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A 20-Year Longitudinal Study of Body Weight, Dieting, and Eating Disorder Symptoms

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The article describes a 20-year longitudinal study of body weight, dieting, and disordered eating in women and men. Body weight increased significantly over time in both women and men. However, women's weight perception and dieting frequency decreased over time, whereas men's weight perception and dieting frequency increased, and disordered eating declined more in women than in men from late adolescence to midlife. In both women and men, changes in weight perception and dieting frequency were associated with changes in disordered eating. In addition, adult roles such as marriage and parenthood were associated with significant decreases in disordered eating from late adolescence to midlife in women, whereas few associations were observed in men. Despite different developmental trajectories, women demonstrated more weight dissatisfaction, dieting, and disordered eating compared with men across the period of observation.

Keywords: eating disorders, bulimia, longitudinal study, gender differences, dieting

Do people grow out of eating disorders as they mature from adolescence into adulthood? Numerous longitudinal studies have investigated the development of disordered eating and eating disorders among adolescent girls (see Jacobi, Hayward, de Zwaan, Kraemer, & Agras, 2004, for review), and a handful of studies have followed girls into adulthood (Graber, Brooks-Gunn, Paikoff, & Warren, 1994; Johnson, Cohen, Kasen, & Brook, 2006; Lewinsohn, Striegel-Moore, & Seeley, 2000). However, no study has investigated the developmental trajectory of these problems into midlife in a nonclinical sample. Instead, data concerning eating disorder trajectory in adulthood have focused on long-term outcome in treatment-seeking samples meeting fairly narrow diagnostic criteria (see Keel & Herzog, 2004, for review). Although these studies are important for predicting long-term outcome among those seeking treatment, they fail to provide information on the natural course of disordered eating. Here we report a 20-year longitudinal study of eating attitudes and behaviors in women and men, following them from late adolescence to midlife. The purpose of the study was to evaluate changes in eating pathology from late adolescence to midlife and to examine factors that may explain these changes.

Changes in Eating Disorders and Disordered Eating From Adolescence to Adulthood

Epidemiological data suggest that the period of peak risk for developing eating disorders is during adolescence and early adulthood (Hudson, Hiripi, Pope, & Kessler, 2007); eating disorder point prevalence is highest among adolescent girls and young adult women compared to any other female age group. These cross-sectional data suggest that women may grow out of bulimia nervosa as they age. However, cohort effects could explain these age differences. Eating disorder incidence, particularly for bulimia nervosa, increased during the latter half of the 20th century, suggesting that changing sociohistorical factors, such as the increasing idealization of thinness, increased risk for developing the disorder (Keel & Klump, 2003). Potentially, these factors had the greatest impact on adolescent girls and young adult women. Young women may have been more likely to adopt a value system that equated self-worth with body shape and weight, a value that has been posited as the core vulnerability for developing bulimia nervosa (P. J. Cooper & Fairburn, 1993). In contrast, older adults may have developed stable sources of self-worth before thinness emerged as a cultural obsession. This would create an association between age cohort and eating disorder prevalence observed in epidemiological studies (Hudson et al., 2007). However, like any

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cross-sectional comparison, different prevalence rates across age groups confound cohort effects with developmental effects. The best way to compare disordered eating across different developmental periods is to examine a single cohort over time using a longitudinal design.

Based on our review of the literature, we were able to locate only six independent prospective longitudinal studies of eating disorders that bridged the developmental transition from adolescence to adulthood (Calam & Waller, 1998; Graber et al., 1994; Johnson et al., 2006; Lewinsohn et al., 2000; Moorhead et al., 2003; Steinhausen, Gavez, & Metzke, 2005). In four studies, ages at final follow-up included 19–20 years (Calam & Waller, 1998; Steinhausen et al., 2005) and 22–24 years (Graber et al., 1994; Lewinsohn et al., 2000). These ages at follow-up may preclude detection of meaningful developmental changes in disordered eating because the period of peak risk for eating disorders spans adolescence to young adulthood (American Psychiatric Association, 2000). Indeed, these studies reported no significant changes in first incidence of eating disorders (Lewinsohn et al., 2000) or disordered eating levels (Graber et al., 1994) in the transition from midadolescence to late adolescence/young adulthood. Results may be explained by the stability of eating disorder symptoms (Calam & Waller, 1998) reported throughout this period.

