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# Traumatic stress, body shame, and internalized weight stigma as mediators of change in disordered eating: a single-arm pilot study of the Body Trust® framework

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## ABSTRACT

To enhance access to evidence-based treatment it is increasingly important to evaluate scalable virtual programs that support the needs of those struggling with disordered eating. This study described a scientifically grounded, trauma-informed framework known as Body Trust®, and aimed to pilot test the preliminary effectiveness and mechanisms of change in a Body Trust® program to improve disordered eating. Using quality outcomes data, we examined 70 mostly white (87%) female-identifying (97%) individuals enrolled in a 6-module online program based in the Body Trust® framework ( $M_{\text{age}} = 45.5 \pm 10.9$ ;  $M_{\text{BMI}} = 33.7 \pm 8.0$ ). Putative mediators included traumatic stress, internalized weight stigma, and body shame. Outcomes were objective and subjective binge episodes, overvaluation of weight and shape, and eating concerns. Generalized estimating equations were applied to determine pre-to-post changes. We applied Montoya's MEMORE macro, the joint-significance test, and calculated 95% Monte Carlo confidence intervals to assess mediation. Significant pre-to-post improvements with medium to large effect sizes were detected for all outcomes and mediators ( $p < .008$ ). All hypothesized mechanisms supported mediation. Using the Body Trust® framework shows early promise for alleviating disordered eating symptoms through targeting traumatic stress, body shame, and internalized weight stigma. Given the program's use of mindfulness techniques, future research should test target mechanisms like interoception.

## Introduction

Studies suggest under 20% of those with an eating disorder receive treatment (e.g., Griffiths et al., 2018; Swanson et al., 2011), despite the majority believing they need it (Cachelin & Striegel-Moore, 2006). Several things account for this, including stigma and shame, a lack of specialist providers, as well as cost and transportation (see Ali, et al., 2017 for a review). According to Kazdin (2019), perhaps the most important and addressable systemic reason for the failure of so many to receive care is the mode of treatment delivery we use (i.e., face-to-face individual therapy). Indeed, after experiencing the

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COVID-19 pandemic with mandated quarantines and widespread uncertainties about the future, it is not surprising illnesses like eating disorders that tend to be exacerbated by social isolation and transitional stress are intensifying (Fernández-Aranda et al., 2020; Schlegl et al., 2020). Thus, there is no better time to underscore the importance of empirical research that examines novel, community building, and more universally accessible modes of mental health service delivery.

With everyday adoption of Internet use in recent years, clinicians and researchers alike have harnessed technology to broaden eating disorder treatment access (e.g., Agras et al., 2017; Barr Taylor et al., 2020; Moessner et al., 2016; Tregarthen et al., 2019). Early data suggest digitized treatments are a promising delivery method for eating disorder interventions, particularly those involving binge eating (Aardoom et al., 2013; Barakat et al., 2019; Bedrosian et al., 2011; Jensen et al., 2020). Given stigma and shame are noted as significant barriers to care, as well as major underlying issues in eating disorders (e.g., Duarte et al., 2016; Swan & Andrews, 2003; Wacker, 2018), internet-based treatments may be a useful tool for aiding people with disclosure difficulties, fears of judgment by healthcare providers, and other treatment barriers (Machado & Rodrigues, 2019; Sánchez-Ortiz et al., 2011).

In two recent meta-analyses, Hilbert et al. (2019, 2020) established multiple forms of treatment (including guided/structured self-help) as successful for decreasing symptoms of binge eating. Even with more empirically supported treatments available however, it is important to recognize that clear superiority of one form of treatment over another is rarely found in head-to-head trials (e.g., Crow, 2003; Kristeller et al., 2014; Stice et al., 2019; Wonderlich et al., 2014). Accordingly, research efforts have turned to a more intentional focus on mechanisms and moderators to help guide decisions about treatment targets and for whom certain modalities may be better suited (e.g., Barney et al., 2019; Linardon et al., 2017). To be sure, funding agencies have shown that identification of treatment process variables is useful at the earliest stages of research, such as pilot and acceptability/feasibility testing. This shift is evident in current funding opportunities available at the U.S. National Institute of Mental Health (e.g., see PAR-21-135 at <https://grants.nih.gov/grants/guide/pa-files/PAR-21-135>). The goal of initially establishing potential processes underlying a treatment's effect may serve to increase efficiency by focusing attention on the most critical elements of therapeutic practices. Despite their essential roles in the research process, establishing signals around mechanisms and pilot feasibility testing should be followed by more controlled efficacy trials that meet highest evidence-based standards for treatment.

### ***Traumatic stress as potential mechanism***

Traumatic stress is a common co-occurring experience for people dealing with disordered eating (Molendijk et al., 2017). In fact, a recent study by Serra et al. (2020) documented that 92.5% of patients with binge eating disorder (BED) reported a history of trauma. Similarly, Tagay et al. (2014) showed 92.2% of their sample with anorexia nervosa and 98% of their sample with bulimia nervosa reported experiences of trauma. Yet, traumatic stress remains an understudied treatment target, and post-traumatic stress disorder (PTSD) is underdiagnosed in people with eating disorders (Tagay et al., 2014).

Moreover, research suggests people with eating disorders and co-occurring PTSD may be less likely to respond to standard treatments (Castellini et al., 2018; Serra et al., 2020). They are also more likely to drop out of care and have higher rates of relapse (Mahon et al., 2001; Rodríguez et al., 2005; Trottier, 2020). Nevertheless, we lack evidence-based treatments simultaneously addressing trauma and eating disorder symptoms (Rijkers et al., 2019; Trottier & MacDonald, 2017). Early findings from Project Recover, an integrated treatment program for individuals with PTSD receiving inpatient eating disorder care showed promising results for tackling symptoms of traumatic stress and disorder eating together (Trottier et al., 2017).

