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DO BULIMIC BEHAVIORS INCREASE SHAME? TOWARD AN UNDERSTANDING OF TRANSDIAGNOSTIC RISK

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UNDERSTANDING OF TRANSDIAGNOSTIC RISK

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DISSERTATION
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the requirements for the degree of Doctor of
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ABSTRACT OF DISSERTATION

DO BULIMIC BEHAVIORS INCREASE SHAME? TOWARD AN
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Binge eating is a harmful, maladaptive behavior associated with comorbid psychopathology. Theory posits that increases in maladaptive, transdiagnostic emotions following binge eating in individuals with BN may predict the experience of comorbid symptoms. The current study served as a laboratory test of the first part of this theory: whether state increases in maladaptive emotions occur following engagement in binge eating behavior in women with BN compared with healthy controls. Women (n = 51) were recruited from the community if they met DSM-5 criteria for BN or OSFED BN (of low frequency) (n = 21) or were free of lifetime disordered eating and current psychopathology (n = 30). Participants completed questionnaires assessing eating disorder symptoms (preoccupation with weight and shape, urge to vomit), state shame, and state negative affect before and after consuming a test meal in which they were instructed to binge. Women with BN endorsed significantly greater preoccupation with weight and shape and urge to vomit following test meal consumption compared with controls. Women with BN reported significant increases in state shame, but not state negative affect, following test meal consumption, compared with controls. Results are consistent with a model indicating binge eating precipitates increases in state shame among women with BN. Given shame's status as a transdiagnostic risk factor, future work should clarify whether state shame following binge eating predicts increases in comorbid symptoms.

KEYWORDS: shame, mood, binge eating, bulimia nervosa, comorbidity

Heather A. Davis

April 29, 2019

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CHAPTER ONE: INTRODUCTION

Background

Bulimia nervosa (BN) is a severe eating disorder characterized by recurrent binge eating episodes, inappropriate compensatory behaviors, and overvaluation of weight and shape (APA, 2013). BN is associated with significant impairment (Jenkins, Hoste, Meyer, & Blissett, 2011), health problems (Klein & Walsh, 2004), increased rates of suicide (Franko & Keel, 2006) and a chronic course (Nagl et al., 2016). Importantly, there is extensive evidence that the problems and distress associated with BN extend beyond disordered eating. BN is highly comorbid with depression, anxiety, substance misuse, and self-harm. Estimates of the percentage of people with BN who also meet criteria for one or more of these other disorders are as high as 74.4% (Ulfvebrand et al., 2015).

Given the negative consequences of BN and its overlap with other severe mental disorders, one important avenue of investigation is to understand mechanisms of BN comorbidity with other disorders. This challenge exists within a broader framework for comorbidity research, where researchers seek to move beyond simply cataloguing comorbidity and toward identifying shared, underlying characteristics of otherwise different disorders that can help explain their co-occurrence. If those characteristics play a causal role in the development or maintenance of multiple disorders, they can be understood as mechanisms that help explain risk for comorbidity. Identification of underlying mechanisms would allow for the development of transdiagnostic interventions targeted toward those mechanisms and, eventually, the treatment of multiple different symptoms or disorders with a common intervention.

Concerning BN, individuals with BN are at higher risk for concurrent symptoms and diagnoses of mood disorders, anxiety disorders, post-traumatic stress disorder, substance use disorder, and suicidality (Bodell, Joiner, & Keel, 2013; Hudson, Hiripi, Pope, & Kessler, 2007; Patel, Olten, Patel, Shah, & Mansuri, 2018; Yao et al., 2016). Emphasizing the seriousness of this overlap, the presence of multiple comorbidities in BN is associated with inpatient hospitalization stays (Rø, Martinsen, Hoffart, & Rosenvinge, 2003) and a poorer prognosis (Milos, Spindler, Buddeberg, & Crameri, 2003). A pertinent question is the process by which this comorbidity develops. One possibility is that, in part, the comorbidity begins with BN.

Although the historic focus has been on studying risk factors for BN, studies have found that engagement in bulimic behaviors does in fact predict future engagement in other forms of psychopathology. Longitudinally, binge eating (or loss of control eating) precedes the development of depressive symptoms (Puccio, Fuller-Tyszkiewicz, Ong, & Krug, 2016; Stice, Burton, & Shaw, 2004; Tanofsky-Kraff et al., 2011), alcohol use (Bulik et al., 2004), and smoking (Stice & Shaw, 2003), although there is also evidence for prospective bi-directionality among these behaviors (Puccio et al., 2016). Thus, binge eating may serve as a risk factor for other types of dysfunction.

The empirical research I present here is based on the following model of comorbidity in the context of BN (see Davis, Ortiz, D'Agostino, & Smith, 2016). Among women with BN, binge eating may result in increases in the experience of shame and negative affect. Those attributes, in turn, may influence engagement in other forms of dysfunction. Thus, a mechanism by which BN may contribute to comorbidity is that engagement in bulimic behaviors may elicit emotional responses that transmit risk.

The current study sought to test one part of this theory: whether, among women with BN, shame and negative affect increase following engagement in binge eating behavior. I next review relevant research for each of these attributes as well as existing research that suggests the viability of this hypothesis test.

Emotion-based Risk as a Possible Mechanism for Comorbidity

 Shame. Shame is part of a family of negatively-valenced "self-conscious emotions" that are evoked by self-reflection and self-evaluation (Tangney, Stuewig, & Mashek, 2007). Shame is thought to be the most dysfunctional of this set of emotions because it represents a negative evaluation of the global self (Lewis, 1971; Tangney et al., 2007), while other such emotions, like guilt and embarrassment, represent negative evaluations of a specific behavior or experience. As such, shame is considered more painful than guilt or embarrassment because it is an overarching, negative attitude toward one's core self, rather than one's behavior. The core self is often viewed as permanent, whereas one's behavior is generally considered changeable. Research suggests that guilt is the more adaptive emotion because it motivates one to engage in reparative action, while shame exacerbates the experience of a variety of maladaptive psychological symptoms and reinforces the person's view of themselves as flawed (Kim, Thibodeau, & Jorgensen, 2011; Tangney et al., 2007).

