i>
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### Patient information

1. Date of birth \_\_\_/\_\_\_/\_\_\_

2. Age \_\_\_\_\_

3. Sex \_\_\_\_\_

4. Race/ethnicity

\_\_\_ American Indian or Alaska Native

\_\_\_ Asian

\_\_\_ Black or African American

\_\_\_ Native Hawaiian

\_\_\_ Other Pacific Islander

\_\_\_ White

5. Who lives in the home?

Relationship to child	Age

## APPENDIX B. GENERAL FOOD CRAVING QUESTIONNAIRE- TRAIT

<b>Disordered Eating Symptoms</b>
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Instructions: Below are some statements about food. For each statement, circle the number that best represents how frequently you feel that way. There are no right or wrong answers.

1	2	3	4	5	6
Never / Does not apply to me	Rarely	Sometimes	Often	Usually	Always

1. I feel like I have food on my mind all the time.	1	2	3	4	5	6
2. I can't stop thinking about eating no matter how hard I try.	1	2	3	4	5	6
3. I find myself preoccupied with (always thinking about) food.	1	2	3	4	5	6
4. If I am craving something, thoughts of eating it consume me.	1	2	3	4	5	6
5. Food cravings always make me think of ways to get what I want to eat.	1	2	3	4	5	6
6. I spend a lot of time thinking about whatever I will eat next.	1	2	3	4	5	6
7. If I eat what I'm craving, I often lose control and eat too much.	1	2	3	4	5	6
8. Once I start eating, I have trouble stopping.	1	2	3	4	5	6
9. When I crave something, I know I won't be able to stop eating once I start.	1	2	3	4	5	6
10. If I get what I am craving I cannot stop myself from eating it.	1	2	3	4	5	6
11. When I am with someone who is overeating, I usually overeat, too.	1	2	3	4	5	6
12. Whenever I go to a buffet, I end up eating more than what I needed.	1	2	3	4	5	6
13. Eating what I crave makes me feel better.	1	2	3	4	5	6
14. When I eat what I crave, I feel great.	1	2	3	4	5	6
15. I feel less anxious after I eat.	1	2	3	4	5	6
16. When I eat food, I feel comforted.	1	2	3	4	5	6
17. Sometimes eating makes things seem just perfect.	1	2	3	4	5	6
18. I crave foods when I am upset.	1	2	3	4	5	6
19. My emotions often make me want to eat.	1	2	3	4	5	6
20. When I am stressed out, I crave food.	1	2	3	4	5	6

21. I crave foods when I feel bored, angry, or sad.	1	2	3	4	5	6
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## APPENDIX C: HUNGER VITAL SIGN

<b>Household Food Insecurity</b>
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Instructions: We are interested in how you feel about the following statements. Read each statement carefully.

Using the following 1-3 scale, please indicate how often the statement applies to your household.

1 = Never    2 = Sometimes    3 = Often

1. Within the past 12 months we worried whether our food would run out before we got money to buy more.	<b>Never</b>	<b>Sometimes</b>	<b>Often</b>
2. Within the past 12 months the food we bought just didn't last and we didn't have money to get more.	<b>Never</b>	<b>Sometimes</b>	<b>Often</b>