Four prospective longitudinal studies, including two in which baseline assessments were conducted in adult samples (Rizvi, Stice, & Agras, 1999; Vogeltanz-Holm et al., 2000), have described eating disorders or levels of disordered eating in cohorts with mean ages of 27 years (Moorhead et al., 2003), 33–35 years (Johnson et al., 2006; Vogeltanz-Holm et al., 2000) and 39 years (Rizvi et al., 1999) at follow-up. Of these, only Rizvi et al. (1999) examined changes in disordered eating from baseline to follow-up. Consistent with patterns predicted by epidemiological data, Rizvi et al. observed significant decreases in self-reported frequencies of binge eating, diuretic use, fasting, laxative use, and restrictive dieting at 6-year follow-up. However, the authors found no significant change for Eating Disorder Inventory (EDI; Garner, Olmstead, & Polivy, 1983) Bulimia or Drive for Thinness scores and reported significant increases on measures of body dissatisfaction and dietary restraint from baseline to follow-up. Importantly, participants originally were recruited for a study on newborn children's growth and completed baseline assessments early in their postpartum period. This design feature may explain the inconsistent pattern of results across measures if women's responses to some questions at baseline were influenced by having just given birth.

In contrast to the studies reviewed above, Heatherton, Mahamedi, Striepe, Field, and Keel (1997) examined stability and change in disordered eating and eating disorders in a sample of college students (mean age 20 $\pm$ 2 years) who completed assessments at 10-year follow-up (mean age 30 $\pm$ 2 years). This study, the first of its kind, concluded that risk for eating disorder development declines from late adolescence to adulthood in women but not men. Whereas body weight increased over time in female and male participants, female participants reported increased weight satisfaction and decreased disordered eating while male participants reported decreased weight satisfaction and increased disordered eating. Of particular interest, during college, the risk ratio of clinical eating disorders in women to men was approximately 5:1; at 10-year follow-up, the risk ratio was reduced to 3:2. Thus, although eating disorders remained more common in women compared to men throughout the period of study, the gender difference declined substantially. These results highlight the importance of differentiating longitudinal patterns between women and men. In addition, they suggest that developmental processes during adulthood may favor women more than men with regard to eating pathology.

Predictors of Changes in Disordered Eating From Adolescence to Midlife

Prospective longitudinal studies have supported dieting and body image as high potency variable risk factors for the development of disordered eating behaviors in adolescent girls (see Jacobi et al., 2004, for review). If these factors are related to the emergence of disordered eating, then one would expect that decreases in disordered eating may be accounted for by decreases in these risk factors. However, few studies have endeavored to identify predictors of *decreases* in disordered eating in adulthood. Instead, studies in adult samples have examined predictors of onset of disordered eating behaviors (Vogeltanz-Holm et al., 2000) or eating disorders diagnosed at follow-up (Johnson et al., 2006; Moorhead et al., 2003). Further, these studies have relied on existing datasets in which the variables examined (e.g., health problems before the age of 5 years in Moorhead et al., 2003, or 12-month illicit substance use in Vogeltanz-Holm et al., 2000) differed substantially from risk factors identified in prospective longitudinal studies of adolescent samples (see Jacobi et al., 2004, for review).

To our knowledge, only Heatherton et al. (1997) examined associations between changes in putative risk factors (dieting and body image) and changes in disordered eating (EDI Drive for Thinness scores, EDI Bulimia scores, and eating disorder classification) over the transition from late adolescence to adulthood. Correlational analyses supported significant associations between decreases in disordered eating and decreases in dieting and poor body image in women and men. These findings raise questions about what accounts for improvements in disordered eating in women but not men during the transition from late adolescence to adulthood.