 Individuals vary in how prone they are to experience shame. A shame-prone person would be expected to experience shame as a consequence of a variety of potential behaviors and outcomes, which may include binge eating, nonsuicidal self-harm, unfavorable interpersonal interactions, and drinking (Tangney et al., 2007). Importantly, shame can be understood at both the trait and state level. Trait shame (or shame

proneness) refers to a stable disposition toward experiencing shame in response to various situations. State shame is defined as an affective reaction in response to one's environment (Tangney, Wagner, Hill-Barlow, Marscall, & Gramzow, 1996) and is subject to momentary fluctuations. Similarly, guilt can be understood as a trait or state. Trait guilt represents a stable orientation toward experiencing regret or remorse about one's behavior, and the belief that the behavior can be changed, in a variety of situations, while state guilt refers to momentary fluctuations in those feelings.

Trait and state shame are associated with a range of psychiatric problems including BN (Cavalera et al., 2016; Goss & Allan, 2009; Sanftner et al., 1995), depression (Kim et al., 2011; Harder & Lewis, 1987), anxiety (Weingarden & Renshaw, 2015; Fergus, Valentiner, McGrath, & Jencius, 2010), and substance use (Dearing, Stuewig, & Tangney, 2005). By contrast, guilt and embarrassment (when measured independent of shame) are not related to multiple forms of dysfunction and so cannot transmit risk transdiagnostically (De Hooge, Breugelmans, & Zeelenberg, 2008; Tangney et al., 2007).

A plausible process by which binge eating may increase risk for transdiagnostic dysfunction through shame is as follows: for women with BN, the act of eating, accompanied by a loss of control, evokes increased feelings of state shame due to the perceived inability to refrain from eating, and/or to prevent the consequences excessive food consumption might have on weight or shape. The resulting increases in state shame may then lead to increases in comorbid symptoms (such as substance use, nonsuicidal self-harm, depression, and anxiety).

Negative affect. The experience of negative affect subsumes shame and guilt as

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well as a host of various other aversive mood states (e.g., anger, contempt, disgust, fear, and nervousness) (Watson & Clark, 1984). Trait negative affect represents a broad and stable mood disposition that predisposes one to experience heightened negative emotions (Watson & Clark, 1984). State negative affect, on the other hand, refers to the momentary experience of broad negative emotions, and is subject to changes in response to events in one's daily life, situational characteristics, and other factors (Watson & Clark, 1984). Similar to shame, trait negative affect is implicated in the development of multiple different types of psychopathology including disordered eating (Smyth et al., 2007; Stice, Marti, & Durant, 2011), depression (Gulley, Hankin, & Young, 2016; Pearson, Zapolski, & Smith, 2015a), substance use (Armeli, Conner, Collum, & Tennen, 2010; Armeli et al., 2015; Mason, Hitch, & Spoth, 2009), and self-harm (Klonsky, 2009). Theory identifies engagement in bulimic behaviors, particularly binge eating, as providing the negative reinforcement function of escape from, or avoidance of, subjective distress (Pearson, Wonderlich, & Smith, 2015b). Empirically, state negative affect precedes subsequent binge eating (Smyth et al., 2007; Stice, 2002).

Though there is abundant evidence regarding both trait and state negative affect as risk factors for binge eating, evidence for the effect of eating on state levels of negative affect is mixed. One study observed an overall decline in negative mood following a binge eating episode in youth (Ranzenhofer et al., 2013), and ecological momentary assessment (EMA) studies have shown a gradual, steady decline in state negative affect following a binge episode in women with BN (Smyth et al., 2007). These results suggest relief from negative emotion as a result of eating. However, a meta-analysis of EMA studies among individuals diagnosed with BN reported increases in negative mood

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shortly following binge eating episodes, suggesting a causal relationship between binge eating and momentary increases in negative emotions (Haedt-Matt & Keel, 2011). Recent EMA work indicated elevated negative mood on days in which loss of control eating occurred, both before and after the episode (Stevenson, Dvorak, Wonderlich, Crosby, & Gordon, 2018). A recent laboratory investigation of adults with BN reported increases in state negative affect after test meal consumption (Keel et al., 2018). Perhaps the discrepancy in findings is due to the impact of binge eating on certain negative emotions, rather than overall, broad negative emotion.

Laboratory Studies of Binge Eating

For decades, researchers in the field of eating disorders have conducted rigorous laboratory studies to better understand eating behavior in those with BN (Forbush & Hunt, 2014; Kissileff, Walsh, Kral, & Cassidy, 1986; Mitchell, Crow, Peterson, Wonderlich, & Crosby, 1998; Sysko, Steinglass, Schebendach, Mayer, & Walsh, 2018). These efforts have led to the recognition that pathological eating behavior among individuals with BN can be modeled in the laboratory when specific instructions are provided (Kaye et al., 1992; Mitchell et al., 1998; Sysko et al., 2018). In further support of these methods, many individuals with BN endorse feeling as though their behavior in the laboratory mimics their binge eating behavior at home (Mitchell et al., 1998), suggesting these experiments offer an acceptable analogue to binge eating. For these reasons, a laboratory study, where one can assess affective state immediately after binge eating behavior, may shed light on the impact of binge eating on affective, transdiagnostic risk processes.

The current study sought to evaluate changes in state shame and state negative affect after a laboratory binge eating episode among women with BN compared with healthy control women without any eating disorder symptoms, in a controlled laboratory environment.

First, as a test of the internal validity of the laboratory binge eating paradigm, I hypothesized that women with BN would report greater subjective eating disorder distress in the form of cognitive (i.e., preoccupation with weight/shape) and behavioral (i.e., urge to vomit) symptoms, after consuming the test meal, compared with controls. This test would replicate prior research indicating these effects for women with BN following a single, ad lib test meal (Keel et al., 2018).

My core hypothesis was that women with BN would report greater increases in state shame following test meal consumption compared to controls. I also hypothesized that women with BN would report greater increases in state negative affect following test meal consumption compared to controls. Previous research on this comparison has produced mixed results (Keel et al., 2018; Ranzenhofer et al., 2013; Smyth et al., 2007).

CHAPTER TWO: METHODS

Participants

     The participants were women (N = 51) recruited from two sources: the

University of Kentucky subject pool and the surrounding community. Participants were

recruited to fill two groups: women with DSM-5 criteria for BN or OSFED BN (of low

frequency)[1] (N = 21) and healthy controls (N = 30). For community-recruited women (N

= 16, 9 of whom were students at the local university), advertisements on social media

(i.e. Facebook and Instagram) and on posters at local college campuses, fitness

establishments, and coffee shops invited normal-weight women with no eating concerns

and women who binge ate and used extreme methods to control weight to email the

primary investigator of the study. Telephone screens were conducted to verify eligibility.

Participants were assessed using the SCID-5 (First, 2014) screening questions for

psychological disorders, to rule out current comorbid psychological diagnoses, and

questions concerning binge eating and extreme compensatory behaviors using the Eating

Disorder Examination (EDE; Cooper & Fairburn, 1987), to confirm diagnostic group.