Interestingly, Tagay et al. (2014) found strong associations between Antonovsky's (1993) "sense of coherence" concept and symptoms of eating disorders and PTSD. Individuals with a higher sense of coherence have substantial resilience and inner resources, and they tend to fare very well during stressful times (Jonsson et al., 2003). A systematic review of the literature demonstrated a robust negative relationship between sense of coherence and PTSD (Schäfer et al., 2019). Hence, in accordance with Antonovsky's theory of 'salutogenesis' (i.e., the origins of health), which focuses on inquiry into the processes that enable one to stay well (1987), strengths-based positive psychology approaches to enhance resilience in at-risk populations are likely to be effective methods for early interventions in eating disorders, especially now during these high-stress times. In this vein, Cook-Cottone et al. (2008) developed an eating disorders intervention and later a framework of flourishing with positive body image (Cook-Cottone, 2015, 2016) that garnered encouraging empirical support for preventing and treating eating disorders this way.

### ***Theoretical frameworks and modalities driving Body Trust®***

First, a Body Trust® practice rejects the notion that to achieve health and well-being, people should aim for an ideal body size. As a strengths-based model, it incorporates a *Weight Inclusive Approach* to care which centralizes the social determinants of health and experiences of weight stigma as a driver of poorer physical and mental health (Tylka et al., 2014). Weight

inclusive care is a framework built on a growing body of research calling for the decoupling of weight and health and prioritizing well-being instead of weight loss for individuals higher on the weight spectrum (e.g., Bacon & Aphramor, 2011; Bacon et al., 2005; Calogero et al., 2019; Mensinger et al., 2016a). Recognizing the significance of weight stigma, the framework underscores how the dominant weight-centric health paradigm creates fertile ground for internalizing weight stigma (i.e., when negative attitudes about higher weight endorsed by society are turned inward against oneself). Studies show associations between internalized weight stigma and a whole host of negative health outcomes—from not enjoying, and avoiding, exercise (Mensinger & Meadows, 2017; Vartanian & Novak, 2011), delaying preventive healthcare (Lee & Pausé, 2016; Mensinger et al., 2018), to increasing binge eating (Durso et al., 2012; Palmeira et al., 2017; see Pearl & Puhl, 2018 for a review). With Tylka et al.'s *Weight Inclusive Approach* (2014) at its core, Body Trust® proposes that weight stigma is an under-evaluated but necessary target mechanism for individuals struggling with disordered eating.

Second, Body Trust® also draws from the science underlying mindful self-compassion (Neff, 2003; Neff & Tirsch, 2013). The mindful self-compassion intervention developed by Germer and Neff (2013) was one of the earliest tested for reducing body dissatisfaction and body shame in a randomized controlled trial (Albertson et al., 2014). Using Neff's three-pronged definition of self-compassion—self-kindness, common humanity, and mindfulness (2003)—Albertson's trial revealed that a brief three-week self-compassion-based meditation program improved ratings of body dissatisfaction, body shame, and body appreciation, significantly more than a waitlist control group. A recent meta-analysis of the literature on self-compassion, eating disorders, and body concerns showed that this is a ripening area of research with great potential as a successful treatment modality (Turk & Waller, 2020).

Third, Brown and colleagues' work on shame resilience (2006, 2011) are the theoretical underpinnings supporting the program's trauma-informed lens and aim to help clients reduce traumatic stress symptoms. *Shame Resilience Theory* (SRT) defines shame as an "intensely painful feeling or experience of believing we are flawed and therefore unworthy of love and belonging" (2006, p. 45). SRT depicts shame as an insidious web of pressures and expectations from the socio-cultural systems and interpersonal environments in which we operate. These pressures dictate who, what, and how we should be in the world, leaving many to feel trapped, powerless, and isolated. Body Trust® uses SRT to provide the language to hold their clients' identification with memories of shame—often body-related experiences of trauma. With SRT, clients permit themselves to be vulnerable by breaking the silence and secrecy that feeds shame.

Finally, Body Trust® draws from the *Developmental Theory of Embodiment* (DTE) (Piran, 2016, 2017; Piran & Teall, 2012). Embodiment is defined as “the lived experience of engagement of the body with the world” (Piran & Teall, p. 171). DTE conceptualizes three components of embodiment to represent how one interacts with the world. The first is attunement to one’s inner states (Piran et al., 2020). Diverging from external measures of negative body image, the focus here is rather on experiences of body *connection*, similar to the construct of interoception, which is defined as our conscious capacity to integrate signals from within the body (Craig, 2003). Interoception is an essential survival skill for maintaining both physiological and psychological homeostasis and has long been recognized as disrupted in people with eating disorders (Bruch, 1962).

The second component of embodiment according to DTE considers psychological and behavioral aspects of an individual’s relationship to their body. It involves self-care and/or self-injurious behaviors such as eating, sleep, and exercise habits as well as attending to sexual desires, social connection needs, and the use of substances to regulate mood and/or emotions.

The final piece of the embodiment construct involves a complex interplay between the body and culture. Social structures interact with embodied practices to form a dialectic relationship that shapes the quality of our experiences and life inhabiting our body. Using these three factors, DTE serves as a framework applied in the Body Trust® approach to establish embodied connection to the world through personal agency, self-empowerment, and owning one’s ‘body narrative’ (Piran et al., 2020).

### **Study aims and hypotheses**

The current pilot study evaluated an online Body Trust® program (*No More Weighting*®) for those seeking guided self-help for disordered eating—a sub-population that tends to have experienced trauma at higher-than-average rates (Brewerton, 2007; Leonard et al., 2003; Wonderlich et al., 2000). More specifically, the primary aim of the present paper was to report pre-post changes in three theory-based mechanisms of the program’s effectiveness (internalized weight stigma, body shame, and traumatic stress) and disordered eating cognitions and behaviors. We hypothesized significant improvements in internalized weight stigma, body shame, and traumatic stress (the three target mechanisms), as well as eating concerns, overvaluation of weight and shape, subjective and objective binge eating (the four clinical outcomes). A secondary aim was to conduct preliminary tests of mediation to support signals of potentially important treatment targets for changing clinical outcomes. The hypotheses driving the secondary aim were that changes in internalized weight stigma, body shame, and traumatic stress were individual mediators of the program’s changes on each clinical outcome.

