



Internet-based preventive intervention for reducing eating disorder risk: A randomized controlled trial comparing guided with unguided self-help[☆]



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ABSTRACT

Student Bodies, an internet-based intervention, has successfully reduced weight/shape concerns and prevented eating disorders in a subset of college-age women at highest risk for an eating disorder. *Student Bodies* includes an online, guided discussion group; however, the clinical utility of this component is unclear. This study investigated whether the guided discussion group improves program efficacy in reducing weight/shape concerns in women at high risk for an eating disorder. Exploratory analyses examined whether baseline variables predicted who benefitted most. Women with high weight/shape concerns ($N = 151$) were randomized to *Student Bodies* with a guided discussion group ($n = 74$) or no discussion group ($n = 77$). Regression analyses showed weight/shape concerns were reduced significantly more among guided discussion group than no discussion group participants ($p = 0.002$; $d = 0.52$); guided discussion group participants had 67% lower odds of having high-risk weight/shape concerns post-intervention ($p = 0.02$). There were no differences in binge eating at post-intervention between the two groups, and no moderators emerged as significant. Results suggest the guided discussion group improves the efficacy of *Student Bodies* in reducing weight/shape concerns in college students at high risk for an eating disorder.

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Evidence-based interventions for eating disorders have been established, but they are not being implemented in routine clinical care, resulting in a devastating gap between those who are and are not receiving treatment (Beidas & Kendall, 2010; Drake et al., 2001; Proctor et al., 2009; Shafran et al., 2009). Translating interventions into disseminable mediums that are readily deliverable, rely less on

specialists, and can be tailored for varied levels of risk and symptom profiles is a priority. Internet-based interventions overcome translational barriers and enable rapid dissemination (Kazdin & Blase, 2011; Paxton, 2013). Online interventions have been successfully used to reduce eating disorder risk factors or for the treatment or prevention of eating disorders (Bauer & Moessner, 2013; Bauer, Moessner, Wolf, Haug, & Kordy, 2009; Carrard et al., 2011, 2010; Jacobi, Volker, Trockel, & Taylor, 2012; Lindenberg, Moessner, Harney, McLaughlin, & Bauer, 2011; Ljotsson et al., 2007; Paxton, McLean, Gollings, Faulkner, & Wertheim, 2007; Pretorius et al., 2009; Sánchez-Ortiz et al., 2010; Stice, Rohde, Durant, & Shaw, 2012; Taylor et al., 2006). These interventions have been tested in comparison to face-to-face treatments as well as educational materials or wait-list control conditions, and have demonstrated reductions in eating risk factors, eating disorder onset, eating disorder symptoms, or relapse (Bauer & Moessner,

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2013). Internet-based interventions are often associated with high user acceptability given their accessible and anonymous format (Abascal, Bruning Brown, Winzelberg, Dev, & Taylor, 2004; Lenhart, Purcell, Smith, & Zickuhr, 2010; Luce et al., 2005; Moessner & Bauer, 2012; Shaw, Stice, & Becker, 2009); however, anonymous online platforms can also be met with user dropout given the reduced accountability than face-to-face treatments or met with reduced engagement if technological innovations/enhancements are not released at the same speed as that of our rapidly-changing technological landscape (Paxton, 2013). Moreover, overcoming access-to-care barriers through the use of internet-based platforms requires strong, collaborative partnerships and ongoing attention to uptake and sustainability to ensure successful implementation (Paxton, 2013).

Student Bodies is an internet-based preventive intervention that aims to reduce eating disorder risk factors in order to prevent eating disorders in college-age women at risk for onset (Beintner, Jacobi, & Taylor, 2012; Taylor et al., 2006). The largest evaluation of *Student Bodies* demonstrated significant differences between intervention conditions in reducing the eating disorder risk factor weight/shape concerns, and although no main effects were shown for reducing eating disorder onset, differential effects were found for eating disorder prevention among two subsets of users. Specifically, the subset of users in the intervention condition who were overweight had significantly fewer eating disorder cases at two-year follow-up than the control condition (i.e., 0% onset versus 10.8% onset), and at one site, those engaging in compensatory behaviors at baseline in the intervention condition had significantly fewer eating disorder cases at two-year follow-up than the control condition (i.e., 14.4% versus 30%, respectively; Taylor et al., 2006). Though no trial evaluating *Student Bodies* has demonstrated main effects for eating disorder prevention, the success of the intervention across multiple trials in reducing eating disorder risk factors makes it ripe for implementation across college campuses for students at high eating disorder risk (Beintner et al., 2012). Scaling the intervention for widespread use may depend on maximizing cost effectiveness. The two highest costs associated with the intervention are running the program on a HIPAA-protected server and delivering the program using a guided self-help format through the use of a guided discussion group. Though the former is imperative for participant privacy, the clinical utility of the latter has yet to be determined.