Heatherton et al. (1997) posited that decreased disordered eating resulted from developmental changes in life goals. During the transition to adulthood, many women select life partners, establish careers, and become parents. The roles and responsibilities that come with adulthood may provide a broader range of qualities upon which women base self-worth. Simply put, there may be a change in priorities such that physical appearance in general, and being thin in particular, become less important to women. Although physical appearance is an important determinant of attracting potential mates before the first serious relationship (Walster, Aronson, Abrahams, & Rottman, 1966), factors unrelated to physical appearance gain greater importance once serious relationships have been initiated (Berscheid, 1985). Indeed, everyday experience demonstrates that many relationships are sustained despite significant increases in weight in one or both partners. Thus, attempts to control weight and reactions to weight gain may become less extreme in women as they select life partners. In support of this hypothesis, Vogeltanz-Holm et al. (2000) reported that being unmarried predicted intense dieting at 5-year follow-up

in adult women. Declining importance placed on weight as a consequence of the adoption of adult roles and responsibilities could explain decreased disordered eating as women age.

Research on the development of disordered eating in adolescent boys suggests more similarities to girls than differences (Leon, Fulkerson, Perry, Keel, & Klump, 1999; Ricciardelli & McCabe, 2004). However, eating disorders are less common in boys than girls, perhaps because boys are less likely to express a desire to be thin compared to girls. In boys, both weight perception and dieting appear to be closely tied to actual body weight (Ricciardelli & McCabe, 2004). If weight perception remains closely tied to actual weight, then men may be more likely to experience body dissatisfaction and increase their dieting efforts as they gain weight during the transition from late adolescence to adulthood. These weight-related changes could explain increased disordered eating in men as they age.

The Current Study

The current study examines stability and change in eating disorder attitudes and behaviors in a cohort of women and men assessed in college and at 10- and 20-year follow-up. In addition, data concerning changes in putative risk factors (body image and dieting) and adult roles and responsibilities are examined for their ability to predict changes in disordered eating in women and men.

Method

Participants

Participants in this study ($N = 654$) had been college students at a selective northeastern college in 1982. This sample comprised 465 women and 189 men; mean age at follow-up was 40 ± 2 years. This group was 81% White, 5% Black, 8% Asian, 4% Hispanic, and 1% mixed/other.

Procedure

In the spring of 1982, researchers affiliated with the Henry Murray Center of Radcliffe College sent out a self-report survey to a randomly selected sample of 800 women and 400 men. Half of the sample was selected from the freshman class, and half was selected from the senior class of the college. The response rate for the initial survey was 78% for women ($n = 624$) and 69% for men ($n = 276$).

During the spring of 2002, we attempted to identify and follow-up all participants from the first study ($N = 900$). Of those who participated in college, 8 had died (5 women and 3 men). None of these individuals had eating disorders according to surveys at baseline or 10-year follow-up. Of the remaining 892 participants, 465 (75%) women and 189 (70%) men returned completed surveys. Finally, 10 returned blank surveys, 214 did not respond to surveys (we mailed 2 follow-up surveys to maximize participation), and 14 (1.6%) were untraceable.

Measures

The 2002 survey was based closely on the 1982 survey. Of participants in 20-year follow-up, 561 (86%) completed 10-year follow-up assessments on which we reported previously (Heatherton et al., 1997). Surveys distributed in 1982, 1992, and 2002 included the same set of questions on demographic background, height, weight, general eating patterns, dieting history, body image, and specific eating disorder symptoms (binge eating, self-induced vomiting, laxative use, diuretic use, and fasting) to allow evaluation of eating disorder trajectory from late adolescence to adulthood to midlife among participants. In addition, follow-up surveys asked about marital status, education, career, and children to evaluate changes in life roles from baseline to follow-up.

Body weight. Body mass index (BMI) was calculated as weight in kilograms divided by the square of height in meters based on self-reported weight and height. Studies have demonstrated high correspondence between self-reported and objectively measured weight in both men and women of different age groups in the United States (Stunkard & Albaum, 1981) as well as height and weight in both college-age men and women (Imrhan, Imrhan, & Hart, 1996) and middle-age men and women (Spencer, Appleby, Davey, & Key, 2002). Small biases have been reported with men tending to overestimate height by approximately 1.23 cm (0.48 in.) and women tending to underestimate weight by 1.4 kg (3.1 lb; Spencer et al., 2002) with absolute errors ranging from 1.00% to 3.54% (Imrhan et al., 1996). However, studies have uniformly concluded that self-reported height and weight are reliable and valid for epidemiological studies (Imrhan et al., 1996; Spencer et al., 2002; Stunkard & Albaum, 1981). Within our own sample, stability in self-reports of height from baseline to follow-up was high, $r(900) = .97$, $p < .001$, as was rank ordering for body weight, Spearman's $r(900) = .84$, $p < .001$. Participants were assigned to a weight group as follows: underweight = BMI < 17.5; average = BMI between 17.5 and 25.0; overweight = BMI between 25 and 30; and obese = BMI > 30 kg/m^2.