## Method

### *Procedures and participants*

Study participants included 70 individuals who completed an online survey link included in their welcome email upon enrolling in the Body Trust®-informed guided self-help *No More Weighting*® e-course during the summer of 2018. This represents 45% of the people who signed up for the e-course. For purposes of understanding program participant characteristics, the survey contained a series of demographics, current weight, height, and highest lifetime weight, which were translated into weight suppression (i.e., highest weight minus current weight in lbs.) and body mass index (BMI, calculated using  $\text{kg/m}^2$ ). Questions about depressive and anxiety symptoms were also included using, respectively, the Patient Health Questionnaire-9 (PHQ-9, Arroll et al., 2010) and the Generalized Anxiety Disorder-7 (GAD-7, Spitzer et al., 2006), in addition to the series of tools specific to this study's analyses, as described in more detail below.

Participants had a mean age of 45.5 years, 97% were female identifying, 87% identified as white, two-thirds were employed full-time, and over half (54.3%) were married. Most reported no or mild depressive (60%) and/or anxiety (74.3%) symptoms according to the PHQ-9 and GAD-7, respectively. Slightly over half (51.4%) reported struggling with a current or past eating disorder diagnosis (47.2% with BED), and most reported engaging in subjective (57.1%) and/or objective (51.4%) binge episodes. See [Tables 1 and 2](#) for the complete set of demographic and psychological characteristics. Program clinicians ascertained that the study sample appeared typical of their *No More Weighting*® course participants.

There were no criteria for exclusion given that the data were collected for quality improvement purposes. At the end of the 6-week course, participants were emailed a second link including the follow-up questionnaire to track outcomes. The survey link remained open for 12 weeks, which is when access to the course content closed. Thirty-two participants responded to the follow-up questionnaire for a response rate of 46%. Unfortunately, low completion and follow-up rates are relatively typical of online-based intervention trials (e.g., Jensen et al., 2020) and reports of quality outcomes data as well (e.g., Lowe et al., 2003). The present study was approved as an 'exempt' protocol by the author's Institutional Review Board (IRB-FY2020-116).

### *Mediation measures*

The PTSD checklist-5 (PCL-5) was used to measure symptoms of traumatic stress. Developed by the National Center for PTSD, the original PCL mapped to the diagnostic criteria for the DSM-IV and was one of the most widely adopted self-report measures for examining symptoms of PTSD (Weathers,



**Table 1.** Demographic characteristics of the baseline study sample.

Characteristic	N (%) <sup>a</sup>
Education	
Less than high school degree	0 (0.0)
High school degree or equivalent (e.g., GED)	0 (0.0)
Some college or trade school	4 (5.7)
Associates or Technical Degree	1 (1.4)
Bachelor's Degree	25 (35.7)
Master's Degree or equivalent	31 (44.3)
Doctoral Degree (e.g., PhD, MD, JD, etc.)	8 (11.4)
Employment Status	
Employed full-time (30 or more hours per week)	47 (67.1)
Employed part-time (1–29 hours per week)	7 (10.0)
Not employed, looking for work	1 (1.4)
Retired	5 (7.1)
Student	3 (4.3)
Full-time care giver or stay-at-home parent	3 (4.3)
Other	3 (4.3)
Race/Ethnicity	
African American/Black	0 (0.0)
White	61 (87.1)
Hispanic/Latinx	4 (5.7)
Asian	0 (0.0)
Native Hawaiian or Pacific Islander	
Native American/Alaskan Native	0 (0.0)
Mixed race	3 (4.3)
Other	1 (1.4)
Marital Status	
Married/Domestic Partnership	38 (54.3)
Never married	18 (25.7)
Widowed	1 (1.4)
Divorced	10 (14.3)
Separated	2 (2.9)
Children	
Yes	35 (50.0)
No	34 (48.6)
Annual Household Income, USD	
Less than \$20,000	3 (4.3)
\$20,000–\$34,999	3 (4.3)
\$35,000–\$49,999	7 (10.0)
\$50,000–\$74,999	10 (14.3)
\$75,000–\$99,999	14 (20.0)
\$100,000–\$149,999	13 (18.6)
\$150,000–\$199,999	9 (12.9)
\$200,000 or more	10 (14.3)
Gender Identity	
Female	68 (97.1)
Male	0 (0.0)
Other (described as Androgenous)	1 (1.4)
Sexual Orientation	
Asexual/demisexual	2 (2.9)
Bisexual/pansexual	7 (10.0)
Heterosexual	54 (77.1)
Queer	4 (5.7)
Not sure	2 (2.9)
Mean Age, years (SD), Range	45.5 (10.9), 26–68

Notes. Some percentages do not add up to 100 because of missing data

<sup>a</sup>Total N = 70,



**Table 2.** Body mass index, eating disorder status, and psychological characteristics of the baseline study sample.

Characteristic	n (%)		
Eating Disorder (past n = 18 or present n = 18)			
Yes	36 (51.4)		
No	34 (48.6)		
Eating Disorder Diagnoses			
Binge Eating Disorder	17 (47.2)		
Other Specified Feeding or Eating Disorder/EDNOS	11 (30.6)		
Bulimia Nervosa	4 (11.1)		
Anorexia Nervosa (including Atypical AN)	4 (11.1)		
Presence of Objective Binge Episodes			
Yes	36 (51.4)		
No	34 (48.6)		
Presence of Subjective Binge Episodes			
Yes	40 (57.1)		
No	30 (42.9)		
Body Mass Index, <sup>b</sup> kg/m <sup>2</sup>			
> 40	13 (18.6)		
35–39.9	8 (11.4)		
30–34.9	11 (15.7)		
25–29.9	13 (18.6)		
18.5–24.9	7 (10.0)		
Missing	18 (25.7)		
Depressive symptoms, PHQ-9			
None (0–4)	16 (22.9)		
Mild (5–9)	26 (37.1)		
Moderate (10–14)	16 (22.9)		
Moderately severe (15–20)	8 (11.4)		
Severe (≥21)	3 (4.3)		
Anxiety symptoms, GAD-7			
None (0–4)	27 (38.6)		
Mild (5–9)	25 (35.7)		
Moderate (10–14)	14 (20.0)		
Severe (15–21)	2 (2.9)		
Variable	N	Mean (SD)	Range
Weight Suppression, lbs	62	17.0 (24.4)	0.0–136.0
Body Mass Index, kg/m <sup>2</sup>	52 <sup>b</sup>	33.7 (8.0)	20.4–56.6
Internalized Weight Stigma	70	4.9 (1.0)	2.3–6.6
Body Shame	70	11.1 (1.4)	6.0–12.0
Traumatic Stress	70	23.6 (13.3)	1.0–57.0
Overvaluation of Weight and Shape <sup>a</sup>	58	3.1 (0.7)	2.0–4.0
Eating Concern	70	2.8 (1.4)	0.0–5.6