The current study sought to examine whether an online, guided discussion group is an active intervention component of *Student Bodies* by comparing the efficacy of delivering the intervention using a guided versus unguided self-help format. Guided self-help interventions are an effective first-line treatment intervention for eating disorders and improve scalability (Wilson & Zandberg, 2012), though data are limited regarding the benefits of guided compared to unguided self-help preventive interventions for eating disorders; to our knowledge, only one pilot trial has been conducted using an internet-based preventive intervention (Low et al., 2006),¹ suggesting the need for large-scale randomized controlled trials (RCTs) to evaluate the effects. Among internet-based treatment programs for eating disorders, guided self-help programs have been associated with higher participation and abstinence from binge eating than unguided self-help interventions (Beintner,

Jacobi, & Schmidt, 2014). In other mental health conditions such as depression and anxiety disorders, trials of internet-based interventions have demonstrated the efficacy or potential benefit of unguided self-help interventions (Berger, Caspar, et al., 2011; Berger, Hammerli, Gubser, Andersson, & Caspar, 2011; Lintvedt et al., 2011). However, meta-analyses suggest that internet-based interventions for depression and anxiety without therapist support have smaller effect sizes than interventions with therapist support (Andersson & Cuijpers, 2009; Spek et al., 2007).

The primary aim of this RCT was to investigate whether a guided discussion group improved program efficacy in reducing weight and shape concerns associated with participation in the 8-week *Student Bodies* intervention. We focused on weight and shape concerns because this construct has been identified as a key risk factor for the onset of eating disorders (Jacobi, Abascal, & Taylor, 2004; Jacobi, Hayward, de Zwaan, Kraemer, & Agras, 2004). We also conducted exploratory analyses to examine whether possible moderator baseline variables predicted who benefitted most from the program, as this information may be useful for circumstances in which intervention delivery is dependent on limited cost resources. Past trials evaluating preventive interventions have demonstrated moderating effects of overweight status (Taylor et al., 2006), elevated eating disorder symptoms (Muller & Stice, 2013; Stice et al., 2012; Stice, Rohde, Shaw, & Marti, 2013), presence of a DSM-5 diagnosis (Muller & Stice, 2013), and pressure to be thin (although results are mixed on the effects of elevated or lower pressure to be thin changes in eating disorder symptoms; Stice et al., 2012; Stice, Rohde, et al., 2013) on reductions in eating disorder symptoms or prevention of eating disorder onset, as well as being an older adolescent/young adult on reductions in body dissatisfaction (Muller & Stice, 2013). We evaluated the possible moderating effect of depression, body mass index (BMI, kg/m²), willingness to improve body image, and willingness to improve emotion regulation. The decision to examine these variables was based on the moderating effect of BMI from a previous trial of *Student Bodies* (Taylor et al., 2006) and the association between depression and increased risk for eating disorder onset (Jacobi et al., 2011). Additionally, since higher levels of willingness and motivation to change in treatment can improve adherence and predict better outcomes in in-person (Burns, Westra, Trockel, & Fisher, 2012) and internet-based interventions (Donkin & Glozier, 2012), we included measures of these variables in the assessment and examined them in relation to intervention effects. We hypothesized that participants who received the *Student Bodies* program with the guided discussion group component (i.e., guided self-help format) would have a greater reduction in weight and shape concerns than would participants who received the program without a discussion group (i.e., unguided self-help format).

Methods

Participants

Participants were college-age women between the ages of 18 and 25, who were considered at high risk for eating disorder onset. High risk was defined as a score at or above 47 on the Weight Concerns Scale (WCS; Jacobi, Abascal, et al., 2004) or endorsement of the statement(s), "My weight is more important than most, but not all, things in my life," "My weight is the most important thing in my life," "I am very afraid of gaining three pounds," or "I am terrified of gaining three pounds" on the WCS, irrespective of total score (Jacobi, Abascal, et al., 2004). The study was conducted in the San Francisco, Sacramento, and St. Louis areas. Participants were eligible for inclusion if they did not meet diagnostic criteria for a current clinical or subclinical eating disorder, as defined in the

¹ A pilot study of *Student Bodies* using a community sample of college-age women (i.e., at low risk for eating disorder onset) found similar effects between a guided discussion group ($n = 14$), an unguided discussion group ($n = 19$), or no discussion group ($n = 14$) compared to a no-program control group ($n = 14$) (Low et al., 2006). However, a large RCT of a guided discussion group versus no discussion group among the *Student Bodies* program's target high-risk population has yet to be conducted.

Diagnostic and Statistical Manual of Mental Disorders revised 4th edition (DSM-IV-TR; American Psychiatric Association, 2000), and were not actively suicidal or psychotic, as determined by an interview using a modified version of the Structured Clinical Interview for DSM-IV Axis I Disorders (First, Spitzer, Gibbon, & Williams, 2002).

This study was approved by the Institutional Review Boards of all participating sites.