Additional inclusion criteria for all participants were age between 18 and 45 years and

body mass index (BMI; weight in kilograms divided by height in meters squared)

between 18.5 and 26.5, based on self-report and verified with objective measure[2] at the

in-person study visit (see "Procedures" subsection).

     Participants were excluded from the study if they endorsed current medical

conditions or medication use that could influence appetite, weight, or ability to safely

participate, current pregnancy, or lactation (to control for variations in appetite due to

pregnancy or breastfeeding). Prospective participants with BN were excluded if they (a)

were in treatment or were seeking or interested in treatment or (b) if they had a lifetime history of AN. For non-eating disorder controls, self-reported lifetime history of eating disorder symptoms (as assessed by EDE-Q questions), dietary restriction for weight loss or maintenance within the past 8 weeks, exercise for more than 45 minutes more than four times per week were exclusion criteria. Participants in the BN group had to endorse criteria consistent with DSM-5 BN or DSM-5 OSFED BN (of low frequency)[1] (APA, 2013). To ensure accurate diagnostic classification, women with BN were required to endorse consuming at least 1000 kcal during objective binge eating episodes accompanied by a perceived loss of control. Calories consumed during objectively large binge eating episodes (OBEs) were calculated using nutritional information available on websites of food companies and restaurants. When brand names of food or restaurant information was unavailable, nutritional websites (i.e. myFitnessPal.com) were used to count calories.

Participants in the BN and control groups did not differ significantly on self-reported race or ethnicity, household income, or religion (all ps > .05). The two groups did not differ on BMI (t(df) = -1.68 (49), p = .10). Participants in the BN group were significantly older than control participants (t(df) = -3.79 (49), $p < .001$; a mean difference of 1.28 years). Mean (SD) age of participants was 19.41 (1.55) years. Racial and ethnic composition of the sample, as reported by participants, was as follows: 72.5% White/European American, 9.8% Black/African American, 7.8% Hispanic, 7.8% Asian/Pacific Islander, and 2% biracial.

Measures

　　BMI. Height (in centimeters) and weight (in kilograms) were measured at the study visit and BMI was calculated using the following formula: kg/m^2.

　　Food consumption. Food provided during the ad lib test meal was weighed before and after the test meal using a standard food scale. Total intake was calculated in grams consumed by taking the difference of the two values and then converting to calories using the gram to calorie ratio of the specific food.

　　Eating Disorder Symptoms. The Eating Disorder Examination-Questionnaire (EDE-Q; Fairburn & Beglin, 2008) was used to assess disordered eating behaviors and thoughts over the past four weeks. This 28-item self-report measure asks participants to rate, on a Likert scale anchored from 0-6, the frequency or severity of their disordered eating behaviors and thoughts. The measure consists of four subscales: Restraint, Eating Concern, Weight Concern, and Shape Concern. The EDE-Q was derived from the structured interview measure, the EDE (Fairburn & Cooper, 1993; Mond, Hay, Rodgers, & Owen, 2006), and has demonstrated good reliability and convergent validity with the EDE. Participants completed the EDE-Q before consuming the test meal. In this study, internal consistency for the four subscales was good to excellent: Restraint, $\alpha = .87$; Eating Concern $\alpha = .88$; Weight Concern $\alpha = .89$; and Shape Concern, $\alpha = .96$.

　　State Shame and Guilt. The State Shame and Guilt Scale (SSGS; Marschall et al., 1994) was used to assess state shame and guilt before and after test meal consumption. The SSGS is a 15-item self-report scale of in-the-moment feelings of shame, guilt, and pride experiences. The 5 items for each SSGS subscale were obtained from the empirical and theoretical literature surrounding shame, guilt, and pride. Only the shame and guilt

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subscales were used for this study. Though shame and guilt correlate highly (Tangney et al., 2007), it is shame independent of guilt that is thought to be most harmful. The SSGS asks participants to respond to how they currently feel and responses are rated on a Likert scale anchored at 1 (not feeling this way at all) to 5 (feeling this way very strongly). An example of a shame item is, "I want to sink into the floor and disappear". A sample guilt item is, "I feel tension about something I have done". The SSGS has demonstrated high levels of internal consistency (α = .82 - .89 for each subscale), test-retest reliability, predictive validity, and convergent validity (Tangney & Dearing, 2002). In this study, internal consistency for the shame (α = .83 at Time 1, α = .91 at Time 2) and guilt (α = .84 at Time 1, α = .94 at Time 2) subscales was good to excellent.

Negative affect. Participants were asked to complete ratings before and after test meal consumption on a 100 mm Visual Analogue Scale (VAS), anchored from "Not at all/No" to "Extreme/Extremely." Ratings included sad, anxious, tense, and angry. Given their conceptual relation, these items were highly correlated (α = .84) and combined to form a negative affect variable. VAS scales have been shown to be more sensitive to changes over time compared to Likert-type scale responses (Hasson & Arnetz, 2005). This approach has been used in previous investigations examining changes in VAS scores over a similar time frame (Mabe, Forney, & Keel, 2014; Keel et al., 2018).

Eating disorder distress. VAS scales were also used to measure feelings of hunger/fullness and eating disorder distress. Ratings included hungry, full, preoccupation with shape, preoccupation with shape, and urge to vomit. Preoccupation with weight and preoccupation with shape (α = .95) were combined to form a composite preoccupation with weight/shape variable, representing cognitive eating disorder distress (Brondolo et

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al., 2008; Keel et al., 2018; Mabe et al., 2014). Urge to vomit represented behavioral eating disorder distress.

Procedures

This study received institutional review board approval from the university's human subjects committee. Participants provided written informed consent prior to participation. Procedures included one study visit that lasted up to two hours.

Participants were provided a 200 kcal standardized breakfast (1 cup of store-bought yogurt with pre-measured granola) the night before or early in the morning of their study visit. They were instructed to consume the standardized breakfast on the morning of their study visit between 9am and 9:30am (between 900 h and 930 h) and to eat nothing else until their study visit assessment at 2pm (1400 h), as research suggests frequency of binge eating peaks after food restriction and in the early afternoon (Smyth et al., 2009). This is consistent with procedures used in other *ad lib* test meal studies (Keel et al., 2007; Kissileff, et al., 1996). Participants who did not follow instructions were not permitted to complete their study visit that day; they were provided another standardized breakfast and re-scheduled for a different day, or discontinued from the study if they reported they would be unable to follow instructions in the future. Reasons for being unable or unwilling to follow instructions were as follows: they did not like the taste of the breakfast, did not feel comfortable eating yogurt and/or granola, or did not prefer to eat that early in the morning. After obtaining informed consent and prior to questionnaire completion and test meal consumption, I verified participants' eligibility to ensure they followed study visit instructions with a brief clinical interview. Participants then had their height and weight measured and provided a urine sample for a pregnancy test.