Body image. Participants' weight perceptions were assessed by a single item with response options of "Very Underweight," "Underweight," "Average," "Overweight," and "Very Overweight." This item has demonstrated predictive validity in examining prospective changes in EDI Bulimia scale scores in women and men (Heatherton et al., 1997; Vohs, Bardone, Joiner, Abramson, & Heatherton, 1999). Weight satisfaction was assessed by a single item that probed whether participants wanted to gain weight, maintain weight, or lose weight. Previous research supports the external validity of these reports with assessments made by a relative or peer in both sexes (Rosen & Poplawski, 1987). Participants who wanted to maintain current weight were considered to be satisfied with their current weight. As described by Cash and Deagle (1997), weight perception and weight satisfaction represent different facets of body image, and both have been associated with eating pathology.

Dieting. Dieting frequency was assessed using a single item with response options of "Never," "Rarely," "Sometimes," and "Often." A single-item assessment of current dieting demonstrated concurrent validity with a validated self-report measure of caloric intake in both women and men, and these associations were similar to those found for a multi-item measure of dietary restraint (Neumark-Sztainer, Jeffery, & French, 1997). Importantly, recent research has challenged the extent to which self-report measures of dieting validly capture actual changes in dietary intake (Stice, Fisher, & Lowe, 2004). Thus, self-reported current diet frequency most likely captures participants' intentions rather than their actual eating behaviors.

EDI. Surveys included 26 items from the EDI that were available in 1982. These items are the principal items for five of the EDI subscales (Bulimia, Drive for Thinness, Perfectionism, Maturity Fears, and Interpersonal Distrust). Of these scales, the Drive for Thinness and Bulimia scales have differentiated bulimic patients from general psychiatric controls, and the Bulimia scale has differentiated bulimic patients from anorexic patients (Hurley, Palmer, & Stretch, 1990). Research supports the validity of the EDI in differentiating eating disordered patients from non-eating disordered controls in both women (Z. Cooper, Cooper, & Fairburn, 1985; Garner et al., 1983) and men (Olivardia, Pope, Mangweth, & Hudson, 1995). Spillane, Boerner, Anderson, and Smith (2004) demonstrated that college-age men and women produce the same factor structure and equivalent factor loadings, factor variances, and factor intercorrelations on the EDI-2, a revised version of the original measure that has retained the same subscales used in the current study. Finally, the scales demonstrated similar correlations with questionnaire measures of bulimic and anorexic symptoms in men and women (Spillane et al., 2004), supporting the concurrent validity of the EDI in both sexes. However, some scales show lower internal consistency in men compared to women. In our study, internal consistencies were generally high in both women and men across assessment waves (see Table 3) with one exception. Internal consistency for the Maturity Fears scale was below .70 in women and men at some assessment waves. Thus, this scale was not included in analyses of longitudinal changes. In a nonclinical population, the original scoring procedure reduces the scales' sensitivity in detecting lower level pathology (Schoemaker, van Strien, & van der Staak, 1994). Thus, item values were summed without recoding, and then scale scores were log-transformed to correct for positive skew. Raw scores are reported in Table 3 for descriptive purposes.

Results

Participants at 20-year follow-up did not differ from nonparticipants on age or ethnicity. However, women were somewhat more likely than men to participate at follow-up, $\chi^2(1, N = 900) = 3.57$, $p = .059$. In addition, participants did not differ from nonparticipants on BMI at baseline. However, compared to nonparticipants, participants described themselves as being heavier, $t(888) = 2.26$, $p = .02$, dieting more frequently, $t(894) = 2.82$, $p = .005$, and having greater Drive for Thinness, $t(893) = 2.60$, $p = .009$. No other significant associations were found between baseline data and follow-up participation. Because analyses indicated that follow-up data were not missing completely at random (Schafer & Graham, 2002), we report results from analyses using the expectation-maximization (EM) method in SPSS 13.0 to impute missing values to prevent biases due to missing data.[1] Missing data were not imputed for nonparametric analyses.