Procedure

This study was conducted through two research sites, and participants were recruited from 11 colleges and universities in the San Francisco, Sacramento, and St. Louis areas. Though there was a cap on the number of total students who could be enrolled into the trial, there were no minimum or maximum limits on the number of possible students that could be recruited from each participating school, in an effort to make participation available to all interested students. Interested individuals responded to campus and community flyers, email advertisements from university student groups, referrals from campus health centers, email or telephone contacts based on referrals from Volunteers for Health (a Washington University-specific research participant database), Facebook, and word of mouth. Participants responded to advertisements for a study on improving body image and healthy coping skills. After completing a brief online or telephone screening questionnaire, potentially eligible participants were invited to complete an in-person semi-structured diagnostic assessment and self-report questionnaires, during which the following demographic variables were assessed: age, race/ethnicity, and parents' highest level of education [as a proxy measure of socio-economic status (SES)]. Trained research assistants objectively measured participants' height and weight as well. Individuals provided informed consent prior to completing the screening questionnaire and again prior to completing the in-person assessment.

At the end of the in-person assessment, individuals who were eligible to receive the intervention were invited to participate. After a complete description of the study was provided to the participants, written informed consent was again obtained. All eligible individuals received the *Student Bodies* intervention. Study investigators randomized participants to one of two conditions: *Student Bodies* with a guided discussion group (i.e., guided self-help condition) or with no discussion group (i.e., unguided self-help condition). Randomization was performed using computer-generated random-number sequences in SPSS (SPSS Inc, Chicago, IL); participants were stratified by site and history of an eating disorder. An investigator at the data-coordinating site performed the randomization; this individual was not involved with participant assessments or intervention delivery.

Before receiving access to the program, participants selected a non-identifying username and private password; usernames were stored in a password-protected database, accessible only to approved study investigators. Participants in both conditions received three email prompts over the course of the intervention to log in to the program and complete the current week's session. At the beginning and end of the intervention, participants were encouraged to complete an online assessment battery, pre-programmed into the *Student Bodies* program. Fig. 1 presents a consort flow chart for the current study.

Intervention

The *Student Bodies* intervention is an 8-week internet-based program primarily focused on reducing body weight and shape concerns, with one session released for viewing at the start of each

week. Sessions are, on average, 21 pages in length. The program incorporates cognitive-behavioral therapy techniques into session content and includes weekly exercises and journal log prompts. Program content is designed to help participants create healthier behavior patterns around eating, exercise, sleep, mood, and emotion regulation, as healthy routines are associated with improved mental health and hence increased body satisfaction. Users have unlimited access to the current week's session material and accompanying components; in addition, users may access previously-released content from already-completed sessions. Upon completion of the program, users are provided continued access to *Student Bodies* for nine months, so they may review the material as needed.

In the current study, there were four intervention cohorts, comprised of 16–23 individuals. For those randomized to the guided discussion group condition, an asynchronous, online guided discussion group accompanied session content. Each guided discussion group cohort was led by a trained bachelor's level research assistant and a supervising clinician affiliated with one of the participating academic institutions. The guided discussion group provided an open forum that allowed participants to discuss reactions to the program material, support each other's progress in the program, seek advice, or ask questions in a safe, confidential, and anonymous environment. All cohort members view postings to the discussion group; it is not possible for a participant to send private, personal messages to another individual participant. Participants were encouraged but not required to post at least once each week to the discussion group. Participants are able to initiate their own messages to the group and respond to intervention guides' prompts. The intervention guides reinforced program participation, posted session-related questions once per week to the group, and commented on user responses to encourage continued dialogue. Intervention guide postings were based on a manual from previous trials. Intervention guide responsibilities included logging in to the program and reviewing participant postings at least once each day to ensure safety and appropriateness of postings. Full program details have been described previously (Taylor et al., 2006).

Measures

Weight Concerns Scale (WCS): The WCS is a 5-item questionnaire that assesses disordered eating attitudes (Killen et al., 1996, 1994). Item responses are standardized on a scale of 0–100, summed and divided by five, and yield a total score ranging from 0 to 100, with higher scores indicating increased weight and shape concerns. Criterion for high eating disorder risk was determined by a score of 47 or above or endorsement of the statement(s), "My weight is more important than most, but not all, things in my life," "My weight is the most important thing in my life," "I am very afraid of gaining three pounds," or "I am terrified of gaining three pounds" on the WCS, irrespective of total score. The cut-off score of 47 was based on a receiver operating curve analysis which showed good sensitivity, specificity, and predictive validity for identifying eating disorder cases (Jacobi, Abascal, et al., 2004).

Eating Disorder Symptoms: At baseline, the Eating Disorder Examination-Questionnaire (Fairburn & Beglin, 2008) was used to evaluate the number of episodes of objective and subjective binge eating and purging behaviors (i.e., vomiting, laxative misuse, and diuretic misuse) over the past 28 days. At the post-intervention assessment, participants were asked to report on the frequency of episodes of binge eating and purging behaviors over the previous 7 days using a symptom checklist.