Notes. <sup>a</sup>Item 20 from the QEWP-5 has a lower N because the item was excluded from the survey for the earliest responders; <sup>b</sup>The first cohort was not asked about height in the pre-program survey; therefore, a BMI could not be calculated; AN-Anorexia Nervosa; EDNOS-Eating Disorder Not Otherwise Specified

2008). The PCL-5 adapts the original tool for the updated DSM-5<sup>®</sup> criteria (Weathers et al., 2013). It consists of 20 items scored on a five-point scale; response anchors range from 0 (*not at all*) to 4 (*extremely*). Scores are summed to provide an indicator of traumatic stress symptom severity (range 0–80). Excellent internal consistency, test-retest reliability, discriminant and convergent validity have been shown (e.g., Blevins et al., 2015; Bovin et al., 2016; Wortmann et al., 2016). Cronbach's Alpha in the baseline sample was .92.

We measured internalized weight stigma with the Weight Bias Internalization Scale-Modified (WBIS-M, Pearl & Puhl, 2014). The WBIS-M assesses the endorsement of society's fat phobic attitudes for oneself.

Statements are scored on a seven-point Likert scale from 1 (*strongly disagree*) to 7 (*strongly agree*). Higher scores suggest greater internalization of negative attitudes about weight. To be consistent with psychometric improvements found in validation studies (e.g., Hilbert et al., 2014), we adopted the 10-item version which drops the first question due to its low item-total correlation. Cronbach's Alpha for the 10-item tool in the baseline sample was .80.

The four-item sub-scale for body shame from the Experience of Shame Scale (ESS-b, Andrews et al., 2002) was adopted to assess body shame. Prior research showed the ESS is a reliable tool that successfully predicted those with depressive disorders (Andrews, 1995), PTSD symptoms (Andrews et al., 2000), and eating disorders (Andrews, 1997). Psychometric testing demonstrated construct validity with other well-validated measures of shame, and confirmatory factor analysis validated the 3-factor structure (Andrews et al., 2002). Items are scored using a four-point scale ranging from 1 (*not at all*) to 4 (*very much*) with higher scores indicating greater bodily shame. When testing internal consistency for the present sample, we detected a poorly performing item, "*Have you avoided looking at yourself in the mirror?*" Upon deleting it, the Cronbach's Alpha increased from below .70 to .86. Therefore, we used the three-item version of the subscale.

### **Outcome measures**

We adopted the five-item eating concerns subscale from the Eating Disorders Examination-Questionnaire (EDE-Q, Fairburn & Beglin, 2008) to assess disordered eating. Research shows it has excellent predictive utility as a brief screening measure for BED and has been recommended for use in clinical settings (Vander Wal et al., 2011). Given its sensitivity to change after treatment (e.g., Hayes et al., 2019), it is an ideal quality outcomes measure for its construct validity, brevity, and availability of normative values in both population-based and clinical studies across the globe (Dahlgren et al., 2017; Hilbert et al., 2012; Mond et al., 2006; Rø et al., 2012). Respondents are asked to mark the frequency with which they have engaged in a series of dysfunctional eating behaviors and attitudes over the past 28 days. Items are scored on a seven-point scale ranging from 0 (*no days*) to 6 (*every day*). Total scores are derived by averaging the items and higher scores show more disordered eating. Cronbach's Alpha in the baseline sample was .74.

To determine the presence of subjective binge episodes (SBEs), objective binge episodes (OBEs), and overvaluation of weight and shape, we used the Questionnaire on Eating and Weight Patterns-5 (QWEP-5©, Yanovski et al., 2015). The QWEP-5© screens for BED and bulimia nervosa and was revised in accordance with the updated DSM-5 criteria. It asks participants to consider their eating behaviors and cognitions during the past three months. The tool differentiates loss of control eating that does, or does not, involve consuming

what others would consider large amounts of food; therefore, the measure captures the presence of OBEs and SBEs (i.e., loss of control without large amounts of food consumed). This is particularly important given evidence that feelings of loss of control, as opposed to quantity of food consumed is the key characteristic to BED (Latner et al., 2007; Shomaker et al., 2010). Overvaluation of weight and shape was determined with the QWEP-5© item ranging from 1 (*weight and shape were **not very important***) to 4 (*weight and shape **were the most important things** that affected how you felt about yourself*).

## Intervention

The *No More Weighting*® e-course was developed by Be Nourished, LLC to heal one's relationship to food and the body using their Body Trust® framework. Pulling elements from the curricula (Brown et al., 2011; Germer & Neff, 2013) and theories (Brown, 2006; Piran & Teall, 2012; Tylka et al., 2014) discussed in the introduction, the e-course aims to teach the following five underlying principles of Body Trust®: 1) practicing weight neutral self-care; 2) eating intuitively; 3) moving your body joyfully; 4) nurturing self-compassion; and 5) redefining success. This is achieved by introducing a new online learning module via email communication for six continuous weeks; access to the program is given for additional 12 weeks.

*Motivational Interviewing* (Miller & Rollnick, 2013) techniques were used to engage participants in the materials and activities for taking steps toward greater mind-body connection and an improved relationship with food through attuned self-care practices following the five core principles mentioned above. The weekly modules consisted of a combination of text that included psychoeducational material, articles (both scientific and consumer oriented), poems, journaling prompts, videos, and guided meditations. In addition, the program included a moderated discussion board with fellow peers in the program, weekly positive affirmation emails, and a live (recorded) Zoom session with the program founders—Hilary Kinavey and Dana Sturtevant (from Be Nourished, LLC). Table 3 offers a brief description of the content covered in each module.

