



Sexual orientation correlates with baseline characteristics but shows no moderating effects of dissonance-based eating disorder prevention programs for women

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ABSTRACT

This study provided the first test of whether sexual orientation (categorized as heterosexual vs. sexual minority) is associated with baseline eating disorder risk factors and symptoms, moderated the intervention effects of variants of the dissonance-based *Body Project*, or moderated the relation of baseline risk factors to future change in eating disorder symptoms. A total of 680 women with body image concerns were randomized to clinician- or peer-led *Body Project* groups, the *eBody Project*, or educational video control and completed assessment of eating disorder risk factors and symptoms at pretest, posttest, and at six-, 12-, 24-, and 36-month follow-up. Results indicated that sexual minority women had significantly higher negative affect and impaired psychosocial functioning at baseline, but did not differ on other eating disorder risk factors or symptoms. We found no evidence that sexual orientation moderates the effects of the *Body Project* on risk factor or symptom change over follow-up or the relation of baseline risk factors to future change in eating disorder symptoms. Overall, sexual minority and heterosexual women differ on two, less specific eating disorder-related risk factors at baseline, but did not differ in response to different versions of the *Body Project* or the relations of risk factors to future symptom change.

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1. Introduction

Approximately 13 % of women are affected by eating disorders, which are marked by chronicity, relapse, distress, functional impairment, and increased risk for obesity, depression, suicide, and mortality (Allen, Byrne, Oddy, & Crosby, 2013; Arcelus, Mitchell, Wales, & Nielsen, 2011; Stice, Marti, & Rohde, 2013). Broad implementation of effective prevention programs is important because 80 % of individuals with eating disorders do not receive treatment (Swanson, Crow, Le Grange, Swendsen, & Merikangas, 2011). Between 7–19 % of women aged 8–44 years of age identify as a sexual minority (Copen, Chandra, & Febo-Vazquez, 2016), but studies to date have not tested whether eating disorder prevention programs are differentially effective for sexual majority and minority women (the term “sexual minority” generally includes those who identify as lesbian, gay, bisexual, or transgender; engage in same-sex sexual behavior; or have same-sex attractions; Bostwick et al., 2014). Although one study compared an adapted version of the

dissonance-based *Body Project* to waitlist control for sexual minority men (Brown & Keel, 2015) and found encouraging effects, and another study focusing on process and acceptability (but not efficacy) of an adapted *Body Project* found improved body satisfaction and dietary habits among HIV-positive gay/bisexual men (Feldman, Torino, & Swift, 2011), no study has examined how the *Body Project* or any other eating disorder prevention program might differentially affect sexual minority women. Assessing the needs of sexual minority populations has been identified as a public health priority (Institute of Medicine, 2011) and could reveal the need for tailored prevention programs.

Little research has examined the prevalence of eating disorders among sexual minority women (Calzo, Blashill, Brown, & Argenal, 2017). Some studies estimate that approximately 8%–9% of lesbian women and 11 % of bisexual women report a lifetime eating disorder (Austin et al., 2009; Mason, Lewis, & Heron, 2017), and found that lesbian women are at similar or increased risk for eating disorders and disordered eating compared to heterosexual women, especially during adolescence (Austin et al., 2009; Bankoff, Marks, Swenson, & Pantalone, 2016; Feldman & Meyer, 2010; Frisell, Lichtenstein, Rahman, & Langstrom, 2010; Hadland, Austin, Goodenow, & Calzo, 2014). Other studies report conflicting

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results, some indicating no significant differences in eating disorder diagnoses (Feldman & Meyer, 2007) or symptoms (Moore & Keel, 2003; Share & Mintz, 2002) in lesbian/bisexual women compared to heterosexual women, while another found that lesbian/bisexual women had higher levels of disordered eating compared to heterosexual women (Wichstrom, 2006).

More research has compared eating disorder risk factors and symptoms of sexual minority to heterosexual females. Compared with heterosexual girls, lesbian/bisexual girls had greater body satisfaction and were less concerned with trying to resemble women in the media (Austin et al., 2004), which could be due to a greater acceptance of a range of body types within the lesbian community and might protect against thin-ideal internalization (Alvy, 2013). Links between peer appearance pressures, thin-ideal internalization, and body dissatisfaction were strongest for bisexual women compared to heterosexual and lesbian women (Hazzard et al., 2019). Other research found that shame, concealing sexual orientation, and experiencing discrimination are associated with eating disorder risk among sexual minority women (Bayer, Robert-McComb, Clopton, & Reich, 2017; Watson, Velez, Brownfield, & Flores, 2016). A recent theoretical model proposes that experiences associated with sexual orientation (e.g., heterosexism) and gender (e.g., gender roles) might interact to increase the risk for disordered eating (Mason, Lewis, & Heron, 2018). Further, three studies have found that, similar to studies using general samples (see Haedt-Matt & Keel, 2011), there was a strong relation between negative affect and disordered eating behaviors among lesbian women (Mason & Lewis, 2015, 2016; Mason et al., 2017), and one study (Mason et al., 2017) found that weight discrepancy was associated with disordered eating, consistent with the larger literature establishing body image as one of the main risk factors for disordered eating (e.g., see Stice & Shaw, 2002).