Physical Changes

A two-way analysis of variance (ANOVA) using repeated measures on BMI indicated a significant effect of time, $F(1, 899) = 629.9$, $p < .001$; sex, $F(1, 899) = 85.4$, $p < .001$; and Sex × Time interaction, $F(1, 899) = 7.0$, $p = .008$. The sample reported no significant change in height from baseline to follow-up. Average height was 70.8 ($SD = 2.6$; 1.8 m ± 6.6 cm) in. for men and 65.5 ($SD = 2.8$; 1.7 m ± 7.1 cm) in. for women. Thus, changes in BMI were attributable to changes in weight over time. Consistent with longitudinal patterns reported for a nationally representative sample (Kuczmarski, 1992), the current sample reported significant increases in weight over the follow-up period. A two-way ANOVA using repeated measures on body weight revealed a significant effect of time, $F(1, 899) = 710.5$, $p < .001$, sex, $F(1, 899) = 572.4$, $p < .001$, and a significant Sex × Time interaction, $F(1, 899) = 22.4$, $p < .001$. Participants gained an average of 17 lb (7.7 kg) over follow-up. Men gained an average of 10 lb (4.5 kg) per decade. In contrast, women gained 5 lb (2.3 kg) from 1982 to 1992 and then gained an additional 9 lb (4.1 kg) from 1992 to 2002.

Body Image and Dieting

Table 1 presents weight categorizations based on BMI, weight perception, and weight satisfaction at baseline, 10-year follow-up, and 20-year follow-up in women and men. Consistent with patterns described above, the percentages of women and men who were overweight or obese increased significantly over time. However, the percentages of women who perceived themselves as overweight and expressed weight dissatisfaction were highest in 1982. Men's weight perception and weight dissatisfaction were highest in 2002, supporting a closer association between actual body weight and body image in men compared to women. Although similar proportions of men and women described themselves as overweight and desired weight loss in 2002, men were more than twice as likely as women to be overweight in 2002.

Table 2 presents changes in dieting from 1982 to 2002 reported by men and women. Dieting frequency decreased in 44% of women, remained the same in 35%, and increased in 21% of women from 1982 to 2002. In men, dieting frequency decreased in 15%, remained the same in 51%, and increased in 34% from 1982 to 2002. Thus, decreased dieting was more than twice as likely as increased dieting in women. In men, the opposite was true. Despite these different longitudinal trajectories, women reported dieting more frequently than men at baseline, $t(749) = 17.0$, $p < .001$, 10-year follow-up, $t(590) = 6.7$, $p < .001$, and 20-year follow-up, $t(600) = 5.7$, $p < .001$.

Eating Disorder Attitudes and Behaviors

Although previous research supports factor invariance for the EDI-2 between men and women (Spillane et al., 2004), no study has examined the stability of the measure's psychometric properties in different age groups. We conducted metric invariance analyses comparing models in which factor loadings were fixed between groups (invariance models) to models in which factor loadings were allowed to vary by sex or age group (variance models; Horn & McArdle, 1992), using LISREL 8.72 (Jöreskog &

[1] Because our sample size was large and our attrition was relatively low (i.e., $N = 900$ and attrition was 25% in the current study compared to $N = 50$ and attrition of 75% in simulated data presented by Schafer & Graham, 2002), results did not differ meaningfully between analyses using maximum likelihood estimates versus those using listwise deletion to handle missing data.