For most people, Body Trust® is a radical shift and revisioning of how to live in and care for their body. The content presented underscores the difficulties of thriving in a society that (a) capitalizes on insecurities driven by impossible standards for body ideals, (b) perceives productivity as a symbol of worthiness, and (c) perpetuates cultural norms of perfectionism. Body Trust® practice helps people unpack and let go of such pressures and acknowledges how they deplete well-being and disrupt mind-body connections. The antidote to the pressures involves encouraging the practice of 'C- work.' Aiming for the metaphorical C- is meant to simply to give participants permission to 'fail.' Individuals with disordered eating and body dissatisfaction, who tend to deal with maladaptive

**Table 3.** Outline of No More Weighting® program modules used for current study.

Week	Module	Brief content description and activities used
1	A Body Trust® Approach to Healing	<ul style="list-style-type: none"> <li>• Welcome/Set the stage/Meet other participants</li> <li>• What is Body Trust? How was it disrupted? How do we rebuild it?</li> <li>• The qualities of a dieting mind and its role in disordered eating</li> <li>• Why dieting hasn't worked: The science of weight regulation &amp; set point theory</li> <li>• What are the foundations for building a Body Trust practice?</li> </ul>
2	Illuminate the Cycle	<ul style="list-style-type: none"> <li>• Exploring the cycle of thoughts, feelings and behaviors that contribute to a predictable, repetitive pattern of eating</li> <li>• Naming what fuels the cycle</li> <li>• Introduce the core elements of a body trust practice as ways to disrupt the cycle</li> </ul>
3	Reconnect to Hunger & Fullness	<ul style="list-style-type: none"> <li>• Attuned/intuitive eating: what it is and how to adopt it</li> <li>• Working with the hunger scale</li> <li>• Connecting with subtle and not-so-subtle hunger and fullness cues</li> <li>• Discerning emotional hunger from physical hunger</li> </ul>
4	Explore & Allow for Pleasure	<ul style="list-style-type: none"> <li>• The difference between appetite and hunger; satisfaction and physical fullness</li> <li>• Food experiments: methods for identifying fullness vs. satiety, exploring the notion of food caretaking</li> <li>• Rooting self-care practices in weight neutrality</li> <li>• Reclaiming movement</li> </ul>
5	Look & Listen with Kindness & Curiosity	<ul style="list-style-type: none"> <li>• The role of shame, the inner critic and the shame web</li> <li>• Increasing shame resilience by understanding the web of pressures and breaking the secrecy that feeds shame</li> <li>• Three components of self-compassion: self-kindness, common humanity, and mindfulness</li> <li>• Practicing radical acceptance and self-compassion</li> </ul>
6	How we Rebuild Trust	<ul style="list-style-type: none"> <li>• The process of rebuilding trust and claiming resilience</li> <li>• Navigating bad body days: "no fixing," identifying triggers and subsequent distraction &amp; coping, normalizing coping strategies</li> <li>• Reviewing what it means to practice Body Trust®</li> <li>• Finding community</li> </ul>

Note. Content provided by Be Nourished, LLC.

perfectionism (Bouguettaya et al., 2019; McGee et al., 2005), may benefit from assistance with lowering one's value of socially prescribed perfectionism. Because many have been socialized to only accept themselves when they feel they have achieved the proverbial A+ (i.e., the perfect body, partner, job, home, etc.), to unravel this pressure, Body Trust® teaches that a 'C-' is okay and says nothing about one's inherent worth.

Overall, the focus of the program aims to help participants begin to understand what disrupts positive embodiment and show them methods of returning to the comforts and freedom of living more fully in their body. To summarize, at the core of the Body Trust® framework is recognizing body liberation is everyone's birthright and a vital part of creating a fair, just, and equitable world.

### **Statistical analysis**

Data were analyzed using SPSS (v.25, Armonk, NY: IBM Corp) and R (v. 4.02, R Core Team, 2020). Exploratory descriptive analyses were performed to examine distributions, outliers, and missingness patterns. Where item missingness was identified (e.g., if only 8 of the 9 items were completed on the PHQ-9), methods of individual score imputation were performed. At least 75% of the scale's items scores were required to invoke the imputation methods. Item missingness due to skipping questions was minimal on the surveys completed; over 95% completed all items. Analyses were performed with and without the few imputed values as a sensitivity test to ensure bias was not introduced with imputation. Since results were unchanged, we kept the imputed values to maintain the larger sample size.

Generalized estimating equations (GEEs) were fit to determine the pre-to-post changes in the outcomes and putative mediators. We chose GEEs because they handle continuous and noncontinuous outcomes. Also, according to guidelines in Muth et al. (2016), GEEs use of robust standard errors is especially advantageous over the generalized linear mixed modeling framework when sample sizes are small. Using full maximum likelihood estimation, GEEs do not drop cases with missing follow-up data; however, the assumption is that the data are missing at random (Little & Rubin, 1987). Covariates, on the other hand, must be complete for observations to be included in the analysis. To correct for unknown potential biases in missingness, we tested whether those who completed the assessment ( $n = 32$ ) differed from those who did not ( $n = 38$ ) on demographics, clinical characteristics, and baseline values of mediator and outcome variables. The only two variables indicating a difference in whether or not post-course surveys were completed were age and working status. Older individuals and retired individuals were more likely to complete the post-course survey than younger individuals and non-retired individuals ( $p = .04$ ;  $p = .02$ , respectively). With multicollinearity present between these variables, we chose to only include age as a model covariate for its superior distributional properties. As a model sensitivity check, we also added BMI as a covariate. It did not change the results; therefore, we present models without BMI to maintain more power and less bias due to high missingness on this variable. A Bonferroni adjustment was used to correct for multiple comparisons in determining the statistical significance of the pre-to-post changes.