Beck Depression Inventory-II (BDI-II): The BDI-II is a 21-item questionnaire used to assess symptoms of depression over the

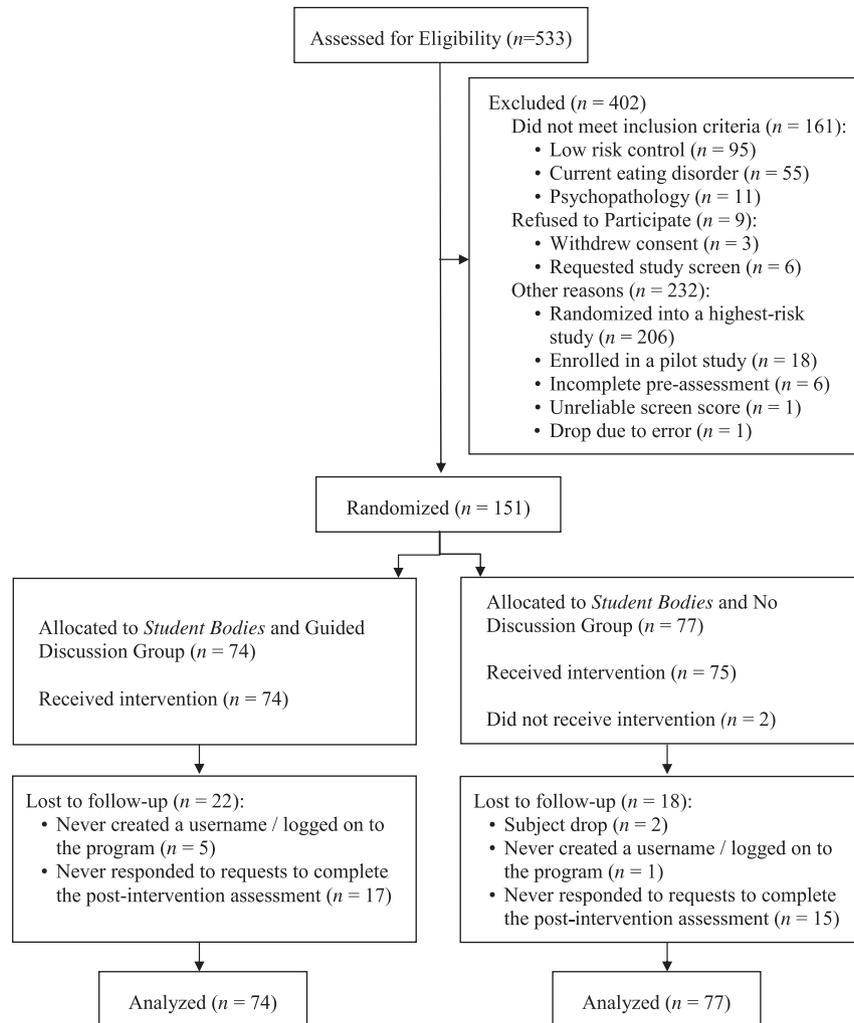


Fig. 1. Consort diagram. See “Intervention” section for information about the online *Student Bodies* intervention, presented in line with the CONSORT-EHEALTH guidelines for web-based health interventions (Eysenbach, 2011).

past two weeks (Beck, Steer, & Brown, 1996). Responses are given on a 4-point Likert-type scale; a total score is calculated by summing the item responses. Scores range from 0 to 63, with higher scores indicating more severe psychopathology. The BDI-II has been shown to have good sensitivity and specificity for unipolar depressive disorders in a college-age population (Shean & Baldwin, 2008).

Motivation and Expectation Scale (MES): The MES is a 13-item questionnaire created by the study investigators. The MES is designed to assess participants' motivation and confidence in being able to improve their body image and emotion regulation as a result of participating in an online intervention. Questions also assess participants' degree of comfort in using the internet. Responses are given on a 0–4 scale, with answers ranging from “none” to “very much.” Items related to body image included, “How motivated are you to improve how you feel about your body? How confident are you that you will be able to improve how you feel about your body? How much time are you willing to put into improving your body image? How much effort are you willing to put into improving your body image (e.g., doing things like reading and reflecting on material, trying exercises, expressing your thoughts with others)? How willing are you to try new behaviors that may feel awkward at first to improve your body image?” Items related to emotion regulation used the same wording as the questions above, but

modified “body image” to focus on “emotion management” (e.g., “How motivated are you to learn about managing your emotions and stress?”).

Factor analysis was conducted using the eight MES items assessing willingness to work on improving body image or willingness to work on improving emotion regulation, using principle axis factoring with a varimax rotation. This analysis yielded two factors with eigenvalues >1.0 and factor loadings >0.4 on only one factor for each of the eight MES scale items. The associated factor-based subscales were: willingness to improve body image and willingness to improve emotion regulation, with Cronbach's alpha internal consistency coefficients of 0.74 and 0.88, respectively.

Body Composition: BMI calculations were conducted from the height and weight measurements performed at baseline by trained research assistants. Measurements were performed using a calibrated scale and portable stadiometer. Participants were weighed without shoes or bulky outerwear.

Adherence

Adherence data were tracked electronically and downloaded upon program completion from the online server. Adherence was quantified in three ways: 1) whether users ever logged on to the program; 2) amount of time spent using the program (in minutes);

and 3) number of session pages viewed (Donkin et al., 2011; Manwaring et al., 2008).

