Student Name: Joel Braun

Project Title: Trauma Exposure, DSM-5 Posttraumatic Stress Disorder, and Binge Eating: Results from a Nationally Representative Sample

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Department: Department of Clinical Health Psychology

Co-Supervisor Name: Dr. Renee El-Gabalawy
Department: Department of Clinical Health Psychology & Anesthesia and Perioperative Medicine

Summary (250 words max single spaced):

BACKGROUND:
Individuals with post-traumatic stress disorder (PTSD) are at a higher risk of engaging in a number of health risk behaviors that can negatively impact health. Binge eating is one such behavior and may account for increased rates of obesity and higher BMI among PTSD individuals.

OBJECTIVE:
To evaluate the association between number and type of PTSD symptoms with number of binge eating symptoms utilizing DSM-5 criteria.

METHODS:
We utilized data from the NESARC-III survey and created 4 trauma/PTSD groups (no trauma, no/low PTSD symptoms, subthreshold and threshold PTSD) and a discrete count variable for number of binge eating symptoms. Analysis was done using zero-inflated negative binomial regression.

RESULTS:
Among both men and women, individuals with subthreshold and threshold PTSD endorsed more binge eating symptoms than trauma-exposed individuals with no/low PTSD symptoms. A higher number of symptoms in the clusters of negative cognitions and mood and alterations in arousal clusters were independently associated with greater binge eating symptoms in men. In women, symptoms in the negative cognitions and mood cluster were associated with greater binge eating symptoms.

CONCLUSIONS:
Trauma exposure and PTSD symptoms are associated with binge eating symptom severity in both men and women. This relationship may mediate the effects of other health risks associated with PTSD including cardiovascular disease and obesity.

Acknowledgments:

Student Signature

Primary Supervisor Signature

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Introduction

Posttraumatic Stress Disorder (PTSD) is a serious mental disorder that can develop following exposure to a traumatic event, and has a lifetime prevalence of 6.8% in the U.S. general population.\textsuperscript{1,2,3} The disorder disproportionally affects women at a ratio of 2:1, and has been strongly associated with a number of comorbid mental health conditions, such as anxiety and depression, increased suicidality as well as functional difficulties in multiple domains.\textsuperscript{1,4} Trauma-exposed individuals and those experiencing PTSD symptoms have also demonstrated increased impulsivity and engagement in health risk behaviors, including using drugs and alcohol, smoking, overeating and risky sexual behaviors.\textsuperscript{4-5} These maladaptive behaviors may be used to help mitigate or manage the stressful emotions and symptoms associated with PTSD.\textsuperscript{6,7}

A health risk behavior that has been less studied to date in relation to trauma exposure and PTSD symptoms is excessive eating, including overeating, food addiction and binge eating. Binge eating symptoms, for example, include eating larger than normal amounts of food within a discrete period of time and feeling a lack of control over the amount of food that is being consumed. Binge eating also often involves feelings of remorse or guilt following an episode of excessive eating.\textsuperscript{8} Among individuals with PTSD, it has been theorized that binge eating behavior can be used as a form of self-medication, similar to alcohol or drugs, to help alleviate some of the distress caused by PTSD symptoms.\textsuperscript{9,10,21-24} In support of this theory are studies that have found a higher prevalence of binge eating disorder among individuals with PTSD symptoms.\textsuperscript{14-15} Recent research has also examined the relationship between food addiction and PTSD. Food addiction is a related but distinct construct from binge eating that includes symptoms such as eating food in larger than intended amounts, being unsuccessful in reducing or stopping the eating behavior, and continuing the behavior despite negative consequences.\textsuperscript{16} Like binge eating, the prevalence of food addiction has also been shown to be higher among individuals exhibiting PTSD symptoms. For example, a recent study found that, in a sample of 49,408 women nurses aged 25 to 42 years old, the prevalence of food addiction was more than twice as high among women exhibiting 6-7 PTSD symptoms than among women with no history of trauma or PTSD symptoms.\textsuperscript{9} Among individuals with PTSD, excessive eating behaviors such as overeating, food addiction and binge eating have been shown to play a role in increasing rates of obesity and body-mass index (BMI).\textsuperscript{17,18} This may account, at least in part, for the increased risk of physical health conditions such as cardiovascular disease, metabolic syndrome and type 2 diabetes among individuals with PTSD.\textsuperscript{17,19,20}