Once deemed eligible, participants were provided with a questionnaire packet to be completed electronically on an iPad. This electronic questionnaire packet included baseline measures listed above and took about 35 to 50 minutes to complete. While the participant completed these questionnaires, I prepared the ad lib test meal.

Based on prior laboratory studies establishing increased food intake in those who binge eat compared to controls (Raymond et al., 2007), the ad lib test meal included three foods that participants with BN reported eating during binge eating episodes, and control participants reported enjoying for snacks. Participants were asked during their eligibility telephone screen to report three store-bought foods that I could provide to them during their study visit. Because I sought to simulate loss-of-control binge eating, I provided enough food to allow for that outcome: 2000 calories of each food item was placed into a bowl or plate and served at an individual place-setting (Wolfe, Metzger, & Jimerson, 2002). Participants were presented with the test meal and I provided the instructions: "Let yourself go and eat as much as you can", per the instructions of previous studies using ad-lib test meal procedures to simulate binge eating in women with BN (Goldfein, Walsh, Devlin, Lachaussée, & Kissileff, 1993; Hadigan et al., 1989; Hadigan, Walsh, Devlin, Lachaussée, Kissileff, 1992; Kissileff et al., 1986; LaChaussee et al., 1992). They were then left alone in the room with the food. These specific instructions have predicted increased food consumption among individuals with BN compared to controls in previous investigations (see Sysko et al., 2018, for a review). Participants were not provided instructions about whether they were permitted to vomit following the test meal. No participant was prevented from vomiting after completing the meal, similar to procedures of previous studies (Hetherington & Rolls, 1991; Rolls et al., 1992; Wolfe et

al., 2002). Of the 21 participants with BN, no participant ever left the room to vomit either during or directly after the study visit while still in the laboratory.

Participants indicated they were finished eating by opening the door to the study visit room. Once they were finished, the food was promptly removed from the room and the participant was immediately provided a follow-up questionnaire packet on the iPad and left alone to complete it. Upon completion of the follow-up questionnaires, the participant was guided through a relaxation exercise by the principle investigator. Previous research indicates binge eating may result in increases in negative affect (Haedt-Matt & Keel, 2011; Keel et al., 2018); the relaxation exercise aimed to return participants to a relaxed and neutral mood. All participants were verbally asked about their current mood before leaving the study visit. I completed follow-up risk assessments with any participant who endorsed self-harm urges, suicidal thoughts, or extreme distress on the questionnaires. Six individuals endorsed wanting to die one or more times in the past month, and two individuals endorsed self-harm urges above 0.

Upon completion of the relaxation exercise, all participants were debriefed on the purpose of the research, provided compensation in cash ($10 or $30[3]) for community-recruited participants or electronic verification of credit for university-recruited participants, and provided a list for local mental health resources at the university (when applicable; i.e., for students) and in the community.

Data analytic method. Descriptive statistics were used to characterize the BN and control groups on demographic and clinical variables. Independent samples t-tests were used to compare groups on demographics, test meal consumption, and scores on the EDE-Q. Mean frequencies were calculated for eating disorder behaviors among

participants in the BN group. Mixed design, repeated measures analysis of covariance (ANCOVAs) assessed the effect of group (BN or control) as a between-subjects variable on within-subject changes in momentary scores on state shame, state negative affect and eating disorder distress (ratings of "preoccupation with weight/shape", and "urge to vomit") following test meal consumption. In each of these analyses, age was entered as a covariate because participants in the BN group were significantly older than controls on average. For analyses including state shame, state guilt was entered as a covariate in order to measure state shame uncomplicated by guilt, as is standard in shame assessment (Tangney et al., 2007). Following guidelines for the inclusion of covariates in mixed ANOVA designs, all covariates were centered (Schneider, Avivi-Reich, & Mozuraitis, 2015). To facilitate interpretation of clinical significance between groups, I calculated effect sizes (Cohen's d) for each result; per Cohen (1992), d = 0.20 represents a small effect size, d = 0.50 represents a medium effect size, and d = 0.80 represents a large effect size.

CHAPTER THREE: RESULTS

Descriptive Data and Comparisons

Table 1 presents comparisons between the BN and control groups on clinical

variables assessed at baseline. Participants in the BN group scored significantly higher on

all EDE-Q measures of eating pathology compared with non-eating disorder controls.

Participants in the BN group consumed significantly more calories during the test meal

and spent more time eating the test meal compared to controls. Though participants in the

control and BN groups did not differ on their hunger level prior to consuming the test

meal, participants in the BN group endorsed greater fullness ratings immediately after

eating the test meal compared to controls.

Test Meal Response

To assess the effects of test meal consumption, comparisons were made between

the BN and control conditions pre- and post- meal (see Table 2) on scores on eating

disorder distress (preoccupation with weight/shape and urge to vomit), state shame, and

state negative affect.

Eating disorder distress. Given my goal of establishing internal validity of the

binge eating paradigm and expected differences between groups, I began analyses by

testing changes in both cognitive and behavioral symptoms of eating disorder-specific

distress following the test meal. Beginning with the cognitive measure, there was a large

main effect of group on preoccupation with weight/shape ($d = 1.96$). As expected, the BN

group reported significantly greater preoccupation with weight/shape compared with

controls. I next tested the effect of test meal consumption on preoccupation with

weight/shape. The main effect of time was not significant, indicating that across groups,

preoccupation with weight/shape remained stable over time. However, a significant and moderate time by group interaction was observed (d = 0.73), indicating that there was a differential effect of test meal consumption on change in preoccupation with weight/shape from pre-meal to post-meal depending on group membership. As illustrated in Figure 1, participants in the BN group endorsed significantly greater increases in preoccupation with weight/shape immediately following the test meal than participants in the control group (M[SD] preoccupation with weight/shape score change = 10.38[22.06] versus –3.17[7.59]). This suggests test meal consumption predicts immediate increases in preoccupation with weight/shape for participants with BN compared with controls.