Analyses

Sample size calculations were based on post-intervention differences in WCS scores ($d = 0.81$) from a previous RCT comparing the intervention to no-treatment control (Taylor et al., 2006). However, given that the current study did not include a no-treatment control group, a smaller effect size of 0.5 was expected. To detect this effect with 80% power (5% alpha), a sample size of 64 individuals per group at study entry, assuming 20% attrition over the course of the study, was needed.

Analyses were intent-to-treat, such that all individuals randomized to the intervention were included in the analyses. Multiple imputation was used to impute post-intervention data for individuals who did not complete the post-intervention assessment. Analyses controlled for parent education, which was associated with attrition, and site.

Linear regression was used to examine the effects of the guided discussion group on post-intervention assessment scores, controlling for baseline scores on the same measures and controlling for parent education and site. Logistic regression was used to determine the effect of the guided discussion group on odds of remaining above the high-risk WCS score (i.e., ≥ 47) at post-intervention, controlling for baseline WCS score and controlling for parent education and site. Poisson regression was used to determine the effects of the guided discussion group on binge rates over the previous 7 days, controlling for binge rates at baseline (defined as the combination of objective and subjective binge episodes). Purge rates over the previous 7 days were not evaluated for significance because of low numbers of individuals who reported purging ($n = 4$) in this population. Exploratory post-hoc regression analyses were used to examine the possible moderating effect of depressive symptoms, BMI, baseline willingness to improve body image, and baseline willingness to improve emotion regulation on post-intervention WCS scores, controlling for baseline scores on the WCS and controlling for parent education and site.

Chi-square analyses and t -tests were used to examine baseline differences and program adherence between the assessment completers and non-completers and between the two intervention conditions. Correlations between adherence variables and post-assessment outcomes were computed as well.

P -values less than 0.05 were considered statistically significant; all tests were two-tailed. Analyses were conducted using the SPSS version 20.0 software package (SPSS Inc, Chicago, IL). Cohen's d effect size was estimated by dividing the treatment assignment effect on WCS score estimated by the pooled standard deviation.

Results

One hundred and fifty-one participants were randomized, with 74 to the guided discussion group condition and 77 to the no discussion group condition. Of those randomized, 111 (73.5%) completed posttest data. Assessment completers and non-completers did not differ on age, race/ethnicity, BMI, or baseline WCS scores; however, non-completers had a higher parental education status than did completers ($F[1, 149] = 4.83$; $p = 0.03$). Completers and non-completers did not significantly differ based on the intervention condition to which they had been randomized. There were no significant differences between conditions by site, baseline demographic variables (age, race/ethnicity, and parent education), BMI, baseline scores on the WCS, or baseline binge or purge rates, presented in Table 1. University site level variance in

Table 1
Baseline demographic and clinical differences by condition.

Variable	Guided intervention (Discussion group) ($n = 74$) %/Mean (SD)	Unguided intervention (No discussion group) ($n = 77$) %/Mean (SD)	P -value
Age (years)	21.0 (2.0)	21.0 (2.1)	0.97
Parent Education >16 years	>16 years	>16 years	0.39
Race/Ethnicity			0.40
White	62.2%	58.4%	
Black/African American	9.5%	9.1%	
Chinese/Chinese American	6.8%	7.8%	
Hispanic/Latina	4.1%	9.1%	
Mixed/Other	17.6%	15.6%	
BMI (kg/m ²)	25.8 (6.3)	24.6 (3.5)	0.14
WCS	55.8 (17.5)	58.1 (18.6)	0.44
BDI-II	8.6 (7.1)	9.2 (8.3)	0.62
W-BI	3.0 (0.6)	3.0 (0.7)	0.80
W-ER	3.0 (0.7)	2.8 (0.9)	0.15
EDE-Q Binge Episodes	2.5 (4.3)	2.0 (4.2)	0.45
EDE-Q Purge Episodes	0.2 (1.1)	0.1 (0.7)	0.76

Note: BMI = Body Mass Index; WCS = Weight Concerns Scale; BDI-II = Beck Depression Inventory II; W-BI = Willingness to Improve Body Image; W-ER = Willingness to Improve Emotion Regulation; EDE-Q = Eating Disorder Examination Questionnaire.

post-test WCS scores was not statistically significant ($\chi^2 = 10.4$; $df = 10$; $p = 0.41$).

Change in weight and shape concerns

Compared to the no discussion group participants, participants in the guided discussion group scored 9.3 points lower on the WCS at post-test, controlling for baseline WCS scores, parent education, and site ($SE = 2.92$; $t = -3.19$; $p = 0.002$; $d = 0.52$). Individuals in the guided discussion group condition had a 67% lower odds of being above the high risk WCS cut-off score of 47 at the post-intervention assessment, controlling for baseline scores, parent education, and site ($SE = 0.47$; $p = 0.02$; $\text{Exp}(B) = 0.33$; 95% $CI = 0.13$ – 0.84).

Post-intervention eating disorder symptoms

At post-intervention, participants in the guided discussion group reported a mean of 0.42 ($SD = 0.74$) binge episodes in the previous week and participants in the no discussion group condition reported a mean of 0.74 ($SD = 1.40$) binge episodes in the previous week; however, these differences were not significant at post-intervention, controlling for baseline binge rates, parent education, and site ($B = -0.37$; $SE = 0.25$; $p = 0.136$).