Type of trauma exposure has also been shown to play a role in the association between PTSD and maladaptive eating, both with restrictive (i.e., anorexia) and less controlled (i.e., bulimia) eating psychopathology. Previous research demonstrates, for example, that sexual assault in particular appears to be closely linked to an increased risk for eating disorders, including binge eating.\textsuperscript{21-23} Previous studies have also shown that early childhood adverse events are also associated with disordered eating.\textsuperscript{24} Very few studies, however, have examined trauma exposure and eating disorders among males. One of the few nationally representative samples conducted to date did find increased rates of both binge eating disorder and bulimia nervosa in men and women who had PTSD symptoms compared to those with no trauma or PTSD.
symptoms. Furthermore, the prevalence of binge eating disorder and bulimia nervosa was
higher in both men and women who had experienced assaultive violence.25

Currently, the majority of studies examining associations between binge eating symptoms and
PTSD have done so in non-nationally representative samples and, in fact, mostly in samples of
women. One U.S. nationally representative study by Mitchell et al, examined gender
differences in the prevalence of disordered eating among individuals with PTSD, and found
higher rates of excessive eating disorders, including bulimia nervosa and binge eating disorder,
in both men and women with PTSD. Further, the highest rates of eating disorders occurred in
men and women who had been exposed to interpersonal traumas such as assault or rape.25,26
However, this study was largely descriptive since the number of overall eating disorder cases
among males was too small to allow for statistical modeling that could account for possible
confounding factors. Two other studies that have examined associations between PTSD and
binge eating disorder in men and women were in samples of military personnel and young
adults (aged 22-29). Both found increased prevalence of binge eating disorder within men and
women with PTSD as compared to individuals with no trauma exposure and no PTSD
symptoms.27,28

Previous studies that have examined the association between binge eating symptoms and
PTSD have had several limitations. Few studies have examined this association using
nationally representative samples. Second, no known studies have examined PTSD according
to criteria from the Diagnostic and Statistical Manual of Mental Disorders 5th Edition (DSM-5),
and there have been significant changes made to PTSD criteria since DSM-IV. Further, most of
the previous studies have utilized self-report measures or screening tools to assess PTSD and
binge eating as opposed to using structured, diagnostic interviews. Finally, no studies have
examined the relationship between binge eating and individual PTSD symptom clusters. These
findings could help inform interventions for binge eating targeted specifically towards individuals
reporting select PTSD symptoms. The current study addressed these limitations by utilizing a
large, nationally representative U.S. sample that utilized current DSM-5 criteria as well as
structured interviews for diagnosing PTSD. This study aimed to examine the following:

1. Associations between trauma exposure, PTSD symptoms, and binge eating
   symptom severity in men and women;
2. Associations between each of the four PTSD symptom clusters and binge eating
   severity, and;
3. Associations between type of index trauma and binge eating symptoms among
   trauma-exposed men and women.

Methods

Participants

The National Epidemiologic Survey on Alcohol and Related Conditions-III (NESARC-III) is a
nationally representative sample of non-institutionalized civilians aged 18 years and older living
in the United States. This survey used multistage sampling to randomly select eligible
individuals from the sampled households across all fifty states. Institutionalized individuals and those on active duty in the U.S. Armed Forces, the Military Reserves, and the National Guard were not included in the sample. A total of 44,931 persons were selected to participate in the NESARC-III and of these, 1,567 persons did not meet the eligibility requirements. Of the remaining 43,364 eligible persons, 36,309 participated in the NESARC-III, resulting in a final response rate of 83.1%. The data were adjusted to take participant nonresponse and oversampling into account, and then were weighted to be nationally representative of the US population. The final sample was comparable to the eligible sample with a few sociodemographic differences. All surveys were conducted face-to-face by trained lay personnel using computer-assisted interviews, between April 2012 and June 2013. A complete description of the methodology used in the NESARC-III survey has been published previously.