Table 1
Weight, Weight Perception, and Weight Satisfaction in Men and Women: 1982 to 2002

Variable	Women			Men		
	1982	1992	2002	1982	1992	2002
Weight group[a]	1.83	1.97	2.20	1.75	1.91	2.34
Underweight (BMI < 17.5)	21 (5)	11 (3)	6 (1)	1 (< 1)	1 (< 1)	0 (0)
Average (17.5 < BMI < 25)	413 (90)	341 (85)	342 (74)	146 (79)	105 (67)	82 (43)
Overweight (25 < BMI < 30)	23 (5)	42 (10)	77 (17)	36 (19)	45 (29)	91 (48)
Obese (BMI > 30)	2 (< 1)	9 (2)	36 (8)	2 (1)	5 (3)	16 (9)
Weight perception[b]	2.23	1.81	1.96	1.80	2.00	2.20
Very underweight	0 (0)	2 (< 1)	2 (< 1)	0 (0)	0 (0)	0 (0)
Underweight	12 (3)	31 (8)	19 (4)	23 (12)	8 (5)	9 (5)
Average	215 (47)	255 (63)	282 (61)	136 (72)	112 (72)	111 (59)
Overweight	220 (48)	105 (26)	135 (29)	28 (15)	34 (22)	64 (34)
Very overweight	14 (3)	11 (3)	22 (5)	1 (.5)	1 (< 1)	4 (2)
Weight satisfaction[c]	2.11	1.91	1.98	1.65	2.03	2.33
Want to gain weight	14 (3)	8 (2)	11 (2)	45 (24)	17 (11)	3 (2)
Want to maintain weight	67 (15)	123 (30)	104 (23)	72 (39)	52 (33)	52 (28)
Want to lose weight	382 (83)	274 (68)	346 (75)	69 (37)	87 (56)	133 (71)

Note. Category is mean ranking; subcategory data represent *n* (%). BMI = body mass index.
[a] Significant change in weight categories over time in women, Friedman test χ^2 (2, N = 396) = 109.02, $p < .001$, and men, Friedman test χ^2 (2, N = 153) = 74.44, $p < .001$.
[b] Significant change in weight perception over time in women, Friedman test χ^2 (2, N = 396) = 77.35, $p < .001$, and men Friedman test χ^2 (2, N = 153) = 31.03, $p < .001$.
[c] Significant change in weight satisfaction over time in women Friedman test χ^2 (2, N = 400) = 76.51, $p < .001$, and men, Friedman test χ^2 (2, N = 153) = 28.30, $p < .001$.

Sörbom, 2004).[2] We fitted a structural measurement model in which items were constrained to load onto their assigned scales (Garner et al., 1983). Latent variables representing the same scales measured in different decades were permitted to intercorrelate. Measurement errors for the same items measured in different decades were also permitted to intercorrelate. Fit statistics for the invariance model were χ^2(5794, N = 654) = 11,682.997, $p < .001$; root-mean-square error of approximation (RMSEA) = .0529; 90% confidence interval (CI) of RMSEA = .0514–.0544; standardized root-mean-square residual (SRMR) = .139; comparative fit index (CFI) = .925. We compared this model to two variance models. In the first variance model, loadings were allowed to vary across decades but were constrained to be the same for men and women. In the second variance model, loadings were allowed to vary between men and women but were constrained to be the same across decades. Fit statistics for the age group variance model were χ^2(5742, N = 654) = 11,437.317, $p < .001$; RMSEA (90% CI) = .0512 (.0497–.0527); SRMR = .138, CFI = .927. Fit statistics for the gender variance model were χ^2(5768, N = 654) = 11,519.555, $p < .001$; RMSEA (90% CI) = .0521 (.0506–.0536); SRMR = .131, CFI = .927.[3] There were significant differences in fit relative to the invariance model for both the age group variance model, χ^2(52, N = 654) = 245.68, $p < .001$, and the gender

Table 2
Changes in Dieting Status for Men and Women: 1982 to 2002

1982 dieting status	*n* (%)	2002 dieting status			
		Never	Rarely	Sometimes	Often
Women, *n* (%)		156 (34)	133 (29)	120 (26)	51 (11)
Never	112 (24)	**60**	38	11	3
Rarely	75 (16)	30	**23**	19	3
Sometimes	169 (37)	44	49	**55**	21
Often	104 (23)	22	23	35	**24**
Men, *n* (%)		92 (49)	48 (26)	39 (21)	8 (4)
Never	125 (67)	**71**	30	21	3
Rarely	32 (17)	15	**11**	5	1
Sometimes	28 (15)	6	7	**12**	3
Often	2 (1)	0	0	1	**1**

