Published in final edited form as:

Eat Weight Disord. 2019 December ; 24(6): 1189–1198. doi:10.1007/s40519-017-0469-7.

Reciprocal Longitudinal Relations Between Weight/Shape Concern and Comorbid Pathology Among Women at Very High Risk for Eating Disorder Onset

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Abstract

Purpose: Understanding how known eating disorder (ED) risk factors change in relation to one another over time may inform efficient intervention targets. We examined short-term (i.e., one month) reciprocal longitudinal relations between weight/shape concern and comorbid symptoms (i.e., depressed mood, anxiety) and behaviors (i.e., binge drinking) over the course of 24 months using cross-lagged panel models.

Methods: Participants were 185 women aged 18–25 years at very high risk for ED onset, randomized to an online ED preventive intervention or waitlist control. We also tested whether relations differed based on intervention receipt.

Results: Weight/shape concern in one month significantly predicted depressed mood the following month; depressed mood in one month also predicted weight/shape concern the following month, but the effect size was smaller. Likewise, weight/shape concern in one month significantly

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On behalf of all authors, the corresponding author states that there is no conflict of interest.

The datasets during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Level of Evidence: Level I, evidence obtained from a properly designed randomized controlled trial

predicted anxiety the following month, but the reverse was not true. Results showed no temporal relations between weight/shape concern and binge drinking in either direction. Relations between weight/shape concern and comorbid symptoms and behaviors did not differ based on intervention receipt.

Conclusions: Results support focusing intervention on reducing weight/shape concern over reducing comorbid constructs for efficient short-term change.

Keywords

weight/shape concern; comorbidity; eating disorder; college-age women

Over-evaluation and control of weight and shape (i.e., weight/shape concern) and the related concept, internalization of the thin body ideal, are potent and specific risk factors for the onset of eating disorders (EDs) [1–5]. Further, depressed mood, anxiety, and binge drinking increase ED risk [1, 5–8]. Weight/shape concern and depressed mood, anxiety, and binge drinking are also associated with one another. Given that EDs are particularly common in college-age women [9] and are associated with high morbidity and mortality, clinical impairment, and comorbid psychopathology [10–12], it is important to understand relationships among their risk factors to inform targeted prevention and treatment.

For instance, weight concerns were positively associated with depressive symptoms in a large, population-based sample of female adolescents [13], and the presence of weight overvaluation was found to increase risk for severe depressive symptoms among adolescent girls with overweight and binge eating disorder [14]. Regarding relationships between weight/shape concern and anxiety and binge drinking, less work has been done. Anxiety is associated with increased risk of developing weight/shape concerns [15], and body dissatisfaction (another key component of body image [16]) is significantly correlated with trait anxiety among college women [17–18]. Relatedly, EDs and anxiety disorders are highly comorbid; about two-thirds of individuals with EDs have a lifetime anxiety disorder that usually precedes the ED [19]. Finally, college women who report any binge drinking are more likely to have higher weight concerns than those who do not [20]. Rates of binge drinking are also high among college-age women at high risk for an ED, with one study finding 67% of respondents reported engagement in binge drinking in the past month [21], which is in contrast to national survey data suggesting that about two out of five (44%) college students binge drink [22–23]. These findings suggest an association between weight/shape concern and binge drinking.

Although past work has shown comorbidity among weight/shape concern and these comorbid symptoms and behaviors, little work has been done on the potential reciprocal relationships between these factors over time. No studies have examined the short-term (e.g., over one month) relationships between weight/shape concern and depressed mood, anxiety, or binge drinking in a college-age sample at very high risk for ED onset, despite theory and research suggesting there may be meaningful relationships among these constructs over the relatively short-term. For instance, cognitive-behavioral theory and research emphasize the fluidity of body image experiences based on context, including in association with mood states and social settings [24–25]. Interpersonal psychotherapy also posits that negative

affect resulting from disrupted interpersonal functioning leads to increased ED pathology [26]. Examining possible short-term reciprocal relationships between these constructs may provide information on efficient targets for prevention/treatment. That is, such knowledge would provide information on targets that are mostly likely to provide individuals with some type of relief in the short-term, which is crucial given the importance of early response to intervention [27–28].