Assessments

Trauma Exposure and PTSD

Individuals were provided with a list of 34 possible traumatic events (e.g., serious or life-threatening injury or illness, sexual assault, child physical and sexual abuse, natural disaster, witnessing or learning about a trauma occurring to others) and were asked whether they had ever experienced any of these events in their lifetimes. Individuals were considered to be trauma-exposed if they endorsed at least one of these events.

PTSD was assessed using the National Institute on Alcohol Abuse and Alcoholism (NIAAA) Alcohol Use Disorder and Associated Disabilities Interview Schedule (AUDADIS-5). This semi-structured Diagnostic Interview utilized criteria from the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) to assess mental disorders. The PTSD module of the AUDADIS-5 Interview Schedule has shown a fair to modest concordance ($\kappa = 0.34 – 0.46$) with the clinician-administered Psychiatric Research Interview for Substance and Mental Disorders-5 (PRISM-5) interview. PTSD symptoms were assessed based on the worst lifetime traumatic event reported. Individuals were categorized into one of four groups based on their trauma exposure and endorsement of lifetime PTSD symptoms: 1) no trauma exposure or PTSD symptoms, 2) trauma exposure with no/low PTSD symptoms (defined as meeting one or less PTSD symptom criteria B-E), 3) subthreshold PTSD symptoms (defined as meeting 2 or more PTSD symptom criteria B-E), and 4) threshold PTSD (defined as meeting all DSM-V criteria A-H). The symptom duration and functional impairment criteria (i.e., G-H) were only assessed among those respondents in the NESARC-III meeting all criteria B through E and therefore, were not incorporated into the operationalization of subthreshold PTSD.

Binge Eating

Lifetime binge eating disorder symptoms were assessed using the AUDADIS-5 interview based on DSM-V criteria. Within the interview, 3 screening questions were asked of all respondents, including “Have you ever eaten an unusually large amount of food within any 2-hour period?”, “Was there ever a time when you ate an unusually large amount of food on average at least once a week for at least 3 months?”, and “During any time like this when you ate an unusually large amount of food did you feel that you couldn’t stop eating or control how much or what you
were eating?”. Participants responding “no” to these symptoms were given “0” values for the remaining symptoms assessed. The other five symptoms assessed whether the individual had ever eaten more quickly than usual, eaten until feeling uncomfortably full, eaten when not being hungry, eaten alone to avoid embarrassment and whether he/she had ever felt disgusted, depressed or guilty about eating so much. A discrete variable of total number of binge eating symptoms with a range of 0 to 8 was created to reflect binge eating severity.

**Covariates**

Sociodemographic covariates included in the analysis were: age (continuous variable: range of 18 years to 90+), race/ethnicity (categorical variable: White, Black, Hispanic and other), total household income (categorical variable: income <$19,999 $20-000 to $39,999, $40,000 to $69,999, ≥$70,000), highest education level achieved (categorical variable: less than high school, high school, some post-secondary education and higher) and marital status (categorical variable: married or cohabitating, separated/ divorced/widowed, never married). A dichotomous summary variable of any other lifetime mental disorder was created and also included as a covariate in analyses. This variable included substance use disorders (alcohol, sedatives, cannabis, opioid, cocaine, stimulants, hallucinogens, heroin and tobacco), mood disorders (depression, dysthymia, mania, hypomania, bipolar), anxiety disorders (specific phobia, social phobia, agoraphobia, generalized anxiety disorder), and personality disorders (borderline, schizotypal and antisocial personality disorder). These disorders were also assessed using the AUDADIS-5, and have been shown to have good concordance with clinician-administered interviews.31,32