Research examining differences in eating disordered behaviors among sexual minority women compared to heterosexual women has generally found the former to be at greater risk. Compared to heterosexual women, women who defined themselves as “mostly heterosexual,” bisexual, or lesbian were more likely to report binge eating, and those defining themselves as “mostly heterosexual” and bisexual were more likely to report purging (Austin et al., 2009). Other studies have found that sexual minority women were more likely to binge eat (Laska et al., 2015); diet (Matthews-Ewald, Zullig, & Ward, 2014); fast or use diet pills (Austin, Nelson, Birkett, Calzo, & Everett, 2013; Watson, Adjei, Saewyc, Homma, & Goodenow, 2017), use laxatives or other purging behavior (Austin et al., 2013; Calzo et al., 2015) than heterosexual females. Finally, Polimeni, Austin, and Kavanagh (2009) found that lesbians were less likely to have body dissatisfaction and cut down on fats and sugars than heterosexual women. This study also found that mainly heterosexual and bisexual women, compared with exclusively heterosexual women, were more likely engage in harmful weight control behaviors (e.g., smoke, cut out meals, vomit after eating, use laxatives). However, recent research has found similarities between heterosexual, bisexual, and lesbian women in disordered eating behaviors (Hazzard et al., 2019).

This paper addresses the significant gap in knowledge regarding whether sexual minority women respond differently to a widely implemented eating disorder prevention program compared to heterosexual women, as no study has examined this important question. If intervention effects for sexual minority women are different than for heterosexual women, the prevention program might need to be tailored; if they do not vary, adaptations may not be needed. Specifically, this study examined the impact of sexual orientation on the effects of completing three variants of the *Body Project*, an empirically supported selective eating disorder prevention program for women.

The second aim of this study was to extend knowledge of whether sexual minority women significantly differ from heterosexual females on eating disorder symptoms and risk factors. Relatively few studies have addressed this question and published findings have been mixed.

The third aim was to test whether baseline risk factors show differential relations to future change in eating disorder symptoms for heterosexual versus sexual minority women (i.e., whether sexual minority status moderated the impact of risk factors on symptom change). To our knowledge, no study has specifically addressed this important question. Given the lack of research on prevention intervention effects and the inconsistent findings related to potential differences in eating disorders risk factors and symptomology, we did not have specific hypotheses for the three aims.

2. Method

2.1. Participants and procedure

Data were obtained from the largest randomized controlled trial of the *Body Project*, which evaluated the relative effectiveness of clinician-led *Body Project* groups, undergraduate peer educator-led *Body Project* groups, and an Internet-delivered version (*eBody Project*) compared to an educational video control condition with young college women with body image concerns through three-year follow-up. The sample included only female college students because eating disorders are much more common among women than men (Hudson, Hiripi, Pope, & Kessler, 2007), there are over 10 million female college students in the U.S. (U.S. Department of Education, 2008), and colleges typically have an existing infrastructure for delivering prevention programs. A previous report with the entire sample (Stice, Rohde, Shaw, & Gau, 2017) found that participants in clinician-led and peer-led *Body Project* groups, relative to video controls, showed similar reductions in outcome measures at both post-intervention ($d = 0.54$ and 0.52 , respectively) and six-month follow-up ($d = 0.33$ and 0.35 , respectively); effects for the Internet-delivered intervention relative to video control were approximately 50 % smaller ($d = 0.33$ at post and 0.16 at six-month follow-up).

The sample included 680 participants (M age = 22.2, $SD = 7.1$; M BMI [kg/m^2] = 25.5, $SD = 5.6$) from three universities in Oregon and Texas. The sample was 60 % Caucasian, 17 % Latina, 14 % Asian, 5 % African American, 3 % American Indian/Alaska Native, and 1 % Native Hawaiian/Pacific Islander. Participants were recruited between March 2013 – April 2015 using mass emails and flyers. Interested women were directed to a webpage to confirm that they had body image concerns (inclusion criterion) and to complete the Eating Disorder Diagnostic Scale (EDDS) (Stice, Fisher, & Martinez, 2004); those with probable DSM-IV-TR (American Psychiatric Association, 2000) anorexia nervosa, bulimia nervosa, and binge eating disorder were excluded. Eligible participants were randomly assigned to one of the three *Body Project* variants [clinician-led groups, ($n = 173$); peer-led groups ($n = 162$), the *eBody Project* ($n = 184$)], or an educational video condition ($n = 161$). Participants completed assessments at pretest, posttest, and six-, 12-, 24-, and 36-month follow-up conducted by female assessors masked to condition.

The *Body Project* is a scripted intervention that consisted of four weekly one-hour group sessions with five-nine participants delivered by pairs of either clinicians or undergraduate peer educators. Participants voluntarily engaged in exercises critiquing the beauty ideal during sessions and in-home exercises (see Stice, Butryn, Rohde, Shaw, & Marti, 2013 for session content). The *eBody Project* is an Internet-based version of this intervention that includes six 40-minute modules involving user driven self-education activities

and games that parallel the group intervention (see [Stice, Rohde, Durant, & Shaw, 2012](#)). Participants in the education video condition were asked to view *Dying to Be Thin* ([WGBH Educational Foundation, 2000](#)), a 55-minute documentary on eating disorders and body acceptance. Additional details regarding the study are provided in [Stice, Rohde et al. \(2017\)](#); [Stice, Gau, Rohde, and Shaw \(2017\)](#).