Potential moderators of outcome

Using split-half analyses, the reduction in WCS associated with moderation was not statistically significant for high BMI ($B = -2.39$; $SE = 5.42$; $t = -0.44$; $p = 0.660$; $d = -0.13$), high BDI-II ($B = 0.37$; $SE = 5.69$; $t = 0.07$; $p = 0.948$; $d = 0.02$), high willingness to work on body image ($B = -0.84$; $SE = 5.76$; $t = -0.15$; $p = 0.89$; $d = -0.05$), or high willingness to work on emotion regulation ($B = -7.99$; $SE = 5.33$; $t = -1.50$; $p = 0.134$; $d = -0.44$).

Adherence

Seventy-five participants (49.7%) logged in to the program. Of those users, the average number of minutes spent using the

program was 374.2 ($SD = 330.9$), equivalent to approximately 6 h and 15 min of total use, and the average number of complete sessions viewed was four out of eight. Among all participants, the average number of minutes spent using the program was 185.9 ($SD = 298.8$).

The correlation between time spent using the program and WCS outcome scores at post-test was not significant ($r = -0.18$; $p = 0.13$). Individuals in both conditions were equally likely to log in to the program ($\chi^2 = 0.37$; $df = 1$; $p = 0.42$). Of those who logged in, the number of session pages viewed was equivalent between the two conditions ($t(73) = -1.35$; $p = 0.18$). However, individuals who logged in to the program in the guided discussion group spent significantly more time using the program than did those in the no discussion group condition ($t(73) = -2.34$; $p = 0.02$). Specifically, individuals in the guided discussion group spent an average of 470.0 ($SD = 372.7$) minutes using the program and individuals in the no discussion group spent an average of 295.0 ($SD = 271.7$) minutes using the program. The mean difference between conditions was 174.7 min, equivalent to approximately 2.9 h of additional use among individuals in the guided discussion group.

Discussion

Consistent with our hypothesis, women using the online program with a guided discussion group had significantly lower weight and shape concerns at the end of the program than did those who received the session content alone, and the controlled effect size was medium in size (estimated Cohen's $d = 0.52$). In addition, individuals in the guided discussion group condition at post-intervention demonstrated significantly lower odds of remaining above the screen criteria indicating heightened risk for the development of an eating disorder. These findings suggest there may be a meaningful benefit to using a guided self-help format for the *Student Bodies* intervention.

The results inform dissemination efforts, suggesting that an online, guided discussion group may enhance intervention outcomes. A guided discussion group might improve program efficacy by building social support for healthy behavior change. Peers and social connectedness have been shown to reduce eating disorder symptoms, reduce risk factors, and increase healthful eating and activity patterns (de la Haye, Robins, Mohr, & Wilson, 2011; McCormack, 2010; Paxton, Schutz, Wertheim, & Muir, 1999; Ransom, La Guardia, Woody, & Boyd, 2010; Wesemann & Grunwald, 2008). As such, peer support from the guided discussion group may have helped to normalize weight and shape concerns, decrease stigma towards participating in an intervention, increase motivation and support for change, and offer novel ideas and modeling for how to apply newly-learned behaviors across real-world contexts. Our results also showed that, among those who logged into the intervention, participants in the guided discussion group spent significantly more time using the program, despite viewing an equivalent number of pages per session as those in the no discussion group condition. It is possible that the additional time spent using the program was attributed to using the guided discussion group; however, it is also possible that individuals spent more time using the program due to greater program investment or interest in session content, lending to the stronger effects. Additional research to replicate the current findings and evaluate the efficacy of other active intervention components via dismantling studies is needed.

Approximately half of randomized participants logged in to the program, and of those using the program, the average participant completed half of the sessions. These program use rates suggest that novel strategies for enhancing user engagement and retention in *Student Bodies* may be beneficial. However, elevated dropout

rates in trials of internet-based interventions are not uncommon. A review of dropout from internet-based treatment programs for psychological disorders reported a weighted average of 31% dropout (range: 2–83%; Melville, Casey, & Kavanagh, 2010), and a review specific to eating disorder treatment programs reported an average of 16% dropout within internet-based treatment programs (Beintner et al., 2014). Program participation has also varied in past trials evaluating internet-based preventive interventions for eating disorders. Users who received the internet-based preventive intervention *eBody Project* had high retention, with 89% of users completing all six modules (Stice et al., 2012), whereas use of modules in the internet-based preventive intervention *Appetite for Life* was reported to be relatively low, with 15% of eligible users never activating their account, 16.67% of active users never using the monitoring program, and 20.51% of users using it only one time (Lindenberg et al., 2011). Participants enrolled in the preventive intervention *Set Your Body Free* had lower session attendance (mean of 6.5 sessions attended) compared to the face-to-face intervention (mean of 7.2 sessions attended; Paxton et al., 2007).