**Statistical Analysis**

All analyses were conducted using STATA Version 13 in order to employ the Taylor Series Linearization variance estimation technique and account for the complex sampling design of the NESARC-III. First, we used cross-tabulations and chi-square analyses to examine differences between the trauma/PTSD groups on sociodemographic variables and binge eating variables. An analysis of variance (ANOVA) was used to examine group differences in age. Second, we used zero-inflated negative binomial regression analysis to examine the associations between our trauma/PTSD groups (independent variable) and binge eating symptoms (dependent variable). Zero-inflated negative binomial regression analysis is the appropriate statistical approach to employ when the dependent variable is a count variable with an excess number of zero values and an over dispersed distribution.33 The reference group for these analyses was trauma-exposed respondents with no/low PTSD symptoms. Third, we examined associations between PTSD symptom clusters and number of binge eating symptoms among trauma-exposed respondents using zero-inflated negative binomial regression analyses. All symptom cluster variables were entered simultaneously into the models along with covariates. In order to examine which individual symptoms of each cluster were independently associated with binge eating symptoms, a post-hoc analysis was then conducted by placing the symptoms of each cluster simultaneously into a model with all the covariates. Fourth, we examined the relationship between type of index trauma and number of binge eating symptoms among trauma-exposed respondents using zero-inflated negative binomial regression analyses. A categorical variable of six trauma type groups was created based on respondents’ worst lifetime traumatic event: combat-related (active military combat, peacekeeper/relief worker, refugee, prisoner of war),
child mistreatment (physically abused or sexually assaulted before the age of 18), assaultive
violence (sexually assaulted as an adult, beaten up by a spouse/romantic partner, beaten up by
someone else, stalking, held hostage), injurious/shocking event (natural disaster, serious or life
threatening injury/illness), witnessed event and ‘other’, consistent with previous
categorizations. The ‘other’ category included any reported trauma not included in the
other traumatic events assessed. All analyses were conducted in men and women separately
and tested in two count models; one adjusted for sociodemographic variables, and a second
model additionally adjusted for any other mental disorder. Analyses examining the associations
between type of index trauma and binge eating symptoms were also adjusted for number of
PTSD symptoms.

Results

Sociodemographic characteristics by sex and trauma/PTSD groups are shown in Table 1.
Across all four groups and in both men and women, samples were predominantly white (range
56.3% to 70.3%), with high school or higher education (range 51.5% to 68.7%) and married or
cohabitating (48.1 to 64.4%). Mean age ranged from 43.7 to 44.1 years among males and 42.9
to 48.6 years among females. \(^2\) tests showed significant differences across all variables
between the four trauma/PTSD groups. The prevalence of endorsing at least 1 binge eating
symptom, lifetime binge eating disorder, and any other mental disorder (anxiety, substance
abuse, mood disorder or personality disorder) increased as PTSD severity increased for both
men and women. The prevalence of endorsing ≥1 binge eating symptom increased from 11.7%
to 29.8% among men and 5.5% to 25.7% among women, lifetime binge eating disorder
prevalence increased from 0.22% to 1.1% among men and 0.20% to 4.7% among women, and
lifetime mental disorders prevalence increased from 43.3% to 79.8% among men and 36.0 to
93.6% among women.

Associations between the trauma/PTSD groups and binge eating symptoms are shown in Table
2. Results of zero-inflated negative binomial regression models demonstrated that, in both men
and women, individuals in the subthreshold and threshold PTSD groups reported a higher
number of binge eating symptoms relative to the trauma-exposed, no PTSD symptoms group (β
range 0.43 to 0.95 in males, β range 0.43 to 0.98 in females, all p’s ≤ 0.001). Individuals
reporting no lifetime trauma exposure demonstrated a lower severity of binge eating symptoms
(β -0.41, p ≤ 0.001 in males, β -0.36, p = 0.001 in females). Results were consistent in both the
model adjusted for sociodemographic variables and the model additionally adjusted for any
mental disorder.