Subsequently, mediation tests were conducted using the MEMORE macro (Montoya & Hayes, 2017) for within-subjects designs on the eating concerns and overvaluation of weight and shape outcomes. Ninety-five percent confidence intervals (CIs) for the indirect effects (IE) were calculated with 5000 percentile bootstrapped samples. As a sensitivity check on the findings from the MEMORE analyses, and as a primary analysis for the variables with

binomial distributions (i.e., engagement in SBEs and/or OBEs) which MEMORE is unequipped to handle, we examined mediation using the joint significance of  $\alpha$  and  $\beta$  using GEEs. The joint-significance test remains a powerful and simple method for evaluating mediation (MacKinnon et al., 2007, 2002). In fact, more recent simulation studies show the method of testing components individually (i.e., the joint-significance test) has the superior Type I error rates compared to index methods where a single indirect effect is tested (Yzerbyt et al., 2018). Yzerbyt et al. suggest that only after joint-significance is ‘passed’ should CIs of the indirect effect be constructed to better determine precision of the estimate. After establishing significance of the  $\alpha$  and  $\beta$  paths, 95% CIs were constructed around the indirect effects as described in MacKinnon et al.’s (2007) distribution of the product method using R code written by Biesanz et al. (2010) available at <https://www.psych.mcgill.ca/perpg/fac/falk/tutorials/mediation/ExampleMediationCode.R>.

## Results

### *Evaluation of pre-to-post changes*

Table 4 shows estimated marginal mean values from the GEEs for each mediator and outcome variable at pre- and post-course, after controlling for age. The difference scores and 95% CIs follow. In support of the hypotheses, there were pre-to-post program improvements in the putative mechanisms

**Table 4.** Predicted means and changes from pre- to post-course for hypothesized mediators and disordered eating outcomes.

Mediator/Outcome Variables	EMMs (SE) <sup>a</sup>	EM Mean change from baseline (95% CI)	p-value
Internalized Weight Stigma			
pre-course	4.87 (0.12)		
post-course	4.12 (0.19)	−0.75 (−1.10 to −0.40)	<.001
Body Shame			
pre-course	11.05 (0.17)		
post-course	8.80 (0.37)	−2.25 (−2.94 to −1.56)	<.001
Traumatic Stress			
pre-course	23.27 (1.59)		
post-course	14.10 (1.82)	−9.17 (−12.21 to −6.12)	<.001
Eating Concern (EDE-Q)			
pre-course	2.71 (0.17)		
post-course	1.36 (0.22)	−1.35 (−1.77 to −0.93)	<.001
Overvaluation of Weight & Shape			
pre-course	3.07 (0.10)		
post-course	2.27 (0.14)	−0.80 (−1.10 to −0.50)	<.001
Subjective Binge Episodes			
pre-course	0.57 (0.06)		
post-course	0.32 (0.08)	−0.25 (−0.44 to −0.07)	0.008
Objective Binge Episodes			
pre-course	0.50 (0.06)		
post-course	0.25 (0.07)	−0.25 (−0.41 to −0.10)	0.002

Notes. N = 69; Bonferroni-adjusted  $\alpha$  = .007 for multiple comparisons; EM—Estimated Marginal

<sup>a</sup>Estimated Marginal Means with Robust Standard Errors Derived from Generalized Estimating Equations controlling for age

(internalized weight stigma, body shame, and traumatic stress) as well as the clinical outcomes: eating concerns, overvaluation of weight and shape, OBEs, and SBEs. With the exception of SBEs ( $p = .008$ ), all program effects were statistically significant ( $p < .002$ ) even after applying the Bonferroni adjustment for multiple comparisons ( $p$ -value required after Bonferroni correction was .007).

### Tests of mediation

In accordance with the hypotheses regarding internalized weight stigma as a mechanism of positive changes in disordered eating outcomes, results using MEMORE suggested changes in internalized weight stigma mediated changes in eating concerns (IE = 0.28;  $CI_{.95} = 0.01, 0.56$ ) and overvaluation of weight and shape (IE = 0.32;  $CI_{.95} = 0.12, 0.60$ ). Evidence of mediation was further supported with the joint-significance test for all outcomes per Table 5 where paths  $\alpha$  and  $\beta$  are provided along with the 95% CIs on the distributions of the product.

Results from the analyses using MEMORE also supported the hypotheses that changes in body shame mediated changes in eating concerns (IE = 0.75;  $CI_{.95} = 0.30, 1.38$ ) and overvaluation of weight and shape (IE = 0.46;  $CI_{.95} = 0.13, 0.90$ ). The joint-significance test replicated these findings. In addition, decreases in body shame mediated changes in OBEs and SBEs. However, the CIs are relatively wide on the binge eating outcomes and approach zero for

**Table 5.** Joint-significance tests for hypothesized mediators on disordered eating outcomes.

Mediator Variable	Path $\alpha$ (SE)	p-value	
Internalized Weight Stigma	0.75 (0.18)	<.001	Indirect Effect (95% CI)
Outcome Variable	Path $\beta$ (SE)		
Eating Concern	0.66 (0.12)	<.001	0.49 (0.23, 0.81)
Overvaluation of Weight & Shape	0.49 (0.07)	<.001	0.37 (0.18, 0.58)
Objective Binge Episodes	0.85 (0.22)	<.001	0.63 (0.25, 1.13)
Subjective Binge Episodes	0.78 (0.24)	.001	0.59 (0.20, 1.09)
Mediator Variable	Path $\alpha$ (SE)		
Body Shame	2.25 (0.34)	<.001	Indirect Effect (95% CI)
Outcome Variable	Path $\beta$ (SE)		
Eating Concern	0.38 (0.07)	<.001	0.85 (0.47, 1.30)
Overvaluation of Weight & Shape	0.26 (0.04)	<.001	0.58 (0.35, 0.85)
Objective Binge Episodes	0.29 (0.15)	.048	0.65 (0.01, 1.36)
Subjective Binge Episodes	0.32 (0.14)	.023	0.71 (0.10, 1.41)
Mediator Variable	Path $\alpha$ (SE)		
Traumatic Stress	9.17 (1.55)	<.001	Indirect Effect (95% CI)
Outcome Variable	Path $\beta$ (SE)		
Eating Concern	0.06 (0.01)	<.001	0.56 (0.33, 0.84)
Overvaluation of Weight & Shape	0.02 (0.01)	.004	0.18 (0.06, 0.32)
Objective Binge Episodes	0.05 (0.02)	.018	0.42 (0.06, 0.81)
Subjective Binge Episodes	0.06 (0.02)	.002	0.59 (0.20, 1.05)

Notes.  $N = 69$ ; Paths  $\alpha$  and  $\beta$  derived with Generalized Estimating Equations using robust standard errors controlling for age, 95% CIs derived with R-code written by Biesanz et al. (2010) for MacKinnon et al.'s (2007) distribution of the product method. Code retrieved from <https://www.psych.mcgill.ca/perpg/fac/falk/tutorials/mediation/ExampleMediationCode.R>



OBEs (see Table 5). This suggests that the estimated indirect effect for body shame is small and/or other factors are simultaneously mediating changes in binge eating.