2.2. Measures

2.2.1. Sexual orientation and gender identity

Two questions assessed sexual orientation and gender identity: (1) "How do you describe yourself (circle one): *Male, Female, Transgender, Do not identify as female, male, or transgender*; (2) Do you think of yourself as: (please check all that apply): *Straight/heterosexual; gay or lesbian; bisexual; queer; questioning; or another identity not specified (please specify)*." Questions were adapted from the measure developed by the Network for LGBT Health Equity ([Conron, Lombardi, & Reisner, 2014](#)).

2.2.2. Thin-ideal internalization

Participants assessed agreement with eight statements representing facets of the beauty ideal ("Slim women are more attractive") rated on a 5-point Scale. The measure showed an average $\alpha = .75$ across assessments in the present trial. An earlier version of the measure, which shared most items, had shown two-week test-retest reliability ($r = .80$), predictive validity for future onset of eating disorders, and sensitivity to detecting intervention effects ([Stice, Gau et al., 2017](#)).

2.2.3. Body dissatisfaction

Items from the Satisfaction and Dissatisfaction with Body Parts Scale ([Berscheid, Walster, & Bohrnstedt, 1973](#)) assessed satisfaction with nine body parts rated on a six-point scale. It has shown internal consistency ($\alpha = .94$), three-week test-retest reliability ($r = .90$), predictive validity for future onset of eating disorder, and sensitivity to intervention effects ([Stice, Gau et al., 2017](#)); $\alpha = .86$ at baseline.

2.2.4. Dieting

The 10-item Dutch Restrained Eating Scale (DRES) ([Van Strien, Frijters, Van Staveren, Defares, & Deurenberg, 1986](#)) assessed the frequency of dieting behaviors rated on a 5-point scale, and has shown internal consistency ($\alpha = .95$), two-week test-retest reliability ($r = .82$), convergent validity with self-reported caloric intake, predictive validity for future onset of eating disorder, and sensitivity to intervention effects ([Stice, Gau et al., 2017](#); [Van Strien et al., 1986](#)); $\alpha = .91$ at baseline.

2.2.5. Negative affect

Negative affect was assessed with the sadness, guilt, and fear/anxiety subscales from the Positive Affect and Negative Affect Scale-Revised (PANAS-X) ([Watson & Clark, 1992](#)). Participants reported the extent to which they had felt 20 negative emotional states, rated on a 5-point scale. This scale has shown internal consistency ($\alpha = .95$), three-week test-retest reliability ($r = .78$), convergent validity, and predictive validity for future onset of eating disorders ([Stice, Gau et al., 2017](#); [Stice, Shaw, Burton, & Wade, 2006](#); [Watson & Clark, 1992](#)), $\alpha = .94$ at baseline.

2.2.6. Eating disorder symptoms

The semi-structured Eating Disorder Diagnostic Interview (EDDI) ([Stice, Rohde, Gau, & Shaw, 2009](#)) assessed DSM-IV eating disorder symptoms. Items assessing symptoms in the past month at each assessment were summed to form a composite, which has shown internal consistency ($\alpha = .92$), one-week test-retest reliability (ICC $r = .95$), sensitivity to prevention and treatment

interventions, and predictive validity for future onset of depression ([Stice et al., 2009](#)). The symptoms composite showed internal consistency (average $\alpha = .70$), inter-rater agreement (ICC = .96), and one-week test-retest reliability (ICC = .96) in the present trial. All statistical models applied a natural-log transformation to the eating disorder symptoms, after adding a continuity-correction (.01) for participants with no eating disorder symptoms.

2.2.7. Psychosocial functioning

Impaired psychosocial functioning in the family, peer, school, and work spheres, which has been found to be a risk factor for all eating disorders ([Stice, Gau et al., 2017](#)) was assessed with 17 items adapted from the Social Adjustment Scale (SAS) ([Weissman & Bothwell, 1976](#)) rated on a 5-point scale. The adapted items have shown internal consistency ($\alpha = .77$), one-week test-retest reliability ($r = .83$), and sensitivity to intervention effects in prevention trials (e.g., [Stice et al., 2006](#)); average $\alpha = .74$ at baseline.

2.3. Statistical methods

All statistical models controlled for study site as random assignment occurred within site. Prior to modeling, we examined whether we needed to control for baseline BMI; because sexual orientation was not related to BMI at baseline, $t(1) = 1.58, p = .114$, or any follow-up, we did not control for it in our models.

To address whether group attendance varied by sexual orientation, we calculated the number of sessions that each group participant attended, and used logistic regression to assess whether orientation predicted attendance.

Receiving non-study mental health services was assessed to control for other factors that might reduce eating disorder symptoms. We first calculated whether a participant sought mental health treatment at a given time and examined whether initial non-study treatment seeking differed by sexual orientation using logistic regression. Next, a latent growth model (LGM) examined differences at posttest (intercept factor) and linear changes in treatment utilization across follow-ups controlling for initial non-study treatment status (slope factor) ([Grimm & Ram, 2018](#)). We allowed error terms of adjacent measurements to co-vary.

To assess whether sexual orientation was related to baseline risk factors or eating disorder symptoms, each variable was regressed onto sexual orientation separately using either multiple linear regression (for continuous variables) or logistic regression (for dichotomous variables).