Table 3 shows the relationship between PTSD symptom clusters and number of binge eating
symptoms among trauma-exposed individuals, stratified by sex. Results of a zero-inflated
negative binomial regression showed that in men, greater severity of negative cognitions and
mood (β = 0.08, SE = 0.002, p = 0.002) and alterations in arousal and reactivity (β = 0.08, SE =
0.03, p = 0.004) were associated with a greater number of binge eating symptoms in a model
where PTSD clusters were entered simultaneously and after adjusting for sociodemographic variables and any mental disorder. In women, negative cognitions and mood was the only PTSD cluster associated with number of binge eating symptoms \((\beta = 0.11 \ SE = 0.03, \ p \leq 0.001)\). A post-hoc analysis was conducted in order to examine which individual symptom(s) of these PTSD clusters were independently associated with binge eating severity. In this analysis, individual PTSD symptoms of the cluster being examined were entered into a model along with the other PTSD symptom clusters, sociodemographic variables and any mental disorder. In men, the symptoms “persistent and exaggerated negative beliefs” \((\beta = 0.34, \ SE = 0.07, \ p \leq 0.001)\) within the negative cognitions and mood cluster, and “hypervigilance” in the alterations in arousal and reactivity cluster \((\beta = 0.19, \ SE = 0.07, \ p = 0.010)\) were independently associated with a higher number of binge eating symptoms. In women, the symptoms “inability to remember important aspects of the traumatic event” \((\beta = 0.24, \ SE = 0.10, \ p = 0.023)\) and “persistent and distorted cognitions about the cause of the trauma” \((\beta = 0.17, \ SE = 0.09, \ p = 0.050)\) within the negative cognitions and mood cluster were associated with greater binge eating symptom severity.

The relationship between the type of index trauma reported by each individual and number of binge eating symptoms is shown in Table 4. Results of a zero-inflated negative binomial regression indicated that, in men, combat-related index traumas were found to be associated with a higher number of binge eating symptoms relative to witnessing trauma in the model adjusted for sociodemographic variables, any mental disorder, and number of PTSD symptoms \((\beta = -0.60, \ SE = 0.16, \ p \leq 0.001)\). In women, and after adjusting for the same covariates, child maltreatment was associated with a greater number of binge eating symptoms relative to witnessing trauma \((\beta = 0.28, \ SE = 0.12, \ p = 0.021)\).

**Discussion**

The current study was the first to examine associations between trauma, DSM-5 PTSD and binge eating symptoms in a nationally representative sample of U.S. adults. A number of novel findings emerged. First, relative to trauma-exposed individuals with no/low PTSD symptoms, individuals with subthreshold and threshold lifetime PTSD demonstrated a greater severity of binge eating symptoms. Individuals never exposed to trauma exhibited significantly lower symptom severity. These results are in line with previous research that have examined the link between PTSD and binge eating symptoms and other related conditions, such as food addiction and bulimia. One explanation for the higher prevalence of these conditions within individuals with PTSD, is that food can behave similarly to a drug, and that individuals use food to self-medicate in order to cope with their PTSD symptoms. Both animal and human experiments, for example, have shown that food intake and drug use both cause dopamine release in the brain. Dopamine is involved in the reward pathways of the brain and can increase a person’s sense of pleasure and well-being. Individuals experiencing distress from their symptoms may binge eat as a way of feeling better. With addictive drugs, neuroadaptations in the dopamine reward system occur resulting in sensitivity, craving and tolerance to the ingested drug. There is increasing evidence that highly palatable foods that are eaten in large quantities can result in these same neuroadaptations in the human brain. By this mechanism, binge eating may lead to treating food as an addictive substance.
This study was also the first to examine the associations between individual PTSD symptom clusters and binge eating symptoms. In both men and women, the negative cognition and mood symptom cluster were independently associated with a higher number of binge eating symptoms. In men, the alterations in arousal symptom cluster was additionally associated with a higher number of binge eating symptoms. In the post-hoc analysis that examined the individual symptoms within each cluster, several differences between men and women were noted. In men, the symptoms of “hypervigilance” and “persistent and exaggerated negative beliefs” were independently associated with a higher number of binge eating symptoms. In women, binge eating symptoms were most strongly associated with the PTSD symptoms “inability to remember important aspects of the traumatic event” and “persistent and distorted cognitions about the cause of the event.” The associations of negative cognition and mood symptoms with binge eating symptoms may underscore the overlap of similar negative cognitions involving feelings of guilt and shame existent in both PTSD and binge eating disorder.25,36,37,38,39,40 These states of negative emotional states can create a cognitive process similar to disassociation and the removal of inhibitions. This may then result in the start of binge eating behavior. Previous studies have shown an association between trauma, dissociative symptoms and binge eating disorder.41 In men, the finding that alterations in arousal were associated with increased binge eating symptoms may be due to the effects of chronic stress on eating behaviour. After prolonged periods of chronic stress, the hypothalamic-pituitary-adrenal axis (HPA) can become dysregulated, leading to altered levels of neuropeptides and glucocorticoids being released. These hormones are involved in glucose metabolism and, over time, dysfunction of this system can result in changes to dietary intake, with individuals beginning to consume more high fat and sugary foods.35,6 Studies have shown that individuals with PTSD do, in fact, consume greater quantities of sugary and fatty foods compared to individuals that have no trauma exposure or PTSD symptoms.42 Further research is needed to fully understand the mechanisms underlying the association between PTSD and binge eating symptoms.