In support of our third hypothesized mechanism, MEMORE also provided evidence suggesting changes in traumatic stress mediated changes in eating concerns ( $IE = 0.66$ ;  $CI_{.95} = 0.22, 1.05$ ) and overvaluation of weight and shape ( $IE = 0.35$ ;  $CI_{.95} = 0.06, 0.68$ ). The joint-significance test also replicated these findings. Moreover, decreases in traumatic stress mediated changes in OBEs and SBEs (see Table 5).

## Discussion

This pilot study provides initial evidence for a novel integrative guided self-help program (*No More Weighting*®) to reduce disordered eating. In addition, this evaluation indicated three theory-driven mechanisms that potentially explain the improvements shown—internalized weight stigma, body shame, and traumatic stress. The Body Trust® framework, guiding the e-course evaluated in this study is theoretically grounded in both the *Weight Inclusive Approach* (Tylka et al., 2014) and the *Development Theory of Embodiment* (Piran & Teall, 2012) while also drawing from scientifically supported curricula in mindful self-compassion (Albertson et al., 2014; Germer & Neff, 2013) and shame resilience (Brown et al., 2011; Hernandez & Mendoza, 2011). With these first signals of positive effects on outcomes and theoretically driven target mediators, researchers and practitioners are well-positioned to further test internalized weight stigma, body shame, and traumatic stress as potentially important clinical process variables for strategically building and iteratively evaluating treatments early on, and often, while designing and continually refining a program.

Few frameworks for interventions to decrease disordered eating explicitly seek to target the embodiment of shame resilience like Body Trust®. Tapping into this construct, initially developed by Brown (2006) in her research on vulnerability, the developers of Body Trust® enhanced its applicability to eating disorders by using Tylka et al.'s *Weight Inclusive Approach* to care (2014) and Piran and Teall's *Developmental Theory of Embodiment* (2012). As a pivotal feature of the intervention, shame resilience makes Body Trust® a unique and novel approach to addressing disrupted connections to one's body and relationships with food. Prior research shows shame resilience moves people from isolated to connected with empathic support, and from self-blame to awareness (Hernandez & Mendoza, 2011; Kirkpatrick, 2017). Kirkpatrick's study qualitatively explored the Body Trust® framework and discussed shame resilience as a powerful coping tool introduced by the program. Her interview-based

research concluded that participants' new relationship with shame and the practice of shame resilience 'healed the internalization of weight stigma' experienced by *No More Weighting*® participants (Kirkpatrick, 2017). This pilot study of pre-to-post changes in internalized weight stigma provides additional quantitative support for Kirkpatrick's inferences in another sample utilizing the program.

Earlier studies of face-to-face programs based in the weight-inclusive paradigm from which Body Trust® evolved also showed significant reductions in internalized weight stigma (Mensinger et al., 2016b). However, as seen in Pearl et al.'s recent trial of a cognitive behavioral intervention aiming to target weight stigma in individuals with elevated BMI, neither trial (i.e., Mensinger et al., 2016b or Pearl et al., 2020) found significantly *greater* decreases in internalized weight stigma compared to the changes seen in peers allocated to a weight loss intervention. Interestingly though, in both trials, there *were* greater improvements in disorder eating behaviors in the groups focusing on undoing weight stigma compared to the weight loss groups. Our preliminary findings regarding internalized weight stigma as a potential mediator are consistent with these earlier studies suggesting that interventions addressing the internalization of biases from the structural source of weight stigma in our society are likely an important target for eating disorder treatment and prevention.

In light of the focus on embodying shame resilience practices, it is also not surprising that our findings suggest participants may benefit from significant improvements in body shame after taking part in *No More Weighting*® and that these improvements were potentially instrumental in changes found in disordered eating cognitions and behaviors according to the mediation analyses. This is consistent with the evidence implicating shame as an etiological factor in eating disorders, as shown in a recent systematic review by Blythin et al. (2020). Importantly, Ferreira et al.'s (2013) research suggests the best antidote to conquering shame is self-compassion. The pairing of mindful self-compassion with building shame resilience practices in Body Trust® is supported by the growing literature base on cultivating self-compassion for the treatment of eating and body-related concerns (Turk & Waller, 2020). Likewise, Kelly et al. (2014) showed improvements in both shame and self-compassion early in treatment among patients hospitalized for an eating disorder predicted faster improvements in disordered eating symptoms over time. In support of the important role of self-compassion for unpacking—and building resilience to—experiences of shame, Kelly et al. also demonstrated that early changes in self-compassion predicted steeper improvements in shame.

The intentional integration of a trauma-informed approach also makes the Body Trust® framework an important contributor to building empirically supported treatments for eating disorders. Our preliminary results showing reductions in traumatic stress served as a mechanism of change in binge eating

behaviors as well as eating concerns and overvaluation of weight and shape lend credence to the theory that traumatic stress is likely an eating disorder maintenance factor and should be targeted as a treatment, and preventive, mechanism (Trottier et al., 2016).

To our knowledge, there are no interventions available to simultaneously address trauma and eating symptoms in a guided self-help modality. Our findings indicate that doing so may be both feasible and successful if designed carefully with theory-informed components relevant to issues surrounding traumatic stress—like shame. Prior research indirectly supports this. For instance, in a study by Duarte and Pinto-Gouveia (2017) the relationship between traumatic memories and binge eating was mediated by body shame. In addition, the results from a recent quality outcomes study of nearly 3000 eating disorder patients receiving higher levels of care demonstrated the potential successes of trauma-informed, self-compassion based, and weight-inclusive care (Mensinger et al., 2020). Analytic models from this study indicated that in a treatment context focused on many of the common elements found in the Body Trust® framework, individuals with trauma histories tended to improve disordered eating symptoms *faster* than their peers without trauma histories.

