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Examining the link between weight suppression and non-suicidal self-injurious behaviors☆,☆☆

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ABSTRACT

Background: Given the negative consequences of excess weight, a large portion of the US population is seeking to obtain and maintain weight loss. Weight Suppression (WS) represents the difference between previous highest adult weight and current weight and may have negative psychological consequences. The current study examined the link between WS and lifetime non-suicidal self-injurious (NSSI) behavior and explored indirect effects in this link using survey data in two large samples.

Methods: Sample 1 included 1011 college students (67% female, mean age = 19 years); Sample 2 included 2461 participants from an epidemiological study (68% female, mean age = 34 years). Models of direct and indirect effects were tested in MPlus using bootstrapping.

Results: As hypothesized, greater WS was associated with increased likelihood of lifetime NSSI in both samples (OR = 1.05 and 1.02). In both samples, significant indirect effects of drive for thinness (Total R^2 = 0.06 and 0.09) and depressive symptoms (Total R^2 = 0.13 and 0.29) accounted for this association. Alternative models in which the indirect effect of WS was tested in associations between drive for thinness or depressive symptoms and NSSI were not supported.

Conclusion: Results suggest that the link between WS and lifetime NSSI may be accounted for by eating or mood-related pathology. Future research should test whether addressing associated eating and mood problems would eliminate the link between WS and NSSI as a means for reducing suicide risk.

1. Introduction

Over 60% of the US adult population is currently overweight or obese (Ogden, Carroll, Kit, & Flegal, 2014). Given the health risks and discrimination incurred by overweight people (Puhl, Andreyeva, & Brownell, 2008; Wyatt & Winters, 2006), a large portion of the US population is seeking weight loss with the goal of maintaining a weight that is lower than their highest weight. The difference between previous highest adult weight and current weight is referred to as Weight Suppression (WS) and has gained increasing attention for its contribution to risk for bulimic syndromes (Butryn, Lowe, & Safer, 2006; Keel & Heatherton, 2010; Lowe et al., 2011). The underlying mechanisms for this association remain unclear, but recent findings have implicated both biological and psychological consequences of WS as contributing to risk (Bodell, Brown, & Keel, 2016; Bodell & Keel, 2015). Importantly, consequences of WS may impact risk for a range of negative outcomes, including suicide risk (Elovainio et al., 2009).

Robins' (1981) classic psychological autopsy study tallied the most common signs and symptoms preceding death by suicide in 134 decedents from the St. Louis area (Robins, 1981). Of all factors considered, weight loss was the single most common feature, exceeding well-known warning signs such as insomnia and agitation. More recently, Elovainio et al. (2009) examined risk for death by suicide at 38-year follow-up in a cohort of 18,784 men. Weight loss was associated with a > 5-fold increase in risk of death by suicide. Further, the association between weight loss and death by suicide remained significant controlling for body mass index (BMI) and history of psychiatric hospitalization. Neither study differentiated intentional from unintentional weight loss. However, taken together, findings

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persuasively connect weight loss to suicide (Elovainio et al., 2009; Robins, 1981) but do not fully address factors that might account for the association, including depression or eating pathology. Unintentional weight loss is a symptom of depression and intentional weight loss is a symptom of anorexia nervosa (American Psychiatric Association, 2013), and these disorders have been associated with increased risk of suicide (Brown, Beck, Steer, & Grisham, 2000; Preti, Rocchi, Sisti, Camboni, & Miotto, 2011). Thus, a link between WS and suicide may be explained by these conditions, as well as the factors that give rise to and/or are associated with these conditions. For example, drive for thinness, a feature of anorexia nervosa, was identified as mediating the prospective association between WS and bulimic symptoms (Bodell et al., 2016), and drive for thinness has been associated with suicidal ideation, nonsuicidal self-injury (NSSI), and suicide attempts (Eichen et al., 2015; Fennig & Hadas, 2010). Similarly, maintaining significant weight loss has been shown to lead to increased depression (Keys et al., 1950), which is a risk factor for suicidal ideation, nonsuicidal self-injury (NSSI), and suicide attempts (Andover, Pepper, Ryabchenko, Orrico, & Gibb, 2005; Hasin et al., 2018; Klonsky, May, & Glenn, 2013; Klonsky, May, & Saffer, 2016). Thus, if an association is found between WS and suicide risk, both drive for thinness and depression should be examined as potential factors accounting for this association.

Predicting who is at risk for suicide and why is crucial for prevention. However, even when risk is elevated, suicide remains rare. An additional approach is to identify more prevalent behaviors that precede and increase risk for suicide. While prior suicide attempts are one of the top five predictors of future death by suicide (Franklin et al., 2016; Ribeiro et al., 2016), 25–78% of individuals' first suicide attempt is lethal (Bostwick, Pabbati, Geske, & McKean, 2016; Innamorati et al., 2008; Isometsa & Lonnqvist, 1998; Suokas et al., 2001), making "prior attempts" useful only in those who have survived a prior attempt. NSSI is more prevalent than suicide attempts (Klonsky et al., 2013), and may contribute to capability for lethal suicide attempts by gradually wearing away an evolutionarily-based revulsion towards self-harm (Joiner, Ribeiro, & Silva, 2012). NSSI is defined by deliberate self-inflicted damage to the body (e.g., cutting, burning) with no intent to cause death (American Psychiatric Association, 2013). A recent meta-analysis indicated that NSSI was the best predictor of future suicide attempts in a multivariate model (Franklin et al., 2016).