In examining whether certain types of index traumas were particularly associated with binge eating symptoms, we found that in men, combat-related traumas were associated with greater number of binge eating symptoms compared to individuals that had witnessed a trauma. In women, child maltreatment was associated with greater number of binge eating symptoms than individuals reporting witnessing trauma as their worst event. Previous research has shown that child maltreatment is associated with the development of eating disorders. This association has been studied mostly in women populations.41,24 Higher prevalence rates of binge eating disorder were also found to be associated with assaultive violence.25,26 The findings from this study that child maltreatment in women is associated with higher binge eating symptoms are consistent with previous research. Few studies have examined the association between trauma and eating disorders in men. In fact, a recent study among women military personnel found that military sexual assault was associated with twice the prevalence of eating disorders (including anorexia, bulimia and binge eating) as compared to military women who had not been sexually assaulted.43 In this study, combat exposure was not associated with an increased prevalence of binge eating, however, no comparable studies have been done among men. The reason for why combat related trauma is associated with more binge eating symptoms in men is unclear and more research is required to fully understand the relationship between type of trauma exposure and eating disorders within men.
The results of this study expand on the existing research examining the link between PTSD and maladaptive eating patterns. Findings may prove clinically useful in encouraging health care providers to screen for binge eating symptoms or other maladaptive eating patterns in trauma-exposed adults, particularly among women with elevated symptoms of PTSD related to negative cognitions and mood, and among men with elevated symptoms of negative cognitions and mood and alterations to arousal. In addition, these results could help inform treatment for binge eating behaviors by ensuring treatment is conducted within a trauma-informed care model. Trauma-informed care emphasizes the physical, psychological and emotional safety of trauma survivors. Finally, treatment for PTSD might be tailored to address binge eating behavior when it is part of the clinical presentation. To date, CBT approaches have been shown to be effective for both of these conditions, which may facilitate the development of a hybrid treatment. Further research into how different PTSD symptom profiles may influence engagement in specific maladaptive behaviors such as alcohol and drug use, smoking and disordered eating would be beneficial in understanding where best to target screening and treatment. Further research into the mediating factors between PTSD and binge eating symptoms using longitudinal designs are also required to fully understand this relationship.

There were several limitations of this study. First, due to the assessment approach of PTSD in the NESARC-III survey, duration and functional impairment were not able to be included in the definition of subthreshold PTSD. However, to date, no clear consensus has been achieved in the literature of a single, accepted definition of subthreshold PTSD. Further, we observed a “dose response” association between the four trauma/PTSD groups and increasing severity of binge eating symptoms. Second, the NESARC-III was a cross-sectional survey and lifetime PTSD and binge eating symptoms were used in the current study. Thus, causal relations between PTSD and binge eating symptoms cannot be assumed. A further limitation was that the individuals conducting the computer-assisted, diagnostic interviews for the NESARC-III were trained lay persons and not clinicians.