## Limitations

Despite the importance of evaluating disordered eating programs currently being publicly offered to allow for necessary iterative improvements, this study is not without limitations. Given the nature of the data being drawn from a real-world sample of individuals seeking help, they were people who could afford the fee associated with the *No More Weighting*® program. Therefore, it is not surprising that the sample primarily consisted of highly educated individuals from higher income brackets. Moreover, all but one participant was female-identifying and 87% identified as non-Hispanic white for their race/ethnicity. This makes generalizability to more diverse samples difficult and not advisable without new data. We must make efforts to test interventions like this among populations with fewer resources and social capital. We specifically need more evidence of models that are designed to address the unique needs of racial and/or ethnic minority-identifying individuals who have been systemically oppressed in our white dominant society. Testing Body Trust® more formally in a controlled setting is needed to address this gap, particularly given the anti-oppression lens with which the developers of the program approach their work.

The rate of post-program completion was another important weakness. Though a severe limitation to our ability to draw firm conclusions, this is unfortunately not out of line with previous reports of dropout and/or completion of post-program assessments in internet-based programs for

psychological treatments (Jensen et al., 2020; Melville et al., 2010). Linardon and Fuller-Tyszkiewicz (2020) showed in a systematic review of attrition in smartphone-based trials that studies with enrollment occurring entirely online (i.e., no face-to-face meeting with study personnel) had an average of 43.4% attrition while those with in-person enrollment showed only an 11.2% attrition. Thus, future research of this kind should consider the potential problems of a purely online protocol. On the other hand, this is a challenge, particularly amidst efforts to make the program accessible to all regardless of ability to come to a face-to-face meeting. Other tools for enhancing post-program retention such as monetary compensation for time spent completing assessments and reminders might aid the lower rates seen in online follow-ups. Methods allowing for distance-based enrollments could involve the use of Zoom interviews to enhance rapport with participants that is theoretically responsible for the lower attrition in studies using in-person enrollment (Linardon & Fuller-Tyszkiewicz, 2020).

The fact that this evaluation represented an uncontrolled single arm trial also limits our ability to discern whether changes would have been seen over a similar period for individuals in a no treatment condition or another active treatment. We also have no way of knowing if the intensity with which the participants engaged in the program impacted the benefits reported. A more rigorous and larger study with a comparative control arm is warranted to help ascertain whether the improvements seen after engaging in this Body Trust® program are replicable and can be maintained during a long-term follow-up period. Furthermore, conducting more frequent assessments, particularly throughout the duration of the intervention will enable a temporal sequencing and hence a more rigorous examination of mediation effects. The methods used in the present study draw only from two timepoints and lack the multiple assumptions required for causal inference. Interpretations discussed here should be considered only preliminary and based on the mechanistic theories reviewed.

### **Future directions and concluding remarks**

In addition to the need for controlled research of programs based in the Body Trust® framework, one important component of the intervention not evaluated in the present study was the use of meditations and mindfulness techniques to enhance mind-body attunement. Mindfulness-based interventions have been widely studied in eating disorders (e.g., Cox et al., 2020; Haynos et al., 2016) especially binge eating spectrum disorders (see Barney et al., 2019, for a systematic review of mechanisms and moderators). Vanzhula and Levinson (2020) recently presented a theoretical framework proposing various mechanisms underlying the relationship between mindfulness interventions and the decrease of eating disorder symptoms. While some of the mechanisms

have garnered significant evidence (e.g., self-compassion, emotion regulation), others—like interoceptive awareness of hunger and fullness—are less well developed and mark important directions for future research in mindfulness. Indeed, the ability to identify hunger and satiety is a core feature of interoception as it relates to eating disorders (see Martin et al., 2019 for a review of this literature). Deficits in interoception were proposed in a meta-analysis of the extant literature as a potential transdiagnostic endophenotype of eating disorders warranting more research (Jenkinson et al., 2018).

Unfortunately, this study did not have available data to evaluate interoception or attuned eating as a potential mechanism, and aside from a few seminal studies (e.g., Kristeller & Wolever, 2010; Kristeller et al., 2014), there is a paucity of research investigating such connections, especially in the context of interventions for binge eating (Martin et al., 2019). With longitudinal data from Project EAT showing adolescents engaging in intuitive eating behaviors are significantly less likely to report binge eating eight years later (Hazzard et al., 2020), knowing whether teaching mindful eating and meditative practices decreases binge eating through improvements in intuitive eating and, by extension, interoceptive awareness, could uncover a powerful target for treating binge eating spectrum disorders.

Additionally, given studies showing the success of a mindfulness-based body awareness intervention targeting interoception in women with substance use disorders and high degrees of traumatic stress (Price et al., 2019), this is a promising new direction for interventions seeking to simultaneously address trauma, eating, and body-related symptoms. In light of research demonstrating that individuals with lower interoception tend to have high levels of trauma and stress (e.g., Price et al., 2019; Schulz & Vögele, 2015), it is not surprising that in a sample of eating disorder patients, those with co-occurring PTSD reported lower mindfulness than their peers without co-occurring PTSD (Scharff et al., 2021). If enhanced interoception can be taught with mindfulness techniques, this may prove to be a fruitful line of inquiry for tackling the common co-occurrence of disordered eating and traumatic stress.

In summary, few interventions for disordered eating exist that simultaneously address weight stigma and trauma symptoms—two understudied potential maintenance factors of eating disorders (Harrop, 2019; Trottier et al., 2016). This research speaks to multiple gaps and needs in the field by providing a first step towards building evidence for alternative treatments. The *No More Weighting*® e-course using Body Trust® targets novel mechanisms with an efficient, accessible, and scalable online guided self-help method for eating disorders.

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## Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to information that could compromise the privacy of research participants.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

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