The DSM-5 included NSSI as a condition for further study (American Psychiatric Association, 2013) due to its prevalence and clinical significance (Muehlenkamp, 2005). Approximately 6% of adults in the U.S. population report a lifetime history of NSSI, with greater prevalence in those under age 30 years (Klonsky, 2011). Indeed, past year prevalence was 36% in Swedish adolescents, with approximately equal gender distribution (56% female) (Zetterqvist, Lundh, Dahlström, & Svedin, 2013). NSSI is associated with numerous psychological problems, including anxiety, depression, eating pathology and various personality disorders (Andover, et al., 2005; Klonsky, Fiedler, Turkheimer, & Oltmanns, 2003; Peterson & Fischer, 2012; Ross, Heath, & Toste, 2009; Svirko & Hawton, 2007; Turner et al., 2015) and increased hospital admission (Centers for Disease Control and Prevention, 2011),

The goal of the current study was to examine the link between WS and NSSI using survey data in two large samples. Following examination of whether WS was linked to NSSI, we examined the indirect effects of drive for thinness and depression for this association. Based on prior research linking NSSI to both eating pathology (Peterson & Fischer, 2012; Ross et al. 2009) and depression (Andover et al., 2005; Klonsky et al., 2003), we predicted that these factors would statistically account for the association between WS and NSSI.

2. Materials and methods: Study 1

2.1. Participants

Data came from surveys administered to 1011 university students (male $n = 332$; female $n = 676$; gender not indicated $n = 3$). Participants were at least 18 years old and had a mean (*SD*) age of 19.38 (1.76) years. 83.2% ($n = 841$) identified as White, 10.0% ($n = 101$) as African-American, 4.2% ($n = 42$) as Asian, 1.2% ($n = 12$) as Native Hawaiian or Other Pacific Islander, 0.1% ($n = 1$) as American Indian/Alaskan Native and 21.4% ($n = 216$) as Hispanic. Participants had a mean (SD) BMI of 23.30 (4.01) kg/m^2.

2.2. Procedures

Undergraduate students completed online surveys for course credit over two semesters (Spring 2015 $n = 361$; Spring 2016 $n = 647$). All participants provided informed consent prior to participation. The IRB approved all procedures.

2.3. Measures

2.3.1. Body mass index

BMI was calculated from self-reported height and weight as kg/m^2. Prior research supports the validity of self-reported height and weight in epidemiological research (Spencer, Appleby, Davey, & Key, 2002).

2.3.2. Lifetime non-suicidal self-injury

In line with previous research (Laye-Gindhu & Schonert-Reichl, 2005; Matsumoto et al., 2008; Nixon, Cloutier, & Jansson, 2008), lifetime NSSI was assessed using the item, "Have you ever engaged in non-suicidal self-injury (e.g., cutting, burning, etc.) without the intent to die?"

2.3.3. Weight suppression

The difference between a person's highest lifetime and current weight was divided by highest lifetime weight and multiplied by 100, in line with prior calculation of WS (Schaumberg et al., 2016), which has shown high test-retest reliability ($r = 0.99$) (Forney, Brown, Holland-Carter, Kennedy, & Keel, 2017).

2.3.4. Drive for thinness

Three items from the Eating Attitudes Test (Garner, Olmstead, Bohr, & Garfinkel, 1982) were used to assess drive for thinness based on their overlap with items on the Eating Disorder Inventory (EDI) Drive for Thinness subscale (Garner, Olmsted, & Polivy, 1983), including "I am preoccupied with the desire to be thinner," "I am terrified about being overweight," and "I engage in dieting behavior." Items were scored on a 6-point scale from "Never" to "Always." Internal consistency was good, Cronbach's $\alpha = 0.84$.

2.3.5. Depressive symptoms

Depressive symptoms over the prior 2 weeks were assessed using 8 items from the Patient Health Questionnaire (PHQ) (Spitzer, Williams, & Kroenke, 1999), excluding the suicidality item to prevent construct contamination (Rogers et al., 2018). The PHQ has previously demonstrated good concurrent validity (Spitzer et al., 1999). Internal consistency was good, Cronbach's $\alpha = 0.84$.

2.4. Data analytic strategy

Logistic regression was used to test the association between WS and NSSI. Associations with factors posited to have significant indirect effects were identified first by examining Pearson correlations (for WS) and Odds Ratios from logistic regression (for NSSI). The significance of direct and indirect effects were tested in a path analysis in MPlus version 7.4 using weighted least squares with mean and variance adjustment (WLSMV). The indirect effect was tested using bootstrapping (5000 draws) with 95% confidence intervals. For correlations and logistic regression, missing data were deleted listwise. For path models, missing data were handled using pairwise deletion. Univariate outliers