The current study aimed to examine the short-term (i.e., one month), reciprocal longitudinal relations between weight/shape concern and comorbid symptoms (i.e., depressed mood, anxiety) and behaviors (i.e., binge drinking) over the course of 24 months among college-age women at very high risk for ED onset participating in a randomized controlled trial (RCT) [29]. Given that this sample was already at high risk for an ED, that appearance investment is high among college women [30], and that these individuals were in a period of developmental transition associated with changes in diet, physical activity, and weight [31], we hypothesized that weight/shape concern would drive problematic symptoms/behaviors. Specifically, we hypothesized that weight/shape concern would predict later comorbid symptoms and behaviors more so than the reverse. Findings have the potential to enhance existing theoretical models of the development and maintenance of weight/shape concern among college-age women and to inform the most efficient approaches to ED prevention and treatment.

Method

Participants

Participants were 206 women aged 18–25 at very high risk of developing an ED participating in an RCT evaluating an online ED prevention program [29]. Participants were eligible and deemed at very high risk for ED onset if they endorsed high weight/shape concerns (i.e., scoring ≥ 47 on the Weight Concerns Scale (WCS) [3, 32]) and at least one of three risk factors: 1) history of critical comments/teasing about eating from a teacher, coach, or sibling; 2) lifetime or current depression; and/or 3) low, non-clinical levels of compensatory behaviors [6, 29, 33]. Exclusion criteria included: meeting criteria for a *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV) [34] ED; having been treated for an ED in the past six months; bipolar disorder; active suicidality or psychosis; being male; residing outside the study site regions; and/or not having regular access to the Internet.

Procedure

Recruitment methods included flyers, listserv emails, social media, a research volunteer database, and word of mouth. Participants were screened and then invited for in-person assessment. Eligible participants were then randomized to either a waitlist control group ($n = 100$) or the 10-week guided online preventive intervention, Image and Mood (IaM) ($n = 106$). IaM has been described previously [29]. All participants provided informed consent, and institutional review boards at all participating sites approved the study.

Measures

Relevant to the current study, participants were assessed at 1- and 2-year follow-up using semi-structured interviews by trained assessors either in person or by telephone. At these follow-up assessments, a time-line follow-back interview method [35] was used to assess the study constructs on a monthly basis over the past 12 months [29]. The procedure began by assessing the past four weeks and then moved back, month-by-month, using a calendar as a guide. This approach has been shown to be reliable for measuring behaviors over the preceding year [35] and has been used in other ED prevention studies [33]. Also, other ED and depression research has utilized a similar approach for obtaining weekly symptom data every six months to assess psychopathology course [36–40].

Weight/shape concern.—The ED Examination (EDE) [41] is a semi-structured interview for assessing ED symptoms. In this study, monthly weight/shape concern was assessed with four EDE Weight Concern and Shape Concern subscale items: importance of weight, importance of shape, fear of weight gain, and feelings of fatness. A reduced item subset was administered to reduce participant burden, and notably, these four items align with the constructs assessed in the WCS, our primary measure of ED risk status [29]. At each follow-up assessment, items were rated for each month over the past year on a 0 to 6 scale, with higher scores indicating greater pathology. Items were averaged to create a measure of weight/shape concern for each month. In the current study, alpha for this measure was .69, which aligns with past research on the internal consistency of the full Weight Concern and Shape Concern subscales [42].

Depressed mood.—Participants rated their worst (maximum) level of depressed mood for each month over the past year at each follow-up assessment on a scale ranging from 0 (*not at all depressed*) to 10 (*most depressed ever*). The correlation between the average of all monthly depression ratings provided by each participant and their baseline score on the Beck Depression Inventory-II (BDI-II) [43] was .44 ($p < .001$)—a moderate-to-large correlation [44]—suggesting concordance. These findings also converge with research on the correlation between momentary measures of negative affect and BDI-II scores in ED patients ($\rho = .50-.55$, $p < .001$) [45].

Anxiety.—Participants rated their worst (maximum) level of anxiety for each month over the past year at each follow-up assessment on a scale ranging from 0 (*not at all anxious*) to 10 (*most anxious ever*). The correlation between the average of all monthly anxiety ratings provided by each participant and their baseline score on the Spielberger State-Trait Anxiety Inventory (STAI) [46] Trait Anxiety scale was .46 ($p < .001$)—a moderate-to-large correlation [44]—suggesting concordance. These findings also converge with research on the correlation between momentary worry and STAI Trait Anxiety scores in college students ($r = .43$, $p < .001$) [47].