## APPENDIX D. QUICK INVENTORY OF DEPRESSIVE SYMPTOMATOLOGY

### Depressive Symptoms

<b>During the past seven days ...</b>	<b>During the past seven days ...</b>
<p><b>1. Falling asleep:</b>            0 I never take longer than 30 minutes to fall asleep.            1 I take at least 30 minutes to fall asleep, less than half the time            2 I take at least 30 minutes to fall asleep more than half the time            3 I take more than 60 minutes to fall asleep more than half the time</p>	<p><b>5. Feeling sad:</b>            0 I do not feel sad            1 I feel sad less than half the time.            2 I feel sad more than half the time.            3 I feel sad nearly all the time.</p> <p>Please complete either 6 or 7 (not both)</p>
<p><b>2. Sleep during the night:</b>            0 I do not wake up at night            1 I have a restless light sleep with a few brief awakenings each night            2 I wake up at least once a night but I go back to sleep easily            3 I awaken more than once a night and stay awake for 20 minutes or more, more than half the time</p>	<p><b>6. Decreased Appetite:</b>            0 There is no change in my usual appetite            1 I eat somewhat less often or lesser amounts of food than usual            2 I eat much less than usual and only with personal effort            3 I rarely eat within a 24-hour period, and only with extreme personal effort or when others persuade me to eat</p>
<p><b>3. Waking up too early:</b>            0 Most of the time, I awaken no more than 30 minutes before I need to get up.            1 More than half the time, I awaken more than 30 minutes before I need to get up.            2 I almost always awaken at least one hour or so before I need to, but I go back to sleep eventually.            3 I awaken at least one hour before I need to, and can't go back to sleep</p>	<p>-- OR --  <b>7. Increased Appetite:</b>            0 There is no change in my usual appetite            1 I feel a need to eat more frequently than usual            2 I regularly eat more often and/or greater amounts of food than usual            3 I feel driven to overeat both at mealtime and between meals</p> <p>Please complete either 8 or 9 (not both)</p>
<p><b>4. Sleeping too much:</b>            0 I sleep no longer than 7-8 hours/night without napping during the day.            1 I sleep no longer than 10 hours in a 24-hour period including naps            2 I sleep no longer than 12 hours in a 24-hour period, including naps            3 I sleep longer than 12 hours in a 24-hour period, including naps.</p>	<p><b>8. Decreased weight (within the last 2 weeks):</b>            0 I have not had a change in my weight            1 I feel as if I have had a slight weight loss            2 I have lost 2 pounds or more            3 I have lost 5 pounds or more</p>
	<p>-- OR --  <b>9. Increased weight (within the last 2 weeks):</b>            0 I have not had a change in my weight            1 I feel as if I have had a slight weight gain            2 I have gained 2 pounds or more            3 I have gained 5 pounds or more</p>

During the past seven days ...	During the past seven days ...
<p><b>10. Concentration/Decision making:</b></p> <p>0 There is no change in my usual capacity to concentrate or make decisions</p> <p>1 I occasionally feel indecisive or find that my attention wanders</p> <p>2 Most of the time, I struggle to focus my attention or to make decisions</p> <p>3 I cannot concentrate well enough to read or cannot make even minor decisions</p>	<p><b>14. Energy level:</b></p> <p>0 There is no change in my usual level of energy</p> <p>1 I get tired more easily than usual</p> <p>2 I have to make a big effort to start or finish my usual daily activities (for example, shopping, homework, cooking, or going to work).</p> <p>3 I really just cannot carry out most of my usual daily activities because I just don't have the energy</p>
<p><b>11. View of myself:</b></p> <p>0 I see myself as equally worthwhile and deserving as other people</p> <p>1 I am more self-blaming than usual</p> <p>2 I largely believe that I cause problems for others</p> <p>3 I think almost constantly about major and minor defects in myself</p>	<p><b>15. Feeling slowed down:</b></p> <p>0 I think, speak, and move at my usual rate of speed</p> <p>1 I find that my thinking is slowed down or my voice sounds dull or flat</p> <p>2 It takes me several seconds to respond to most questions, and I'm sure my thinking is slowed.</p> <p>3 I am often unable to respond to questions without extreme effort</p>
<p><b>12. Thoughts of death and suicide:</b></p> <p>0 I do not think of suicide or death</p> <p>1 I feel that life is empty or wonder if it's worth living</p> <p>2 I think of suicide or death several times a week for several minutes</p> <p>3 I think of suicide or death several times a day in some detail, or I have made specific plans for suicide or have actually tried to take my life.</p>	<p><b>16. Feeling restless:</b></p> <p>0 I do not feel restless</p> <p>1 I'm often fidgety, wringing my hands, or need to shift how I am sitting</p> <p>2 I have impulses to move about and am quite restless</p> <p>3 At times, I am unable to stay seated and need to pace around.</p>
<p><b>13. General Interest:</b></p> <p>0 There is no change from usual in how interested I am in other people or activities</p> <p>1 I notice that I am less interested in people or activities</p> <p>2 I find I have interest in only one or two of my formerly pursued activities</p> <p>3 I have virtually no interest in formerly pursued activities</p>	<p><b>DO NOT WRITE BELOW THIS LINE</b></p> <p><b>OFFICE USE ONLY</b></p> <p><b>Total Score</b> _____</p> <p><b>Subscales:</b></p> <p><b>S</b>            _____    <b>Fa</b> _____</p> <p><b>W</b>            _____    <b>Gu</b> _____</p> <p><b>PsmCh</b>    _____    <b>Con</b> _____</p> <p><b>Dep</b>        _____    <b>SI</b> _____</p> <p><b>DecInt</b>    _____</p>