The variability of internet-based program use suggests that novel strategies to enhance engagement and retention are needed. Internet-based platforms afford substantial opportunity for incorporating strategies to strengthen program retention, many of which may not significantly increase cost or delivery burden. For example, program engagement may benefit from increasing the frequency but shortening the length of sessions, sending more frequent reminders (e.g., “push notifications”) to use the program, integrating peer opinion leaders into discussion group forums to increase peer discussion, offering in-person or telephone engagement sessions with program guides, or hosting synchronous real-time online group sessions with users and program guides. Our team is currently evaluating whether incorporating user-specific motivation-enhancement modules increases program retention; using algorithms, these modules can be systematically “released” within a participant's intervention when engagement begins to decline. Such changes can then be evaluated in “real-time,” using new methods for studying evolving behavioral intervention technologies that allow for more rapid evaluation of efficacious or inferior interventions than standard comparative effectiveness trial paradigms (Mohr, Cheung, Schueller, Hendricks Brown, & Duan, 2013).

It is also possible that users may have disengaged from the program if they were unsatisfied with the technological features of the online intervention. It is often challenging for research-funded interventions to release technological enhancements at the same speed as other online programs available in our innovative technological milieu, given the cost of designing and maintaining software updates (Paxton, 2013). As such, users may be more inclined to decrease program engagement or discontinue program use based on factors affecting the user experience in the intervention. Since the time of this study, our team has partnered with a health technology start-up company; this innovative partnership aligns with recommendations to join together multiple stakeholders to effectively disseminate research-initiated interventions to a mass audience (Paxton, 2013). Through this collaboration, we bring together the expertise of behavioral scientists, computer scientists, entrepreneurs, platform designers, and individuals skilled in the technology user experience, in order to help ensure the necessary and ongoing attention is given to dissemination, uptake, and sustainability central to successful program implementation.

Reducing eating disorder symptoms is a critical target for interventions aiming to prevent eating disorders, and preventive interventions have demonstrated significant reductions in eating disorder symptoms (Stice, Becker, & Yokum, 2013). Results here showed there were no differences between conditions in episodes of binge eating at post-intervention. Despite no between-condition

differences, the mean rates of binge eating at post-intervention suggest that, for some individuals, more intensive intervention to reduce binge eating may be beneficial. To address this need, our team is currently evaluating a stepped-care online platform for screening and intervention for individuals at risk for or with a clinical/subclinical eating disorder (i.e., via universal preventive intervention, targeted preventive intervention, guided self-help online intervention, and in-person referral) to address individuals' needs across the risk/symptom spectrum (Jones et al., 2014; Wilfley, Agras, & Taylor, 2013). In this model, individuals who do not improve over the course of their intervention are subsequently offered a more intensive intervention or clinical referral as appropriate.

Research evaluating moderators of preventive intervention trials has demonstrated that elevated eating disorder symptoms, presence of a DSM-5 diagnosis, pressure to be thin, and older adolescent/young adult status (compared to mid-adolescent) are associated with reduced eating disorder symptoms and body dissatisfaction (Muller & Stice, 2013; Stice et al., 2012; Stice, Rohde, et al., 2013). Extant research also indicates that women with a history of depression are at increased risk for the development of an eating disorder (Jacobi et al., 2011), and overweight status has been shown to moderate the efficacy of *Student Bodies* (Taylor et al., 2006). Results here revealed that depressive symptomatology and BMI did not moderate the effects of the intervention, suggesting that individuals of any weight or of varying depressive symptomatology can benefit from the guided discussion group in the context of the intervention, informing intervention delivery efforts. Contrary to our hypothesis, results showed that the effect of the guided discussion group was not moderated by willingness to improve body image or emotion regulation. Though we would have anticipated that having high willingness to improve body image or emotion regulation would have impacted use of the intervention and guided discussion group, our results suggested that willingness to work on these constructs did not increase the benefit of the guided discussion group in reducing weight and shape concerns. Future research may benefit from continued characterization of individuals or population sub-groups who may require more or less specialized resources.

In line with wanting to make the program widely available to all interested students, we did not specify a minimum or maximum limit on the number of students who could be recruited and enrolled from each participating school. As such, study enrollment was not equivalent across sites, although no site effects were found across conditions and outcome analyses controlled for the effects of site. However, given the importance of evaluating program implementation across diverse settings, future efforts to recruit representative proportions of students from diverse campuses may allow for novel analyses of the moderating effects of school-level factors on program effectiveness, such as geographic location, school size, academic selectivity, tuition cost, racial/ethnic diversity, and availability of campus resources to support mental health.