Binge drinking.—Participants were asked how many times they consumed four or more drinks on one occasion, a well-accepted definition of binge drinking for females [48], for each month over the past year at each follow-up assessment. Participants were provided guidelines for standard alcohol drinks (e.g., “one drink” equals 12 oz of beer (a bottle)) at

baseline. The correlation between the average of all monthly binge drinking frequency ratings provided by each participant and their baseline report of number of binge drinking episodes in the past month was .54 ($p < .001$)—a large correlation [44]—suggesting concordance. This converges with research finding that correlations between more momentary and retrospective reports of drinking are high [49].

Analytic Strategy

Analyses were conducted using an autoregressive cross-lagged panel model approach [50] to simultaneously examine relationships between weight/shape concern and the comorbid symptoms over 24 months. More specifically, these models examined three types of paths: 1) temporal stability (i.e., autoregressive paths) within each construct over time (e.g., weight/shape concern in one month predicting weight/shape concern the following month); 2) concurrent correlations between the two constructs at each time point (e.g., correlation between weight/shape concern and depressed mood in a given month); and 3) cross-lagged paths between constructs over time in both directions (e.g., weight/shape concern in one month predicting depressed mood the following month and depressed mood in one month predicting weight/shape concern the following month). The cross-lagged paths thus indicate the effect of one variable on the other, controlling for both the stability of the variables over time and their correlation at a given time point. These analyses were conducted using Mplus Version 7.3 [51] using full information maximum likelihood estimation with robust standard errors (MLR). While the study variables were non-normally distributed, with standardized skewness values ranging from 12.56–77.15 and standardized kurtosis values ranging from –4.4–184.19, the MLR estimator is robust to non-normality of continuous variables. Goodness-of-fit was evaluated using the root mean square error of approximation (RMSEA, .08), comparative fit index (CFI, .90), and Tucker-Lewis Index (TLI, .90) [52–54]. Unstandardized parameter estimates are reported throughout.

Because participants were randomized to IaM or waitlist, we tested whether group assignment contributed to the model using multiple-group vs. single-group (i.e., no differentiation between groups) framework models. We also tested whether the autoregressive, concurrent, and cross-lagged paths were invariant across time in both the multiple-group and single-group frameworks. Thus, we tested four models: 1) a model using a multiple-group framework (i.e., IaM vs. waitlist) with no constraints on the model paths; 2) a model using a multiple-group framework in which the paths were constrained to be invariant across time within group; 3) a model using a single-group framework with no constraints on the model paths; and 4) a model using a single-group framework in which the paths were constrained to be invariant across time. Models 1–4 were examined for each of the three sets of variables [i.e., weight/shape concern and depressed mood (labeled DM1–DM4), weight/shape concern and anxiety (labeled A1–A4), weight/shape concern and binge drinking (labeled BD1–BD4)]. To identify differences in model fit, the test of small differences in fit [55] was used.

Results

A total of 185 participants provided monthly follow-up data ($n = 91$ in the IaM condition and $n = 94$ in the waitlist condition).¹ Table 1 contains demographic information. Table 2 shows grand means for and correlations among person-level means (i.e., individuals' mean monthly levels of a given construct over the 2-year follow-up period) of the study constructs.

Weight/Shape Concern and Depressed Mood Models

Table 3 summarizes results evaluating weight/shape concern and depressed mood. Model DM4 is considered the best and most parsimonious, as the multiple-group models (DM1, DM2) provided poor fit, and imposed invariance constraints to the single-group model (DM3, which provided a good fit) did not significantly change model fit (test of small differences in fit: $p = .263$). Autoregressive paths for weight/shape concern ($B = .94, p < .001$) and depressed mood ($B = .71, p < .001$) were large and significant (Figure 1), whereas concurrent paths between weight/shape concern and depressed mood were non-significant ($B = .02, p = .188$). Cross-lagged paths from weight/shape concern in one month to depressed mood the following month were positive and significant ($B = .17, p < .001$; with standardized estimates ranging from .06-.10, representing a small effect size [54]). Cross-lagged paths from depressed mood in one month to weight/shape concern the following month were also positive and significant ($B = .01, p = .049$; with standardized estimates all .01, representing an extremely small effect size), albeit much smaller in magnitude.