The behavioral measure of eating disorder-specific distress used was the VAS rating of urge to vomit. As expected, there was a significant and large main effect of group on urge to vomit (d = 1.36): the BN group reported significantly greater urge to vomit across time, compared with controls. The main effect of urge to vomit was significant, indicating urge to vomit increased across groups over time (d = 1.37). There was a significant and large time by group interaction (d = 0.92) such that the effect of test meal consumption on change in urge to vomit was different for participants in each group. As illustrated in Figure 2, participants in the BN group reported a significantly greater increase in urge to vomit rating immediately following the test meal than participants in the control group (M[SD] urge to vomit rating = 31.81[37.07] versus 0.63[2.67]).

Emotions. After establishing the internal validity of the binge eating task and clinical group, I next tested the effect of test meal consumption on state shame level, controlling for pre- meal state guilt. There was a significant and large main effect of

group on state shame controlling for state guilt (d = 1.12). Specifically, the BN group reported significantly higher state shame compared with controls. The main effect of time was not significant, indicating across groups, state shame level remained stable over time, controlling for guilt. A significant time by group interaction was observed for state shame, indicating that there was a moderately large differential effect of test meal consumption on change in state shame from pre-meal to post-meal depending on group membership (d = 0.62). As illustrated in Figure 3, participants in the BN group endorsed significantly greater increases in state shame following the test meal than participants in the control group, who reported a slight decrease in state shame following the test meal (M[SD] state shame score change = 1.81[4.20] versus –0.31[1.28]). The interaction of time by state guilt on change in state shame over time was not significant.

I next tested changes in negative affect following test meal consumption. There was a significant and moderate main effect of group on state negative affect (d = 1.08). Specifically, the BN group reported significantly greater negative affect compared with controls. The main effect of time on negative affect was not significant, indicating that collapsing across groups, negative affect remained stable over time. The interaction of group by time on negative affect was not significant, indicating change in negative affect level following the test meal was not different according to group.

Table 1. Comparison of groups on demographic and clinical characteristics

	Mean (SD)			
Measure	Control (n = 30)	BN (n = 21)	T (1, 49)	d
Age, years	18.80 (1.00)	20.29 (1.79)	3.79**	1.03
BMI	22.17 (2.29)	23.24 (2.15)	1.68	0.48
Test Meal Consumption, kcal	554.06 (235.60)	1276.35 (629.22)	5.67**	1.52
Time spent eating test meal, in minutes	13.84 (7.69)	19.42 (8.44)	2.29*	0.69
VAS Hunger, pre-meal	58.03 (19.80)	60.05 (23.78)	0.33	0.09
VAS Fullness, post-meal	59.13 (33.76)	79.43 (23.51)	2.37*	0.70
EDE-Q Restraint	0.21 (0.55)	2.83 (1.18)	10.68**	2.85
EDE-Q Eating Concern	0.15 (0.31)	2.70 (1.26)	10.72**	2.78
EDE-Q Weight Concern	0.65 (0.66)	3.61 (1.34)	10.41**	2.80
EDE-Q Shape Concern	1.02 (0.91)	4.30 (1.28)	10.71**	2.95
Binge/month	--	8.81 (12.51)	--	
Self-induced vomiting/month	--	5.50 (14.28)	--	
Driven exercise/month	--	9.52 (8.58)	--	
Fasting/month	--	8.25 (5.63)	--	

Note. n = 51. Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by height in meters squared); VAS, Visual Analogue Scale; EDE-Q, Eating Disorder Examination- Questionnaire. Mean (SD) values for eating disorder behaviors indicate average number of episodes in the past month.

*p < .05, ** p < . 001.

Table 2. Subjective responses to the laboratory binge eating meal.

Variable	Control Mean (SD) (n = 30)	BN Mean (SD) (n = 21)	Group F	Time F	Time X Age F	Time X State Guilt F	Group X Time F	df
Preoccupation with shape/weight Pre	6.00 (9.82)	43.62 (28.81)	46.04 ***	2.57	0.15	--	6.42*	1, 48
Post	2.83 (7.05)	54.00 (31.41)						
Urge to vomit Pre	0.13 (0.57)	1.90 (5.21)	11.40 ***	22.46 ***	4.58*	--	10.11 **	1, 48
Post	0.77 (3.15)	33.71 (38.10)						
State Shame Pre	5.60 (1.43)	8.86 (4.22)	14.69 ***	3.47	0.30	0.90	4.47*	1, 47
Post	5.33 (0.76)	10.67 (5.16)						
Negative Affect Pre	5.89 (6.93)	16.17 (14.27)	13.98 ***	0.66	4.25*	--	1.07	1, 48
Post	1.75 (3.84)	19.52 (18.92)						

Note. n = 51. *p < .05, ** p < .01, *** p < .001.
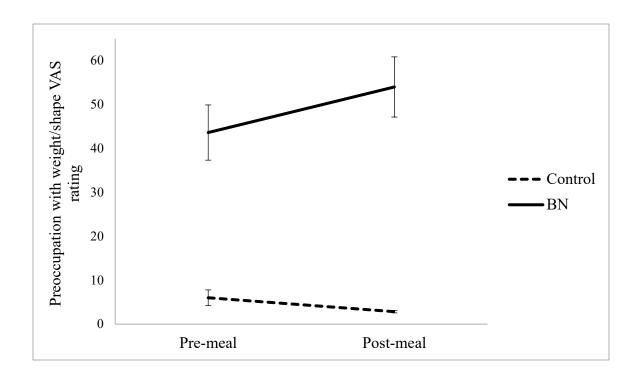
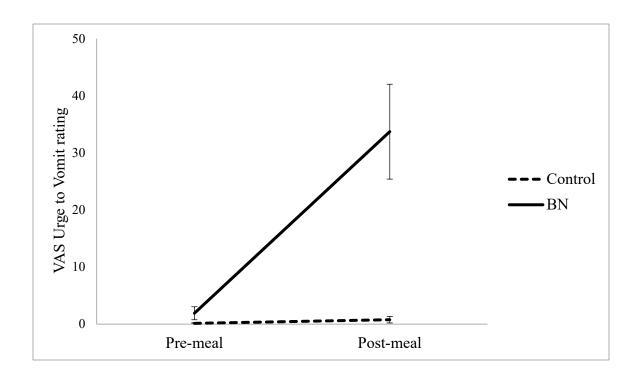Figure 1. Mean (± SE) self-reported preoccupation with weight/shape from pre-meal to post-meal.