Note. Numbers on the bolded diagonal represent participants who remained in the same dieting status category from 1982 to 2002. Numbers above the diagonal represent participants who increased the frequency of their dieting from 1982 to 2002. Numbers below the diagonal represent participants who decreased the frequency of their dieting from 1982 to 2002. Dieting frequency decreased significantly for women from 1982 to 2002, Friedman test χ^2 (2, N = 400) = 39.14, $p < .001$, but increased significantly for men from 1982 to 2002, Friedman test χ^2 (2, N = 153) = 12.57, $p < .001$.

[2] Missing item values were imputed in SPSS 13.0 before being imported to LISREL to obtain additional fit indices. Interested readers may obtain full output of these analyses from Pamela K. Keel.

[3] Across models, the chi-square statistic was significant, indicating a difference between observed and predicted values. In addition, the SRMR and CFI values did not conform to currently recommended cutoffs for good fit (i.e., SRMR ≤ .08 and CFI ≥ .95; Hu & Bentler, 1999). However, the upper limits of the models' CIs for RMSEA were less than .06, indicating adequate fit across models (Browne & Cudeck, 1993). RMSEA values less than .06, combined with SRMR values up to .11, have been associated with low Type I and Type II error rates in evaluating model fit (Hu & Bentler), and concerns have been raised regarding rigid adherence to cutoff values for fit indices (Marsh, Hau, & Wen, 2004). Moreover, the purpose of these analyses was not to challenge the originally proposed factor structure of the EDI. Instead, we aimed to examine whether the factor structure differed between men and women or by age group.

variance model, $\chi^2(26, N = 654) = 163.44$, $p < .001$, measured by difference in chi-square. However, this statistic is sensitive to very minor differences in factor loadings when sample size is large (Jöreskog, 1993). SRMR values did not differ appreciably between invariance and variance models, and CFI values differed by .002 between invariance and variance models. Only differences in CFI greater than .01 indicate model variance (Cheung & Rensvold, 2002). Further, the 90% CIs for RMSEA from both variance models overlap with the invariance model. Thus, both the RMSEA and other fit indices support factor invariance for the EDI across sex and age groups.

A repeated measures ANOVA was used to assess the effects of sex, time of survey, and Sex × Time interaction for each of the EDI subscales (Bulimia, Drive for Thinness, Perfectionism, and Interpersonal Distrust). Perfectionism scores demonstrated no effect of sex, no effect of time, and no significant Sex × Time interaction, supporting the longitudinal stability of this personality trait. However, other eating disorder attitudes and behaviors differed significantly for men and women and over time (see Table 3).

For each significant Sex × Time interaction, simple effects of sex within time of survey and time of survey within sex were examined with correction for familywise error rate in post-hoc comparisons. Significant decreases in Bulimia scores were observed in women and men ($ps < .001$). Although women demonstrated larger decreases in Bulimia scale scores compared to men ($p < .001$), they had higher Bulimia scores compared to men at each time of survey ($ps < .001$). Only women demonstrated decreased scores on Drive for Thinness over time ($p < .001$); men reported increases over time ($p = .016$) that approached significance after correction for multiple comparisons. However, women reported higher Drive for Thinness than men at each assessment ($ps < .001$). Finally, Interpersonal Distrust decreased significantly over time in women ($p < .001$) but not men ($p = .10$), and women reported significantly lower Interpersonal Distrust compared to men at each assessment ($ps < .001$).

Table 4 summarizes current rates of disordered eating behaviors in women and men at each assessment. Both women and men reported significant declines in binge eating. In addition, women reported significant decreases in current use of diet pills, laxatives, and fasting to control weight. In contrast, vomiting did not decline in frequency in women and demonstrated a slight, nonsignificant increase in frequency in men over follow-up.