The current study found that individuals with subthreshold or threshold PTSD had more binge eating symptoms relative to individuals with no trauma exposure and no/low PTSD symptoms. Further, negative cognition and mood symptoms in both men and women were associated with a higher number of binge eating symptoms, and certain trauma types were particularly associated with binge eating symptoms. Individuals who suffer from PTSD experience significant dysfunction and are at increased risk of engaging in a number of health risk behaviors, including using drugs and alcohol, smoking, risky sex and overeating. Future research should examine the relationship between these various health risk behaviors and the specific PTSD symptomology and trauma exposures that may be associated with them.
References


42. Hirth JM, Rahman M, Berenson AB. The association of posttraumatic stress disorder with


Table 1. Characteristics Across Trauma/PTSD Groups in the NESARC-III

<table>
<thead>
<tr>
<th></th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No Trauma Exposure (n=5,282)</td>
<td>Trauma Exposed No/Low PTSD Symptoms (n=6,515)</td>
</tr>
<tr>
<td>Mean Age</td>
<td>43.7</td>
<td>47.5</td>
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<tr>
<td></td>
<td>SE=0.32</td>
<td>SE=0.34</td>
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<td>Race/ethnicity</td>
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<tr>
<td>White</td>
<td>2356 (57.3)c</td>
<td>3913 (72.0)</td>
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<tr>
<td>Black</td>
<td>1160 (12.4)</td>
<td>1141 (9.5)</td>
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<tr>
<td>Hispanic</td>
<td>1382 (22.5)</td>
<td>1027 (11.6)</td>
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<tr>
<td>Other</td>
<td>384 (8.0)</td>
<td>434 (6.7)</td>
</tr>
<tr>
<td>Education</td>
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<td>Less than high school</td>
<td>1138 (19.2)</td>
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<td>High school</td>
<td>1625 (29.3)</td>
<td>1656 (24.3)</td>
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<td>Post-secondary education</td>
<td>2519 (51.5)</td>
<td>4138 (66.5)</td>
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<tr>
<td>Marital status</td>
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<td>Married or cohabitating</td>
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<td>Separated, divorced, or widowed</td>
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<td>1255 (13.5)</td>
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<td>Endorsed ≥1 binge eating symptoms</td>
<td>542 (11.7)</td>
<td>1254 (19.9)</td>
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<tr>
<td>Lifetime binge eating disorder</td>
<td>12 (0.22)</td>
<td>14 (0.20)</td>
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<tr>
<td>Lifetime any other mental disorder</td>
<td>2227 (43.3)</td>
<td>3734 (57.1)</td>
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Table 2. Relationship Between Trauma/PTSD Groups and Binge Eating Symptoms

<table>
<thead>
<tr>
<th></th>
<th>Model 1&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Model 2&lt;sup&gt;c&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men</td>
<td>Women</td>
</tr>
<tr>
<td></td>
<td>β Value (SE)&lt;sup&gt;d&lt;/sup&gt;</td>
<td>p value</td>
</tr>
<tr>
<td>No trauma exposure&lt;sup&gt;a&lt;/sup&gt;</td>
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<td>≤0.001</td>
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<tr>
<td>Subthreshold PTSD</td>
<td>0.57 (0.06)</td>
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<tr>
<td>Threshold PTSD</td>
<td>1.14 (0.09)</td>
<td>≤0.001</td>
</tr>
</tbody>
</table>

<sup>a</sup> reference group was trauma-exposed individuals with no/low PTSD symptoms

<sup>b</sup> zero-inflated negative binomial regression count model 1 adjusted for sociodemographic variables (BMI, age, race/ethnicity, education, marital status and income); zero-inflated model adjusted for age and BMI

<sup>c</sup> zero-inflated negative binomial regression count model 2 adjusted for sociodemographic variables plus any other mental disorder (any mood, anxiety, substance use disorder and personality disorder); zero-inflated model adjusted for age and BMI