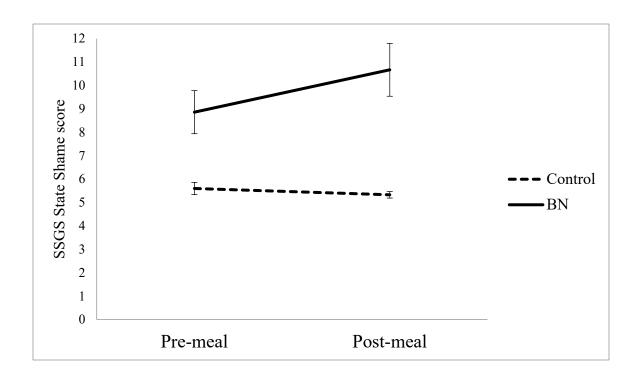Figure 2. Mean (± SE) self-reported urge to vomit from pre-meal to post-meal.

Figure 3. Mean (± SE) self-reported state shame from pre-meal to post-meal.

CHAPTER FOUR: DISCUSSION

The results of the current study provide further support for the use of laboratory analog binge eating designs in eating disorder research: In contrast to healthy control women, women with BN reported experiencing increases in both cognitive (preoccupation with weight and shape) and behavioral (urge to vomit) eating disorder symptoms after a laboratory binge eating event. Most importantly, the key study hypothesis was supported. State shame increased after laboratory binge eating for women with BN compared with control women. Contrary to my hypothesis, women with BN did not experience an increase in state negative affect compared to control women following the test meal.

While traditional research in the field of eating disorders has generally sought to establish risk for binge eating, I aimed to better understand the momentary, real-time consequences of binge eating on the experience of high-risk emotions and eating disorder symptoms. Given BN's chronic course, high comorbidity with other psychiatric disorders, and poor prognosis (Milos et al., 2003; Slane et al., 2014; Ulfvebrand et al., 2015), it is essential that researchers aim to better understand the consequences of binge eating behavior on women with BN.

Although prior work has established both cross-sectional and longitudinal associations between disordered eating and shame (Davis & Smith, 2019; Duarte, Ferreira, & Pinto-Gouveia, 2016; Goss & Allan, 2009; Sanftner, Barlow, Marschall, & Tangney, 1995; Sanftner & Crowther, 1998), this is the first documentation of increases in state shame following laboratory binge eating in a clinical sample of young women with BN. The findings of this study, though not demonstrative of causal processes, are consistent with the theory that binge eating behavior in the context of BN causes

increases in the experience of shame, a harmful emotion that heightens risk for the experience of multiple forms of psychopathology beyond just disordered eating (Tangney et al., 2007).

It is striking that increases in state shame among women with BN could be observed after just one occasion of binge eating in a laboratory setting. This observation suggests the possibility that binge eating in one's natural environment, engaged in repetitively over time, may impact overall trait shame levels. Although it is not yet clear whether repeated changes in state levels of a variable result in changes in trait levels of the variable, there is an emerging body of literature documenting personality change over extended periods of time that is predictable from engagement in specific behaviors. For example, early onset alcohol consumption, tobacco smoking, and binge eating predict subsequent increases in the trait of urgency, the tendency to act rashly when emotional among adolescents (Burris, Riley, Puleo, & Smith, 2017; Davis, Ortiz, & Smith, 2019; Riley, Rukavina, & Smith, 2016).

Recently, Davis and Smith (2019) showed that engagement in binge eating behavior predicts increases in shame three months later. This longitudinal finding, together with the current laboratory finding, may have important implications: if shame, a transdiagnostic risk factor for depression, anxiety, substance use, and self-harm (Kim et al., 2011; Tangney et al., 2007), increases as a result of binge eating, does the binge eating effect on shame increase risk for these other maladaptive behaviors? These laboratory and longitudinal findings may be the first step toward the validation of a comorbidity risk model that emphasizes shame as a mechanism for the relationship between BN and other types of psychopathology (Davis et al., 2016). Future laboratory

work may seek to investigate urges to engage in transdiagnostic behaviors and endorsement of comorbid symptoms (such as depression and anxiety) in the minutes and hours following ad lib test meal consumption.

It is striking that increases in state shame following binge eating were greater for the BN group compared with controls, even after controlling for state guilt, indicating that the resulting increases in shame were uncomplicated by overlap with state guilt. The finding that uncomplicated shame was more strongly associated with BN overlaps with other research indicating a stronger association between shame and psychopathology, rather than guilt and psychopathology (Fergus et al., 2010; Kim et al., 2011; Pineles, Street, & Koenen, 2006; Tangney et al., 2007).

Clearly, shame is associated with harm among women with BN. By contrast, guilt among those with eating disorders demonstrates a protective effect (Sanftner et al., 1995). Shame and guilt most often occur in situations that are both self-relevant and negative. In the case of guilt, the focus is on regret for having engaged (or not engaged) in a given behavior (Miceli & Castelfranchi, 2018). One can address and resolve one's guilt by seeking to behave differently in the future (Dearing et al., 2005; Miceli & Castelfranchi, 2018). However, shame reflects a negative evaluation of the self as a whole (Tangney et al., 2007); someone experiencing shame experiences a negative attitude toward the self, rather than only toward a specific behavior. It appears that women with BN tend to experience more shame than guilt after binge eating. This more fundamentally negative affect predisposes risk to multiple forms of dysfunction and a host of problems (Tangney et al., 2007).

The BN and control groups reported significantly different levels of state negative affect across time, as expected and shown in previous work (Keel et al., 2018). However, given laboratory work indicating increases in state negative affect following test meal consumption in participants with BN instructed to eat until they felt full (Keel et al., 2018) and some EMA research demonstrating increases in state negative affect following binge eating (Haedt-Matt & Keel, 2011), it is surprising that state negative affect did not significantly increase immediately following laboratory binge eating for the BN group compared with controls in the current study. Other laboratory and EMA studies have found decreases in negative affect after binge eating for women with BN and girls with loss of control eating (Berg et al., 2013; Ranzenhofer et al., 2013). One possibility is that negative findings of the effect of laboratory binge eating on negative affect are in part due to small sample sizes. An additional possibility is that broad negative affect includes both affects influenced by, and not influenced by, binge eating among women with BN. One cross-sectional study reported that trait shame predicts eating disorder symptoms above and beyond general negative affectivity (Gupta, Rosenthal, Mancini, Cheavens, & Lynch, 2008). Perhaps shame is a particularly important facet of negative mood in the context of eating disorders, including BN and OSFED BN. Nevertheless, the current negative finding merits further investigation to better understand how broad negative mood is impacted after engagement in binge eating among women with BN.