Weight/Shape Concern and Anxiety Models

Table 3 summarizes results of the model fitting for the cross-lagged relationship between weight/shape concern and anxiety. Model A4 is considered the best and most parsimonious, as A1 and A2 provided poor fit, and A3 (which provided an acceptable fit²) did not significantly change model fit (test of small differences in fit: $p = .592$). Autoregressive paths for weight/shape concern ($B = .94, p < .001$) and anxiety ($B = .70, p < .001$) were large and significant (Figure 2), whereas concurrent paths between weight/shape concern and anxiety were non-significant ($B = .01, p = .682$). Cross-lagged paths from weight/shape concern in one month to anxiety the following month were positive and significant ($B = .14, p < .001$; with standardized estimates ranging from .05-.08, representing a small effect size). In contrast, cross-lagged paths from anxiety in one month to weight/shape concern the following month were non-significant ($B = .00, p = .230$).

¹Of these 185 participants, 161 provided monthly data at both the 1- and 2-year follow-up ($n = 76$ IaM and $n = 85$ waitlist), 10 provided monthly data at the 1-year follow-up only ($n = 3$ IaM and $n = 7$ waitlist), and 14 provided monthly data at the 2-year follow-up only ($n = 12$ IaM and $n = 2$ waitlist). Analyses presented in the paper were run using the full sample of 185 participants who provided some monthly follow-up data. However, analyses were also re-run using only those 161 participants who provided monthly data at both the 1- and 2-year follow-up. Patterns of significance and fit statistics were similar to those presented for the full sample. As such, results on the full sample of 185 participants are presented for the sake of parsimony.

²In model A3, the CFI and TLI values we obtained (.88 and .87, respectively) were slightly below the recommended cutoff of .90; however, these indices can demonstrate worse fit simply due to a large number of model variables [53]. In this situation, because the RMSEA indicated good fit, there may be "no real cause for concern" [53, p. 349]. Thus, because A3 was deemed to have an acceptable fit, as a next step, model A4 was tested.

Weight/Shape Concern and Binge Drinking Models

Table 3 summarizes results of the model fitting for the cross-lagged relationship between weight/shape concern and binge drinking. Model BD4 is considered the best and most parsimonious,³ as BD1 and BD2 provided poor fit, and BD3 did not significantly change model fit (test of small differences in fit: $p = .667$). Autoregressive paths for weight/shape concern ($B = .94, p < .001$) and binge drinking ($B = .78, p < .001$) were large and significant (Figure 3), whereas concurrent paths between weight/shape concern and binge drinking were non-significant ($B = .01, p = .724$). Neither the cross-lagged paths from weight/shape concern in one month to binge drinking the following month ($B = -.01, p = .832$) or from binge drinking in one month to weight/shape concern the following month ($B = .00, p = .943$) were significant.

Model Validation

Notably, to validate the timeline follow-back procedure and results using the full 24 months of data, we reran the best-fitting models (DM4, A4, and BD4) only including data at the month of the 1- and 2-year follow-ups (i.e., at the time of assessment) and the month previous. That is, we re-ran analyses using these 4 months of data only. Notably, the models provided an adequate fit to the data (CFI and TLI increased to the .92-.98 range), and the pattern of significance for each of these models was nearly identical to the original models, with one exception. Specifically, the cross-lagged paths from depressed mood in one month to weight/shape concern the following month were non-significant ($B = -.001, p = .894$), in contrast to the original DM4 model, where this path was positive and significant ($p = .049$).

Discussion

This study examined short-term, reciprocal longitudinal relationships between weight/shape concern and depressed mood, anxiety, and binge drinking using cross-lagged panel models over the course of 24 months among college-age women at very high risk for ED onset, randomized to either an online ED preventive intervention or waitlist control. In line with hypotheses, results indicated that weight/shape concern in one month significantly predicted depressed mood and anxiety the following month. Depressed mood in one month also predicted weight/shape concern the following month, but the effect size was much smaller (and was non-significant when examined using only the two months of data closest to the follow-up time points). Anxiety in one month did not predict weight/shape concern the following month. Results suggested no temporal relations between weight/shape concern and binge drinking in either direction. Importantly, all relationships were tested while accounting for the stability of each construct from month to month, and each construct under investigation was found to be very stable over time. Thus, even after accounting for construct stability, some cross-lagged relationships were found. Also notable, while the intervention was found to improve eating attitudes and behaviors and depressive symptomatology more in the intervention than control [29], current results suggest that the intervention may not have changed how body image concerns and comorbid symptoms

³Model BD3 provided a mediocre fit. In Model BD4, the constraints improved the RMSEA to be within the recommended range, and the TLI also slightly improved. Both the CFI and TLI were still below the recommended cutoff, but given the findings of Kenny and McCoach [53] and the fact that the RMSEA was in the appropriate range, this model was deemed to have an acceptable fit.

predict one another over the course of a month over time, based on poor fit of the multiple-group models vs. good fit of the single-group models.