<sup>d</sup> coefficients are reported as non-standardized β, (SE) = Standard Error
Table 3. Relationship Between PTSD Symptom Clusters and Binge Eating Symptoms among Trauma-exposed Individuals

<table>
<thead>
<tr>
<th>PTSD Symptom Cluster</th>
<th>Model 1a</th>
<th></th>
<th></th>
<th>Model 2b</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men</td>
<td>Women</td>
<td>Men</td>
<td>Women</td>
<td>Men</td>
<td>Women</td>
</tr>
<tr>
<td>Intrusions</td>
<td>0.03 (0.03)</td>
<td>0.266</td>
<td>0.03 (0.04)</td>
<td>0.333</td>
<td>0.01 (0.03)</td>
<td>0.720</td>
</tr>
<tr>
<td>Avoidance</td>
<td>0.10 (0.06)</td>
<td>0.084</td>
<td>0.12 (0.06)</td>
<td>0.048</td>
<td>0.09 (0.06)</td>
<td>0.114</td>
</tr>
<tr>
<td>Negative cognitions and mood</td>
<td>0.09 (0.02)</td>
<td>≤0.001</td>
<td>0.14 (0.03)</td>
<td>≤0.001</td>
<td>0.08 (0.02)</td>
<td>0.002</td>
</tr>
<tr>
<td>Alterations in arousal and reactivity</td>
<td>0.09 (0.03)</td>
<td>0.002</td>
<td>0.07 (0.04)</td>
<td>0.043</td>
<td>0.08 (0.03)</td>
<td>0.004</td>
</tr>
</tbody>
</table>

a zero-inflated negative binomial regression count model 1 adjusted for sociodemographic variables (BMI, age, race/ethnicity, education, marital status and income); zero-inflated model adjusted for age and BMI

b zero-inflated negative binomial regression count model 2 adjusted for sociodemographic variables plus any other mental disorder (any mood, anxiety, substance use disorder and personality disorder); zero-inflated model adjusted for age and BMI

model 1 adjusted for sociodemographic variables (BMI, age, race/ethnicity, education, marital status and income)

c coefficients are reported as non-standardized β, (SE) = Standard Error
<table>
<thead>
<tr>
<th>Trauma Type</th>
<th>Model 1&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Model 2&lt;sup&gt;c&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>β Value (SE)</td>
<td>P value</td>
</tr>
<tr>
<td>Combat-related</td>
<td>-0.65 (0.16)</td>
<td>≤0.001</td>
</tr>
<tr>
<td>Child maltreatment</td>
<td>-0.02 (0.13)</td>
<td>0.874</td>
</tr>
<tr>
<td>Assaultive violence</td>
<td>0.15 (0.10)</td>
<td>0.149</td>
</tr>
<tr>
<td>Injurious/shocking event</td>
<td>-0.02 (0.06)</td>
<td>0.723</td>
</tr>
<tr>
<td>Other</td>
<td>-0.15 (0.19)</td>
<td>0.425</td>
</tr>
</tbody>
</table>

<sup>a</sup> reference group is individuals reporting witnessed events as worst trauma. Examples of trauma within each trauma group include: combat-related (active military combat, peacekeeper/relief worker, refugee, prisoner of war), child mistreatment (physically abused or sexually assaulted before the age of 18), assaultive violence (sexually assaulted as an adult, beaten up by a spouse/romantic partner, beaten up by someone else, stalking, held hostage), injurious/shocking event (natural disaster, serious or life threatening injury/illness), witnessed event and ‘other’

<sup>b</sup> zero-inflated negative binomial regression count model 1 adjusted for sociodemographic variables (BMI, age, race/ethnicity, education, marital status and income); zero-inflated model adjusted for age and BMI

<sup>c</sup> zero-inflated negative binomial regression count model 2 adjusted for sociodemographic variables plus any other mental disorder (any mood, anxiety, substance use disorder and personality disorder); zero-inflated model adjusted for age and BMI

<sup>d</sup> PTSD severity is a discrete variable of number of PTSD symptoms.