As noted, participants with BN endorsed increases in both cognitive (preoccupation with weight/shape) and behavioral (urge to vomit) symptoms of eating disorder distress following the laboratory binge eating episode, compared with controls. These findings were a replication of previous studies reporting increases in preoccupation

with weight/shape and increased urges to vomit among women with BN, compared to controls, after consuming a single-item test meal (Keel et al., 2018). Notably, Keel et al. (2018) provided different instructions for their test meal ("Please eat until you feel full") than provided in the current study ("Let yourself go and eat as much as you can"). The current study used a multi-item test meal based on participants' preferences (Raymond et al., 2007), as well as the instruction to binge, and so provides new information about changes in preoccupation with weight/shape and urge to vomit following ad lib test meal consumption in the context of BN.

State shame may be a useful intervention target. Targeted intervention to treat shame precisely and promptly may be warranted in women with BN. Indeed, compassion-focused therapy (Gilbert, 2010; Goss & Allan, 2010) leads to reductions in shame level, and early reductions in shame are associated with decreases in eating disorder symptoms (Kelly, Carter, & Borairi, 2014). Clinicians treating women with BN or OSFED BN may elect to focus on shame as a primary treatment target. As noted, shame predicts transdiagnostic behaviors and symptoms (Dearing et al., 2005; Fergus et al., 2010; Harder & Lewis, 1987; Kim et al., 2011; Weingarden & Renshaw, 2015) that are comorbid with BN. If interventions to treat state shame resulting from binge eating are implemented, engagement in other behaviors and the experience of other symptoms (e.g. substance use, self-harm, anxiety, depression) may be reduced.

The current study had several strengths. First, the rigorous laboratory design allowed me to test state levels of high-risk emotions and eating disorder symptoms directly before and immediately after a laboratory binge eating task among women with BN. These findings lend support for utilizing laboratory studies of binge eating to

examine changes in specific emotions following ad-lib test meal consumption and add to an existing literature of laboratory models of binge eating (Forbush & Hunt, 2014; Sysko et al., 2018). Second, I employed a large enough clinical and control sample to detect moderate to large effect sizes, even when controlling for covariates (i.e. shame, guilt, and age). Third, I used measures with strong psychometric properties and well-established study methods to examine laboratory binge eating.

Despite its many strengths, this study had several limitations. First, although the study design allowed for an experience that closely mirrored that of a binge eating episode and analogue designs of binge eating behavior using these methods have been shown to be rigorous and reproducible (Sysko et al., 2018), the experience was nonetheless a laboratory approximation of a binge eating episode. It therefore differed from a typical binge eating episode in one's natural environment. I cannot know if participants' emotional responses following binge eating would have differed if they were assessed after binge eating in their natural environment.

Second, despite efforts to match participants on age, participants in the control and BN groups differed significantly by age. Though participants were recruited using stringent eligibility criteria and through similar methods, women with BN in this sample tended to be older on average than controls. It is noteworthy that (a) the mean age difference was only 1.3 years and (b) the results regarding increases in state shame and cognitive and behavioral measures of disordered eating following the test meal did not differ even when controlling for age. However, I cannot know if some results (i.e. change in negative affect) would have been different with age-matched controls. Third, because I could only enroll non-treatment seeking women with BN, the sample of women with BN

was recruited largely from the community and was of mixed severity: some participants endorsed below-threshold binge eating frequency (i.e. OSFED BN) while others endorsed daily binge eating and purging. Thus, it is possible that results may differ with a sample of women with higher rates of binge eating and purging.

Fourth, there are likely other candidate mechanisms for the proposed comorbidity model that were not tested in this study. Though these results indicate shame in particular increases following laboratory binge eating, it is possible that other facets of negative affect also increase. Future studies may investigate all aspects of negative affect to allow for comparisons between emotions.

The results of this study provide important information about the effect of binge eating on state levels of the harmful, maladaptive emotion of shame. The impact of shame appears to be beyond merely increasing risk for binge eating, and instead appears to be a harmful consequence of engagement in binge eating behavior, for women with BN. Clinicians and researchers alike are urged to consider shame in their conceptualization of binge eating in the context of BN.

1. Of the 21 participants in the BN group, 4 participants endorsed fewer than 12 episodes of binge eating in the past 12 weeks (range: 6-11 episodes), thus meeting criteria for OSFED BN (of low frequency). Results of the study did not differ when these 4 participants were excluded from analyses, so these participants were retained in the study. In this paper, the term "BN group" refers to all 21 participants who met criteria for BN or OSFED BN.

2. Eligibility was determined based on participants' self-reported height and weight at the time of the phone screen. Upon objective measurement of height and weight, it was determined that four participants (two in the control group and two in the BN group) had BMIs outside of the range specified for eligibility (18.5-26.5). Results of the study did not differ when those with higher BMIs were excluded from analyses, so these participants were retained in the study.

3. Participants recruited from social media and community advertisements were initially offered $10 for participation during the summer months. Payment was increased to $30 at the start of the fall semester in recognition of the additional effort it would require for those enrolled in university courses to participate in the study.

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EDUCATION

2015   **Master of Science in Clinical Psychology**
                University of Kentucky; Lexington, KY

2012   **Bachelor of Science in Psychology with Honors, Minor in Child Development**
                Florida State University; Tallahassee, Florida

HONORS AND AWARDS

<u>University of Kentucky</u>
Michael T. Nietzel Award, 2019
P.E.O. Scholar Award, 2019-2020
National Research Service Award, National Institute on Mental Health 2017-2019
Jesse G. Harris Dissertation Research Award, 2018
Harris Psychological Services Center Excellent Clinical Performance Recognition, 2017
Department of Psychology Graduate Student Travel Awards, 2013-2019
Lipman Endowment Fund for Research on Alcohol Abuse 2015-2016
Lyman T. Johnson Fellowship 2013-2016
Graduate School Travel Award, 2013-2015

<u>Florida State University</u>
Honors in the Major Program in Psychology, 2011-2012
Dean's List, 2008-2012
Psi Chi Honor Society, 2010-2012
Order of Omega Honor Society, 2010-2012
Department of Psychology Undergraduate Research Day Best Poster Award, 2012
Mark A. Berkley Undergraduate Research Endowment, 2011
Mentored Research and Creative Activity Award, 2011
Florida Bright Futures Academic Scholars Award, 2008-2012
Freshmen University Scholarship, 2008-2012
Florida State University Grant, 2008-2012
Academic Competitiveness Grant, 2008-2010

PROFESSIONAL POSITIONS

Graduate Research Assistant   August 2013 – present
        Adolescent Risky Behavior Research Laboratory
Workshop Facilitator   August 2015 – May 2018
        Office of Wellness Initiatives for Student Empowerment, University of Kentucky,
        Lexington, KY
Practicum Therapist   June 2017 – May 2018
        Louisville Center for Eating Disorders, Louisville, KY