Our study had an overall effect of 0.52, which is moderate in size. The efficacy trial comparing *Student Bodies* to a waitlist control condition had a post-intervention effect size of 0.81 and a 12-month follow-up effect size of 0.42 on the Weight Concerns Scale outcome measure (Taylor et al., 2006). Although the current study did not achieve as high of an effect size at the post-intervention assessment, the current study compared two active interventions; thus, a lower effect size was expected. We cannot evaluate the possibility that the *Student Bodies* program without a moderated discussion group is more effective in managing weight and shape concerns than a waitlist control, because the current study did not include a waitlist control condition. In comparison, two other internet-based preventive intervention trials have published the

effects from efficacy trials of their interventions. The *eBody Project*, an online, unguided intervention adapted from the in-person enhanced-dissonance preventive intervention the *Body Project*, had a mean within-subjects effect of 0.69 and a mean effect size of 0.75 compared to a brochure control condition at post-intervention (Stice et al., 2012). At 1- and 2-year follow-up, the mean effect of the online intervention was 0.44 and 0.25 compared to the brochure control condition, 0.39 and 0.28 compared to a video control condition, and 0.07 and 0.21 compared to an in-person group condition, respectively (Stice, Durant, Rohde, & Shaw, 2014). It is important to note, however, that the sample size for the online intervention condition was small ($n = 19$). The online, guided intervention *Set Your Body Free* was evaluated in a large-scale treatment trial ($N = 116$) compared to face-to-face treatment and a control condition (Paxton et al., 2007). On the variables related to weight and shape concerns and eating disorder behaviors, the effect sizes from pre-intervention to post-intervention for the online intervention ranged from -0.32 to -0.58 for the online intervention. Thus, our intervention had slightly lower effects than the *eBody Project* intervention at post-intervention, and comparable/slightly higher effects than the *Set Your Body Free* intervention.

We calculated that each intervention guide (two per cohort of approximately 19 women) spent a maximum of 1 h each week monitoring a group, resulting in a maximum total time of 16 h over eight weeks for one cohort. The use of bachelor's-level program guides with clinician supervision allowed for more cost-effective delivery. Though the time spent moderating the discussion group in the current trial was longer than the amount of interventionist time implementing the *Body Project* and *eBody Project* (which requires 4 h with a clinician or no intervention guide, respectively, and has produced medium-to-large intervention effects in efficacy and effectiveness trials; Stice et al., 2012), it was shorter than the time spent moderating the *Set Your Body Free* online and face-to-face interventions (which required 90 min of moderation for eight weeks per cohort; Paxton et al., 2007). However, when considering issues related to capacity for widespread dissemination, the benefit of internet-based interventions compared to in-person programs is its high scalability, such that discussion groups can be readily increased in size to accommodate large cohorts of users with minimal to no increase in staff burden. Moreover, internet-based interventions may also be financially appealing for college counseling centers with limited to no staff capacity to implement the program, as the opportunity to expand reach across multiple geographic locations could enable counseling centers to offer the program on their campus using program guides from another institution. If the online program *eBody Project* demonstrates efficacy in large-scale studies as it did in the pilot evaluation, it might provide another cost-effective option for preventive intervention since it did not require program guides to achieve its effects (Stice et al., 2012).

The current study reflects the research priority of conducting translational science, with the goal of making effective interventions available for widespread use by evaluating ways to reduce program costs (Insel, 2009; Muñoz, 2010). Given that the guided discussion group provided added benefit over offering the intervention content alone, future work should aim to disseminate a training manual for discussion group guides. Such a tool may enable ease of program facilitation and the ability to train individuals with less specialized clinical experience (e.g., graduate students, university residential advisors) to monitor the groups. Moreover, intervention guide training could be pre-specified to address various populations such as particular racial/ethnic groups, thereby tailoring preventive resources to specific participant groups or risk/clinical profiles. Given that community-partnership research using an eating disorder preventive intervention has

been successful in increasing engagement and ease of implementation (Becker, Stice, Shaw, & Woda, 2009), this mode of delivery may be similarly beneficial with the *Student Bodies* intervention.

There are study limitations that warrant comment. First, the limited assessment of eating disorder symptoms at post-intervention is a significant study limitation. Although the *Student Bodies* intervention aims to reduce eating disorder risk factors in order to prevent eating disorders, the current analyses only evaluated whether the intervention conditions were associated with reductions in an eating disorder risk factor—weight and shape concerns—and not whether the intervention conditions prevented eating disorder onset. The absence of a follow-up assessment to measure new cases of eating disorders also precludes us from evaluating the efficacy of the discussion group component of the intervention on preventing eating disorders. The absence of a no-treatment control group also represents an important limitation. Notably, though, a meta-analysis of 10 RCTs comparing the *Student Bodies* intervention to control conditions showed consistent effects of the intervention that are maintained at follow-up (Beintner et al., 2012). In this study, the use of a high-intensity comparator (i.e., two active intervention conditions) allowed for careful examination of intervention differences specific to particular program components. The current design also did not allow for examination of whether participation in an unguided discussion group would be equally beneficial to a guided discussion group, as suggested by Low et al. (2006). Until further research is done, we can only recommend a guided discussion group for the *Student Bodies* program.

Conclusion

Overall, this research provides continued evidence for the use of internet-based interventions for reducing eating disorder risk factors and supports the inclusion of the guided discussion group in the delivery of the *Student Bodies* intervention for college students at high risk for developing an eating disorder. Continued efforts to evaluate ways to scale the *Student Bodies* intervention, including opportunities to increase user participation and engagement, will enhance the potential for widespread dissemination.

Conflict of interest

The authors report no conflict of interests.

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