To assess whether sexual orientation moderated the acute effects of interventions on change in risk factors or symptoms, we fit a LGM with both an intercept and a linear slope factor and allowed error terms of adjacent measurements to co-vary. The intercept corresponds to differences at posttest (i.e., end of intervention) and the linear slope factor corresponds to change in risk factors/symptoms from posttest to 36-month follow-up. We regressed each factor onto sexual orientation, condition, the interaction of orientation and condition, study site, and the risk factor/symptoms on the pre-assessment (i.e., beginning of intervention). A significant interaction of sexual orientation and condition for the intercept factor would indicate a differential number of posttest risk factors or symptoms for condition as a function of sexual orientation, while a significant interaction of orientation and condition on the linear slope factor would indicate differential trajectories over three-year follow-up for the risk factor or symptom composite for condition as a function of orientation.

To assess whether sexual orientation moderated the effects of baseline risk factors on future change in symptoms, we fit a LGM with both an intercept and a linear slope factor and correlated adjacent residuals. Each factor was regressed onto the baseline risk factor, orientation, and the interaction of the risk factor and ori-

Table 1
Study participants' sexual orientation and gender identity by study condition and site.

	Condition							
	Video control		Clinician-delivered		Peer-delivered		Internet-based	
	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
Sexual Orientation								
Straight/Heterosexual	99	81.8	100	77.5	93	72.7	115	80.4
Gay/Lesbian	2	1.7	2	1.6	3	2.3	0	0.0
Bisexual	10	8.3	17	13.2	21	16.4	15	10.5
Queer	4	3.3	3	2.3	4	3.1	5	3.5
Question	1	0.8	2	1.6	0	0.0	1	0.7
Multiple categories	5	4.1	5	3.9	7	5.5	7	4.9
Data not available	40		44		34		41	
Gender Identity	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
Female	120	99.2	133	100.0	126	97.7	144	98.0
Male	0	0.0	0	0.0	1	0.8	0	0.0
Transgender	0	0.0	0	0.0	0	0.0	3	2.0
Do not identify as female, male, or transgender	1	0.8	0	0.0	2	1.5	0	0.0
Data not available	40		40		33		37	
	Site Study							
	Texas		Oregon School 1		Oregon School 2			
	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
Sexual Orientation								
Straight/Heterosexual	210	78.4	93	72.1	103	83.7		
Gay/Lesbian	3	1.1	1	0.8	3	2.4		
Bisexual	32	11.9	22	17.1	9	7.3		
Queer	7	2.6	6	4.7	3	2.4		
Question	2	0.7	1	0.8	1	0.8		
Multiple categories	14	5.2	6	4.7	4	3.3		
Data not available	66		42		51			
Gender Identity	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
Female	270	98.9	127	97.7	125	99.2		
Male	1	0.4	0	0.0	0	0.0		
Transgender	1	0.5	2	1.5	0	0.0		
Do not identify as female, male, or transgender	1	0.4	1	0.8	1	0.8		
Data not available	61		41		48			

entation, while controlling for baseline symptoms. We used z-tests to test the significance of moderation.

Given that data were missing from follow-up assessments, we used full information maximum likelihood (FIML) because it gives unbiased parameter estimates when data are missing at random (Schafer & Graham, 2002) and is asymptotically equivalent to multiple imputation. Auxiliary variables were included in the models if they correlated at least .50 with the outcome (Graham, 2009); this applied only to negative affect and psychosocial functioning. All analyses were performed in R (Version 3.5.1; R Core Team, 2018) except the LGCMs which were run in Mplus (Version 8.1; Muthén & Muthén, 2017).

We controlled for an inflated type I error rate by applying the Benjamini-Hochberg (BH) correction (Benjamini & Hochberg, 1995). The BH correction controls the false discovery rate, and relative to the Bonferroni's correction is more powerful, while still adequately protecting against Type I errors (Williams et al., 1999) and is the adopted correction of the Institute of Education Science's What Works (WWC, 2017). We applied the BH method in two ways. First, we corrected for the 20 comparisons associated with testing whether sexual orientation was related to baseline factors and second, we corrected for the 22 comparisons related to testing sexual orientation as a moderator.

Sensitivity analyses were performed comparing bisexual participants (*n* = 80) to heterosexual participants and bisexual participants to other sexual minority participants (*n* = 34). For the former comparison, we reran all analyses, while for the latter comparison all analyses except the LGCMs were rerun (because of the small sample size). After adjusting for multiple comparisons, the analyses comparing bisexual participants to heterosexual participants were qualitatively identical to the main findings. Additionally, bisexual participants did not differ from other sexual minority participants on any of the outcomes. Both analyses sup-

ported the decision to combine bisexual with other sexual minority participants. As a final sensitivity analysis, heterosexual participants who also identified as sexual minority (*n* = 9) were included in the heterosexual group and this did not affect the findings. Therefore, the findings were robust to which group these participants were placed in.

3. Results

3.1. Descriptive statistics

Seventy-seven percent of participants provided sexual orientation data. Of these, 417 (78 %) identified as heterosexual, while 114 (22 %) identified as either sexual minority or heterosexual and another category (henceforth referred to as the sexual minority group). Of the 24 participants who identified as more than one category, 11 identified as bisexual and queer, six as heterosexual and questioning; two as bisexual and questioning; two as heterosexual, bisexual, and questioning; one as gay and queer; one as heterosexual and bisexual; and one as gay, bisexual, and queer; all were included in the sexual minority group. Regarding gender identity, 99 % of the sample identified as female (one identified as male, three as transgender, and three as neither female, male, or transgender), which precluded any analyses based on this variable. Table 1 provides a breakdown of sexual orientation by condition and site. Chi-square tests found no association between sexual orientation and condition, $\chi^2(3) = 3.67, p = .299$, or site, $\chi^2(2) = 5.02, p = .082$.