Practicum Therapist	August 2014 – March 2018
Jesse G. Harris Psychological Services Center, Lexington, KY	
Graduate Research Assistant	May 2015 – August 2017
Center for Drug Abuse Research Translation	
Group Therapist	August 2014 – May 2017
Jesse G. Harris Psychological Services Center, Lexington, KY	
Practicum Therapist	September 2016 – April 2017
Good Samaritan Adolescent Inpatient Unit, Lexington, KY	
Interventionist	June 2015 – August 2016
Department of Health Behavior, University of Kentucky, Lexington, KY	
Group Therapy Coordinator	July 2015 – July 2016
Jesse G. Harris Psychological Services Center, Lexington, KY	
Youth Assessment Therapist	April-May 2015, April-May 2016
The Lexington School, Lexington, KY	
Practicum Therapist	August 2014 – May 2015
University of Kentucky Counseling Center, Lexington, KY	
Interpersonal Process Therapy Group Leader	August 2014 –May 2015
University of Kentucky Counseling Center, Lexington, KY	
Teaching Assistant	August 2016 – May 2017
University of Kentucky, Lexington, KY	
Project Coordinator	May 2012 – June 2013
Eating Behaviors Research Clinic	

PROFESSIONAL PUBLICATIONS

1. **Davis, H. A.,** Ortiz, A. M. L, Smith, G. T. (in press). Transactions between early binge eating and personality predict transdiagnostic risk. *European Eating Disorders Review.*
2. Ortiz, A. M. L., **Davis, H. A.,** Smith, G. T. (2019). Transactions between thinness expectancies and depression in the prediction of adolescent weight control behaviors. *International Journal of Eating Disorders, 52*(2), 142-152.
3. Riley, E. N., **Davis, H. A.,** Milich, R., Smith, G. T. (2018). Heavy, problematic college drinking predicts increases in impulsivity. *Journal of Studies on Alcohol and Drugs, 79*(5), 790-798.
4. **Davis, H. A.,** Riley, E. N., & Smith, G. T. (2018). Transactions between personality and psychosocial learning: Advances in the acquired preparedness model of risk. In P. M. Monti, Suzanne M. Colby, and T. A. O'Leary (Eds.), *Adolescents, Alcohol, and Substance Abuse: Reaching Teens through Brief Interventions (2nd Edition).* New York: Guilford Press.
5. Kaiser, A. J., **Davis, H. A.,** & Milich, R. (2018). Bidirectional relations of impulsive personality and alcohol use over two years. *Substance Use & Misuse, 53*(14), 2386-2393.
6. **Davis, H. A.** & Smith, G. T. (2018). An integrative model of risk for high school disordered eating. *Journal of Abnormal Psychology, 127*(6), 559-570.
7. Peterson, S. J., **Davis, H. A.,** & Smith, G. T. (2018). Personality and learning predictors of adolescent alcohol consumption trajectories. *Journal of Abnormal Psychology, 127*(5), 482-495.
8. **Davis, H. A.,** Ortiz, A. M. L. & Smith G. T. (2018). The occurrence and covariation of binge eating and compensatory behaviors across early to mid-adolescence. *Journal of Pediatric Psychology, 43*(1), 402-412.
9. **Davis, H. A.,** Peterson, S. J., & Smith, G. T. (2017). Assessment. In A. Wenzel (Ed.), *The SAGE Encyclopedia of Abnormal and Clinical Psychology,* NY: Sage Publications.

10. Lee, C. L., Derefinko, K. J., **Davis, H. A**., Milich, R. & Lynam, D. R. (2017). Cross-lagged relations between motives and substance use: Can use strengthen your motivation over time? *Drug and Alcohol Dependence, 178,* 544-550.
11. **Davis, H. A.,** Riley, E. N., Smith, G. T., Milich, R. & Burris, J. (2017). Alcohol use and strenuous physical activity in college students: A longitudinal test of two explanatory models of health behavior. *Journal of American College Health, 65*(2), 112-121.
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13. **Davis, H. A.,** Guller, L., & Smith, G. T. (2016). Developmental trajectories of compensatory exercise and fasting behavior across the middle school years. *Appetite, 107,* 330-338.
14. **Davis, H. A.,** Guller, L., & Smith, G. T. (2016). Developmental trajectories of boys' driven exercise and fasting during the middle school years. *Journal of Abnormal Child Psychology, 44*(7), 1309-1319.
15. Riley, E. N., **Davis, H. A.** & Smith, G. T. (2015). Personality change and problem behavior: A positive feedback loop of increasing risk in early adolescence. In N. Columbus (Ed.), *Advances in Psychology Research.* Volume 105. Nova Science Publishers.
16. Riley, E. N., **Davis, H. A.,** Combs, J. L., Jordan, C. E., & Smith, G. T. (2015). Nonsuicidal self-injury as a risk factor for purging onset: Negatively reinforced behaviours that reduce emotional distress. *European Eating Disorders Review, 24*(1), 78-82.
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18. Smith, G. T., & **Davis, H. A.** (2015). An exemplar of progress on understanding complex disorders: Commentary on what we have learned about eating disorders. *Journal of Child Psychology and Psychiatry, 56*(11), 1165-1167.
19. Riley, E. N., Combs, H., **Davis, H. A.**, & Smith, G. T. (2015) Theory as evidence: Criterion validity in neuropsychological testing. In Bowden, S. C. (Ed.), Evidence-Based Neuropsychological Practice: National Academy of Neuropsychology. NY: Oxford University press.
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21. Riley, E. N., Combs, J. L., **Davis, H. A.,** & Smith, G. T. (2014) Impulsive behaviors that distract from distress: Non-suicidal self-injury. In M. Olmstead (Ed.), *Psychology of Impulsivity: New Research.* Nova Science Publishers.
22. **Davis, H. A.,** Holland, L. A., Keel, P. K. (2014). A preliminary examination of a nonpurging compensatory eating disorder. *International Journal of Eating Disorders, 47*(3), 239-243.
23. Smith, A. R., Fink, E. L., Anestis, M. D., Ribeiro, J., Gordon, K. H., **Davis, H. A**., Keel, P. K., Bardone-Cone, A. M., Peterson, C. M., Klein, M. H., Crow, S., Mitchell, J. E., Crosby, R. D., Wonderlich, S. A., le Grange, D., & Joiner, T. E. (2013). Exercise caution: Over-exercise is associated with suicidality in bulimia nervosa. *Psychiatry Research, 26,* 246-255.