Overall, weight/shape concern predicted depressed mood and anxiety over time, more so than the reverse. This in line with past work finding that body dissatisfaction predicted internalizing symptoms one year later among adolescent girls but that the reverse did not hold true [56]. However, when EDs and anxiety disorders co-occur, the anxiety disorder usually comes first [19]. Yet current findings indicate that in a high-risk sample that is already experiencing elevated weight/shape concern and over a shorter time period, concerns about weight and shape may predict more unhappiness and anxiety among college-age women at high ED risk—more so than the reverse. Weight/shape concern may contribute to internalizing symptoms given the high levels of appearance investment and developmental transitions (including changes in diet, physical activity, and weight) occurring for this group [30–31], as well as the fact that appearance is a critical dimension by which women are evaluated in Western society [52]. However, it is possible that reciprocal influences between weight/shape concern and these comorbid symptoms hold in both directions or even that the relationships between depression/anxiety predicting weight/shape concern are stronger over longer time periods. Finally, although past work has indicated associations between weight/shape concern and binge drinking [20–21], current findings suggest these constructs may not be potent predictors of one another over the course of one month; rather, it may be that relationships between these constructs would emerge using even more momentary data. For instance, it could be that binge drinking serves as a coping mechanism for in-the-moment weight/shape concern—in line with escape theory [57]. Indeed, one study found that self-reported alcohol intoxication was preceded by decreasing positive affect, perhaps as a means to cope, in women with bulimia nervosa [58]. Alternatively, it may be that binge drinking is more closely tied to anticipatory or compensatory behaviors, a phenomenon that has been described in the popular press as “drunkorexia” [59–60]. Future research should explore the possibility of reciprocal relationships between these constructs, or related ones, over different time periods, which may have implications for refining interventions.

Major strengths include examination of a large, racially/ethnically diverse sample of college-age women at very high ED risk and the collection of monthly data over two years using interviews. Additionally, our analytic approach provided a stringent test of reciprocal longitudinal relationships by controlling for temporal stability of each construct and their concurrent correlations. Limitations must also be noted. First, monthly data were obtained via time-line follow-back. While this approach has been found to be reliable for measuring behaviors over the preceding year [35], retrospective recall biases may have been reduced if these data had been collected in real time, and results may not generalize to different time frames. Second, depressed mood, anxiety, and binge drinking were assessed using single items. However, correlations with longer, well-validated measures of each construct collected at baseline were moderate to large, providing support for validity. Third, the assessment of drinking was particularly limited (e.g., binge drinking definition could have been more specific—4 drinks over the course of 2 hours, lack of assessment of other alcohol use measures such as total drinks per week or alcohol problems). Fourth, the study constructs were relatively stable over time, limiting the amount of variance to explain.

Finally, the sample was comprised of college-age women at high ED risk; thus, findings may not generalize to college-age women in general, males, or younger or older individuals.

Despite these limitations, there are important clinical implications. Findings suggest that prevention and treatment of weight/shape concern may be beneficial for preventing or reducing depressed mood and anxiety over the short-term among very high-risk college-age women, whereas the reverse may not prove as fruitful. Thus, clinicians working with college women struggling with body image should address this issue directly and not assume that improvements in other domains, like depressed mood and anxiety, will lead to a reduction in weight/shape concerns. Current findings suggest that weight/shape concern and binge drinking were not temporally related over the time frame assessed, suggesting clinicians should not assume changes in these constructs will impact one another over the relatively short-term; however, as mentioned, future research should explore the possibility of reciprocal relationships that may hold over different time periods, which may have important clinical implications. Additionally, the finding that relationships between the study constructs did not change based on intervention receipt suggests that future prevention and early intervention programming should include an explicit focus on how different symptoms can influence one another and how to interrupt these connections. That is, interventions may want to focus on how to stop weight/shape concerns from translating into more general mood-related problems.