Missing sexual orientation data were not significantly associated with condition, $\chi^2(3) = 1.25, p = .742$, or site, $\chi^2(2) = 5.91, p = .052$. At pretest, missing data on sexual orientation were not associated with any risk factors but were associated with total symptoms, $\chi^2(1) = 4.11, p = .042$, and several specific symptoms (8 out of 14). In

Table 2
Comparison of participants of identifying as heterosexual and participants identifying as sexual minority on baseline risk factors and eating symptom types.

Outcome	Heterosexual		Sexual Minority		Test statistics			Effect size
	Mean	SD	Mean	SD	<i>t</i>	<i>p</i>	adj. <i>p</i>	<i>d</i>
Risk factor (continuous)								
Thin ideal internalization	3.85	0.43	3.86	0.40	0.33	.738	.796	0.02
Body dissatisfaction	3.62	0.64	3.72	0.61	1.63	.104	.189	0.15
Dieting	3.13	0.83	3.16	0.76	0.57	.566	.666	0.05
Negative affect	2.25	0.77	2.56	0.83	3.91	< .001	.002	0.40
Psychosocial functioning	2.25	0.49	2.42	0.53	3.33	.001	.009	0.34
Eating symptoms (continuous)	Mean	SD	Mean	SD	<i>t</i>	<i>p</i>	adj. <i>p</i>	<i>d</i>
Composite	2.56	0.75	2.65	0.67	1.37	.171	.285	0.12
Weight or shape influenced how feel about self	3.95	1.17	3.97	1.08	0.31	.756	.796	0.02
Fear of gaining weight	2.29	2.46	2.18	2.35	-0.23	.815	.815	-0.05
Felt fat	3.4	2.17	3.79	1.94	1.84	.067	.149	0.19
Eating symptoms (dichotomized)	<i>N</i>	%	<i>N</i>	%	<i>z</i>	<i>p</i>	adj. <i>p</i>	OR
Binge episodes	90	22.17	29	25.44	0.91	.362	.518	1.25
Eat rapidly	101	24.94	34	29.82	1.19	.233	.359	1.33
Eat until uncomfortably full	115	28.40	45	39.47	2.43	.015	.086	1.72
Eat large amounts food when not hungry	119	29.38	43	37.72	1.90	.058	.146	1.53
Eat alone b/c embarrassed how much you were eating	73	18.02	30	26.32	1.89	.059	.146	1.61
Feel depressed or guilty after overeating	124	30.62	46	40.35	2.11	.035	.117	1.60
Feel upset that you could not control eating	117	28.89	44	38.60	2.15	.031	.117	1.62
Times made yourself sick to control shape or weight	19	4.68	12	10.53	2.38	.017	.086	2.53
Times take laxatives/diuretics to control weight	12	2.96	2	1.75	-0.65	.514	.666	0.60
Times fasted to control shape or weight	119	29.31	29	25.44	-0.62	.538	.666	0.86
Times exercised to compensate for overconsumption	143	35.31	31	27.19	-1.67	.098	.189	0.67

Note. adj. *p* refers to a Benjamini-Hochberg adjusted *p*-value based on 20 comparisons and *d* and OR refer to Cohen's *d* and odds ratio, respectively.

all cases, as the number of symptoms increased, the odds of missing data on sexual orientation increased (OR ranged from 1.01 to 1.92). Statistical analyses focused on comparisons between heterosexual and sexual minority participants, as we did not have enough cases to explore more refined categories.

3.2. Preliminary analyses

3.2.1. Group attendance by sexual orientation

There were no differences in the odds of attending group sessions by sexual orientation after controlling for study site. Seventy-five percent of heterosexual participants and 78 % of sexual minority participants attended all four sessions, while 12 % of heterosexual participants and 9 % of sexual minority participants attended no sessions. The average number of sessions attended by heterosexual and sexual minority participants were $M=3.31$ ($SD=1.37$) and $M=3.44$ ($SD=1.23$), respectively, a non-significant difference, $OR=1.20$, $\chi^2(1)=0.80$, $p=.372$.

3.2.2. Rates of non-study mental health treatment by sexual orientation

The percent of sexual minority participants who received out-of-study mental health treatment at baseline (35 %) was greater than the heterosexual participants (18 %); $OR=2.61$, $\chi^2(1)=15.52$, $p<.001$.

Differences in rates of non-study treatment utilization at posttest by sexual orientation were smaller and not significantly different ($OR=1.55$, $z=1.91$, $p=.056$) but sexual orientation was a significant predictor of the non-study treatment slope factor ($OR=1.03$, $z=2.51$, $p=.012$). The effect was such that sexual minority women sought a greater number of treatments as the follow-up time increased relative to heterosexual women, who remained relatively constant in rate of treatment seeking.

3.3. Relation between sexual orientation and baseline risk factors and symptoms

Table 2 summarizes the results examining whether sexual orientation was associated with differences in baseline risk factors. Sexual minority women had higher negative affect, $t(1)=3.91$, $p<.001$, adj. $p=.002$, $d=0.40$, and psychosocial impairment, $t(1)=3.33$,

$p=.001$, adj. $p=.009$, $d=0.34$, which were small to medium effects per Cohen (1992). There were no baseline differences in thin-ideal internalization, body dissatisfaction, or dieting associated with sexual orientation.

Table 2 also summarizes the results examining whether sexual orientation was associated with baseline differences in total eating disorder symptoms or individual eating disorder symptoms. Differences on these variables were nonsignificant, but a few differences in specific behaviors were noted in the unadjusted analyses. Namely, sexual minority women were more likely than heterosexual women to say they ate until uncomfortably full ($z=2.43$, $p=.015$, adj. $p=.086$, $OR=1.72$), felt depressed or guilty after overeating ($z=2.11$, $p=.035$, adj. $p=.117$, $OR=1.60$), felt upset that they could not control eating ($z=2.16$, $p=.031$, adj. $p=.117$, $OR=1.62$), and vomited to control their shape or weight ($z=2.38$, $p=.018$, adj. $p=.086$, $OR=2.53$).

3.4. Sexual orientation as a moderator of the relation between condition and change in eating disorder risk factors and symptoms

Table 3 shows the fit of the LGMs for the eating disorder risk factors and symptoms. Because of differences in non-study treatment seeking, we controlled for this variable at baseline, which is reflected in Table 3. Three of the risk factors (thin-ideal internalization, body dissatisfaction, and negative affect) had good fit based on the chi-square test of model fit ($p>.10$ for all outcomes), RMSEA ($<.025$ for all outcomes), CFI ($>.990$ for all outcomes), and SRMR ($<.04$). Dieting and eating disorder symptoms had good fit based on the fit statistics but not the chi-square test of model fit ($p<.02$ for both outcomes) and psychosocial functioning had acceptable fit based on the fit statistics but again not the chi-square test of model fit. For all models, correlations residuals and standardized mean residuals were examined to assess local misfit. For all outcomes, the maximum correlation residual (in absolute value) was .087, suggesting that the model-implied correlation matrices adequately captured the sample-covariance matrices. For the standardized mean residuals, the thin-ideal internalization, dieting, and eating disorder symptoms models each had one large residual ($z=-2.038$ at the third follow-up, $z=-2.913$ at the second follow-up and $z=2.373$ at posttest follow-up, respectively), while psychosocial functioning models had two large residuals ($z=10.576$ and -6.808

Table 3
Fit of latent growth curve models for the risk factors and eating disorder symptoms.

Risk factor	Chi-Square Test of Model Fit			Fit Statistics		
	χ^2	df	p	RMSEA (90% CI)	CFI	SRMR
Thin-ideal internalization	42.43	36	.325	.013 (.000–.034)	.997	.035
Body dissatisfaction	42.52	36	.322	.013 (.000–.034)	.997	.034
Dieting	60.24	36	.016	.032 (.014–.048)	.986	.029
Negative affect	34.05	36	.695	.000 (.000–.002)	1.00	.021
Psychosocial functioning	139.33	36	<.001	.070 (.058–.083)	.931	.062
Eating disorder symptoms	71.86	36	.001	.040 (.025–.055)	.961	.033

Table 4
Tests of sexual orientation as a moderator of posttest condition differences (intercept factor) and of changes in condition trajectories across the 36-month follow-up for eating disorder risk factors and symptom composite (slope factor).

Risk factor	Intercept factor				Slope factor			
	χ^2	p	adj. p	ΔR^2	χ^2	p	adj. p	ΔR^2
Thin-ideal internalization	2.50	.475	.651	.005	0.69	.876	.918	.006
Body dissatisfaction	0.35	.951	.951	<.001	1.38	.711	.823	.003
Dieting	3.75	.290	.624	.005	3.57	.312	.624	.008
Negative affect	4.53	.209	.511	.010	3.13	.372	.636	.011
Psychosocial functioning	2.69	.123	.451	.001	5.25	.155	.451	.026
Eating disorder symptoms	1.46	.692	.823	.004	1.06	.786	.865	.058

Note. χ^2 corresponds to the chi-square test of difference, degrees of freedom were 3 for all tests and adj. p refers to a Benjamini-Hochberg adjusted p-value based on 22 comparisons in Tables 4 and 5. Finally, ΔR^2 corresponds to the change in R^2 associated with adding the interaction to the intercept and slope factors, respectively.

Table 5
Tests of sexual orientation as a moderator of baseline risk factor (intercept factor) and changes in the trajectory of the eating disorder symptom composite across 36-month follow-up (slope factor).

Risk factor	Intercept factor					Slope factor				
	Est.	z	p	adj. p	ΔR^2	Est.	z	p	adj. p	ΔR^2
Thin-ideal internalization	−0.41	−1.76	.078	.451	.011	0.01	0.67	.503	.651	.002
Body dissatisfaction	0.13	0.90	.503	.651	.002	−0.01	−1.39	.164	.451	.004
Dieting	0.11	0.88	.378	.636	.001	0.01	1.85	.064	.451	.013
Negative affect	−0.10	−0.83	.405	.636	.005	0.01	1.49	.136	.451	.046
Psychosocial functioning	−0.32	−1.75	.080	.451	.015	0.01	1.51	.132	.451	.025

Note. Est. corresponds to the unstandardized parameter and adj. p refers to a Benjamini-Hochberg adjusted p-value based on 22 comparisons in Tables 4 and 5. Finally, ΔR^2 corresponds to the change in R^2 associated with adding the interaction to the intercept and slope factors, respectively.

at posttest and 6-month follow-up, respectively), implying that the model-implied means did not adequately capture these observed means and that the linear model, for these outcomes, did not capture all mean change over time. These large standardized mean residuals were likely responsible for the poorer fit of these models relative to the other models considered. On the whole, all the eating disorder risk factors and symptom models appeared to adequately capture the sample covariance matrices and the majority of mean changes for all outcomes and were retained.