Acknowledgments

This research was supported by R01 MH081125, R01 MH100455, T32 HL007456, and F32 HD089586 from the National Institutes of Health and T32 HS00078 from the Agency for Healthcare Research and Quality.

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Figure 1.

Cross-lagged model of the relationship between weight/shape concern and depressed mood over 24 months. Path coefficients are unstandardized, and as depicted via the use of the terms “Month x ” and “Month $x + 1$,” these coefficients hold over the entire 24 month study period. *** $p < .001$. * $p < .05$.

Figure 2.

Cross-lagged model of the relationship between weight/shape concern and anxiety over 24 months. Path coefficients are unstandardized, and as depicted via the use of the terms “Month x ” and “Month $x + 1$,” these coefficients hold over the entire 24 month study period. *** $p < .001$.

Figure 3.

Cross-lagged model of the relationship between weight/shape concern and binge drinking over 24 months. Path coefficients are unstandardized, and as depicted via the use of the terms “Month x ” and “Month $x + 1$,” these coefficients hold over the entire 24 month study period. *** $p < .001$.

Table 1

Baseline Demographic Information (N = 185)

Demographic Variable	Summary
Age	Mean = 20.31 years (<i>SD</i> = 1.79)
Body mass index	Mean = 24.83 kg/m ² (<i>SD</i> = 4.90)
Race/ethnicity	49.2% non-Hispanic White 20.0% Asian 11.9% Black 10.2% Hispanic 1.1% Pacific Islander 3.8% multi-ethnic 3.8% other
Parents' highest level of education	50.3% graduate degree 18.9% college degree 28.6% high school degree 1.6% less than high school 0.5% unknown

Table 2

Grand Means For and Correlations Among Person-Level Means of the Measured Variables (N = 185)

Measure	1	2	3	4	<i>M</i>	<i>SD</i>	Possible Range
1. Weight/shape concern	-				1.95	1.01	0–6
2. Depressed mood	.43***	-			2.86	1.61	0–10
3. Anxiety	.31***	.68***	-		3.34	1.82	0–10
4. Binge drinking	-.01	.00	-.09	-	1.54	1.95	0–28

Note. $p < .001$.

Table 3

Goodness-of-Fit Summary for the 24-Month Cross-Lagged Models

Model	χ^2	df	p	RMSEA	RMSEA 90% CI	CFI	TLI
<i>Weight/Shape Concern and Depressed Mood Models</i>							
DM1. Multiple-group, no constraints	4779.10	2024	<.001	.12	.12-.13	.77	.74
DM2. Multiple-group, paths constrained to be invariant across time within group	5144.80	2246	<.001	.12	.11-.12	.76	.76
DM3. Single-group, no constraints	1764.80	1012	<.001	.06	.06-.07	.91	.90
DM4. Single-group, paths constrained to be invariant across time	1973.88	1123	<.001	.06	.06-.07	.90	.90
<i>Weight/Shape Concern and Anxiety Models</i>							
A1. Multiple-group, no constraints	4963.75	2024	<.001	.13	.12-.13	.75	.72
A2. Multiple-group, paths constrained to be invariant across time within group	5306.94	2246	<.001	.12	.12-.13	.74	.74
A3. Single-group, no constraints	2035.33	1012	<.001	.07	.07-.08	.88	.87
A4. Single-group, paths constrained to be invariant across time	2221.55	1123	<.001	.07	.07-.08	.88	.88
<i>Weight/Shape Concern and Binge Drinking Models</i>							
BD1. Multiple-group, no constraints	5736.99	2024	<.001	.14	.14-.15	.74	.71
BD2. Multiple-group, paths constrained to be invariant across time within group	6266.98	2246	<.001	.14	.14-.14	.72	.71
BD3. Single-group, no constraints	2236.03	1012	<.001	.08	.08-.09	.87	.86
BD4. Single-group, paths constrained to be invariant across time	2404.67	1123	<.001	.08	.07-.08	.86	.86

Note. DM = depressed mood; A = anxiety; BD = binge drinking. Multiple-group = accounts for randomized group assignment (i.e., intervention versus waitlist control groups). Single-group = does not account for randomized group assignment.