Table 4 summarizes the results examining whether sexual orientation moderated the effectiveness of condition, in terms of changes in risk factors or eating disorder symptoms; condition by sexual orientation interactions were non-significant in both unadjusted and adjusted analyses, indicating a lack of support for sexual orientation as a moderator of these outcomes at posttest. Similarly, all condition by sexual orientation by time interactions were non-significant, indicating a lack of support for sexual orientation as a moderator of the impact of conditions on changes in both risk factors and symptoms over 36-month follow-up. The average change in R^2 for these models was .011 indicating that the interactions, on average, explained about 1.1 % additional variation in either initial values or change during the 36-month follow-up. This value is quite small and unlikely to be clinically meaningful. The average effect sizes across outcomes for clinician-led groups at posttest were −0.445 for sexual minority women and −0.522 for heterosexual women; for peer-led groups the average effect size across outcomes at posttest was −0.612 for sexual minority women and −0.387 for heterosexual women; and for Internet-led groups the effect size across outcomes was −0.385 for sexual minority women

and −0.292 for heterosexual women, with negative values all indicating that the intervention groups were producing superior effects to the control group and all represented medium effect sizes.

3.5. Sexual orientation as a moderator of the relation between baseline risk factors and change in eating disorder symptoms

The third aim was to test whether sexual orientation moderated the relation between baseline risk factors and change in eating disorder symptoms over 3-year follow-up. These analyses controlled for non-study treatment. Results of both the unadjusted and adjusted analyses revealed that sexual orientation did not significantly moderate any of the relations between any of the baseline risk factors and future change in eating disorder symptoms (Table 5). The average change in R^2 for these models was .012 or approximately 1.2 % additional variation, on average, was explained by the interactions.

4. Discussion

This study examined whether sexual orientation was associated with baseline eating disorder risk factors or symptoms, whether sexual orientation moderated prevention intervention effects on changes in both risk factors and symptoms, and whether the relation of baseline risk factors and future increases in eating disorder symptoms varied by sexual orientation. First, results indicated that sexual minority women had significantly higher levels of negative affect and psychosocial impairment at baseline than heterosexual women, but that they did not differ on thin-ideal internalization,

body dissatisfaction, or dieting. It was noteworthy that both risk factors that were higher for sexual minority versus heterosexual women are general indices of impairment and might be associated with other psychiatric disorders, such as depression and anxiety, whereas the two groups did not differ on the three risk factors that are more specifically related to eating disorder etiology. Regarding the question of whether sexual orientation was associated with different baseline eating disorder symptoms, the difference in the composite scores was non-significant but rates of a few specific eating disorder behaviors appeared higher among the sexual minority women; namely eating until uncomfortably full, making themselves sick in order to control shape or weight, feeling upset or depressed or guilty because they could not control their eating. However, sexual orientation was not significantly associated with eating disorder symptoms in the adjusted analyses, suggesting that these differences may have occurred by chance or that we were underpowered to detect them given low base rates or small magnitude differences.

Two theoretical models have been used to interpret the relation of sexual orientation to eating pathology: the sociocultural model suggests that gender and sexual minority-based community norms regarding beauty ideals drive any differences in eating disorders (Feldman & Meyer, 2007; McClain & Peebles, 2016) and potentially reduce risk, whereas the minority stress model posits that responses to victimization, discrimination and stigma related to sexual orientation might increase eating disorder risk (Katz-Wise et al., 2015; Meyer, 2003). Similar to prior research, our findings provide mixed support for these models. That sexual minority women in this study had higher negative affect and psychosocial impairment provides some support for the minority stress model; however, the lack of significant differences observed in the other eating disorder risk factors and the symptom composite measure does not support this model. Further, contrary to what the sociocultural model would predict, we did not find evidence that sexual minority women had lower thin-ideal internalization or body dissatisfaction, suggesting that protective factors resulting from sexual minority status were not present. In contrast, one study found that younger lesbian/bisexual girls (ages 9–14) had greater body satisfaction and were less concerned with trying to resemble women in the media (Austin et al., 2004). However, our conclusions regarding support for these models should be considered within the limitation that factors related to minority stress experiences, such as openness regarding sexual orientation, or sociocultural experiences specific to sexual minority individuals, such as perceived norms within certain subgroups of sexual minority individuals, were not assessed in this study, and it could be that these experiences affect future disordered eating in women. A recently proposed model of disordered eating and body image among sexual minority women integrates the sociocultural and minority stress models and posits that gender- and sexual orientation-related experiences are both interactively and directly related to internalization of sociocultural norms, social resources, and maladaptive emotion regulation, which then are related to negative affect and body image concerns, which then relate to disordered eating (Mason et al., 2018). Incorporating measures of these experiences unique to sexual minority women in future research would help ascertain which theoretical model is most appropriate for this group, as would including individuals identifying across the full spectrum of genders.

There was no evidence that sexual orientation moderated intervention effects, suggesting that the intervention may work equally well for heterosexual and sexual minority women. The medium intervention effect sizes across outcomes for both sexual minority and heterosexual participants indicate that the *Body Project* in all of its three delivery modalities is working well for many women in the study. It was also interesting that although the difference

was not statistically significant, the peer-led *Body Project* groups appeared to work slightly better for sexual minority participants. Though we did not directly test for non-inferiority, the consistent lack of moderation effects across all variables (including attendance) is reassuring and increases confidence in the findings. Thus, the results suggest that adaptations for this population may not be necessary. A qualitative study of participant feedback to the three delivery modalities of the *Body Project* (Shaw, Rohde, & Stice, 2016) corroborates these findings. Although eating disorder prevention interventions specifically designed for gay men have been developed and appear to be effective, producing larger effects ($d=0.55$) than a version for straight males ($d=0.31$) (Brown & Keel, 2015; Brown, Forney, Pinner, & Keel, 2017), separate interventions for sexual minority women are not suggested by the current data. Nonetheless, it is possible that a version of the *Body Project* that was tailored to sexual minority females might have higher acceptability and be more effective than the standard *Body Project*. The slightly higher effect size for sexual minority women in peer-led groups might also suggest that future research test whether peer-led groups composed exclusively of sexual minority individuals might produce better results for this subgroup. Indeed, the recent call for evidence-based affirmative practice for sexual and gender minority mental health treatments (Pachankis, 2018), including recognizing how minority-related stigma impacts mental health and the cultivation of community pride, could also be applied to prevention.

Finally, we found no evidence that sexual orientation moderated the relation of baseline risk factors to future change in eating disorder symptoms, which had not been previously examined and provides support for the notion that baseline risk factors predict change in eating disorder symptoms similarly for heterosexual and sexual minority women. The evidence that risk factors for future increases in eating disorder symptoms are similar for heterosexual and sexual minority women appears consistent with the evidence that eating disorder prevention programs that seek to reduce psychosocial pressures for thinness and related constructs are similarly effective for these groups.

Important study limitations should be noted. First, the sample size was not adequate to examine lesbian or bisexual individuals separately, which would have provided more detailed information about these groups than was provided by combining them. Second, we were not able to examine gender identity as a moderator as the vast majority identified as female, and no one identified as transgender in our sample. Further, although 32 participants identified as bisexual, this did not provide adequate power to examine potential differences between study conditions. One prior study found that transgender individuals of all sexual orientations have elevated prevalence of self-reported eating disorders in the past year compared to cisgender heterosexual women (15.8 %) (Diemer, Grant, Munn-Chemoff, Patterson, & Duncan, 2015), suggesting that this is an important focus of future research. Third, we were missing 23 % of the sexual orientation data, presumably because this is sensitive personal information, limiting the generalization of our findings. It should also be noted that all participants were recruited from college campuses, which are presumed to have more inclusive and accepting attitudes regarding sexual orientation than society in general. Fourth, sexual orientation was also assessed at 36-month follow-up rather than baseline, which could have affected the missing data. However, it is important to note that the percentage of missing data for sexual orientation is only 8–9 % higher than for the other outcomes measured at 36 months (missing data during the post-assessment and follow-ups [six-, 12-, 24-, and 36-months] ranged from 1.9 % to 8.1 % with an average amount of data missing per variable at any given assessment of 4.6 %; the average amount of missingness at the post-assessment was 4.6 % and at the six-,

12-, 24-, and 36-month follow-up were 4.8 %, 4.6 %, 6.9 %, and 2.2 %).

Fifth, participants were recruited for study participation on the basis of body image concerns and sexual minority women who engage in disordered eating behaviors due to other factors, such as minority stress, might have been unlikely to enroll in project; thus, study results are not assumed to reflect the entire population of sexual minority (or heterosexual) women. It is important to note, however, that although we did not specifically over-recruit sexual minority groups, we felt a responsibility to conduct large studies and conduct boundary condition analyses to ensure that the intervention works well for different subgroups of participants in our samples. Lastly, although there was no evidence of moderation, it is always possible that the study was under-powered and that we committed a Type II error. However, the observed effect sizes were generally quite small (ΔR^2) and given our large sample size, we were unlikely to miss a clinically meaningful effect. Nonetheless, clinicians delivering the *Body Project* should not simply ignore sexual orientation without future studies replicating our findings and focused directly on this population.

This is the first study to examine whether sexual orientation moderated intervention effects for an eating disorder prevention program targeting women with body image disturbances. We were reassured that our findings suggest that the three delivery modalities of the *Body Project* appear to work equally well for sexual minority as heterosexual women, although there were baseline differences in the broad risk factors of negative affect and impaired psychosocial functioning, which generally dovetails with the lack of differences in baseline risk factors and symptoms and change in risk factors and symptoms across sexual orientation groups. An important direction for future research would also be to examine whether certain outcomes related to sexual orientation and gender identity (e.g., self-acceptance of gender identity and sexual orientation, degree of concealment, stigma consciousness, minority stress) might be impacted by the *Body Project*. It would also be interesting to assess whether the effectiveness of the *Body Project* might vary for sexual minority members in a group of mixed-sexual orientation versus a group of solely sexual minority members. Future research in this area should strive to address how sexual orientation can best be measured so that more young women feel comfortable providing this information so that we can better address the questions outlined in this paper.

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