Associations for Changes in Putative Risk Factors, Life Roles, and Disordered Eating

We used multilevel model analyses to examine how within-person changes over time in disordered eating (EDI Bulimia and Drive for Thinness scores; Level 1) were associated with between-person differences in putative risk factors (weight perception and dieting frequency) or life roles (marital status, parental status, occupational status, and educational attainment; Level 2). In all analyses, predictor variables were centered on baseline mean values and were time-varying. For both Bulimia and Drive for Thinness, the unconditional means model indicated significant within-person variance in both women, σ^2_ε (*SE*) = 6.51 (0.26) and 8.84 (0.35), respectively, and men, σ^2_ε (*SE*) = 3.25 (0.20) and 6.48 (0.39). Following the methods described by Singer and Willett (2003), we fit an unconditional growth model to examine the effect of age on disordered eating. Consistent with results from the repeated measures ANOVA, unconditional growth models confirmed significant within-person decreases in Bulimia in women and men, significant within-person decreases in Drive for Thinness

Table 3
Changes in Modified EDI Subscale Scores for Women and Men: 1982, 1992, and 2002

	Women			Men			
EDI subscale	1982	1992	2002	1982	1992	2002	Effect: *F* (1,899)
Bulimia							
α	.85	.86	.80	.72	.72	.73	
M (*SE*)	14.2 (0.2)	11.0 (0.1)	10.5 (0.1)	10.5 (0.3)	9.5 (0.2)	9.3 (0.2)	Sex: 81.6*** Time: 315.3*** Sex × Time: 58.9***
Drive for thinness							
α	.90	.90	.88	.86	.88	.86	
M (*SE*)	15.7 (0.2)	12.4 (0.2)	12.2 (0.2)	9.1 (0.4)	9.6 (0.3)	9.3 (0.3)	Sex: 187.3*** Time: 35.7** Sex × Time: 99.8***
Perfectionism							
α	.78	.77	.81	.73	.77	.78	
M (*SE*)	23.1 (0.2)	24.1 (0.2)	23.3 (0.2)	22.9 (0.3)	23.4 (0.3)	22.7 (0.3)	Sex: 2.3 Time: 0.1 Sex × Time: 0.9
Interpersonal distrust							
α	.80	.79	.80	.76	.78	.80	
M (*SE*)	12.3 (0.2)	11.9 (0.1)	11.4 (0.1)	13.2 (0.2)	13.1 (0.2)	12.8 (0.2)	Sex: 26.0*** Time: 22.9** Sex × Time: 4.2*

Note. *F* tests of within-subjects effects test for linear contrasts. EDI = Eating Disorder Inventory.
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table 4
Eating Disorder Symptoms for Women and Men: 1982, 1992, and 2002

	1982	1992	2002		
Disorder symptom	*n* (%)	*n* (%)	*n* (%)	$\chi^2(2)$[a]	*p*
Women					
Binge eating	148 (32)	52 (13)	36 (8)	108.13	< .001
Diuretics	7 (2)	2 (<1)	1 (<1)	3.25	.20
Diet pills	19 (4)	6 (2)	4 (1)	9.70	.008
Laxatives	10 (2)	2 (<1)	1 (<1)	11.23	.004
Fasting	93 (20)	27 (7)	27 (6)	46.77	< .001
Vomiting	10 (2)	6 (2)	7 (2)	0.40	.82
Men					
Binge eating	24 (13)	15 (10)	7 (4)	12.07	.002
Diuretics	0 (0)	0 (0)	0 (0)	—	—
Diet pills	1 (<1)	0 (0)	0 (0)	2.00	.37
Laxatives	0 (0)	0 (0)	0 (0)	—	—
Fasting	16 (9)	11 (8)	8 (4)	3.10	.21
Vomiting	0 (0)	1 (1)	2 (1)	3.00	.22

[a] Cochran Q Test for related samples. Dash = no data collected.

in women, and significant within-person increases in Drive for Thinness in men (see Table 5 Model A parameters for Age).

All Level 2 variables were included in an initial multilevel model to examine associations between time-varying between-person predictors and disordered eating levels (intercept) and rates of change (slope). Predictors with parameter estimates that did not differ significantly from zero were sequentially removed from the models, and the parameters for remaining variables were examined for possible removal until a final model was achieved. The Hessian matrix was positive definite, and conversion criteria were satisfied for all final models. Full maximum likelihood estimates were employed so that fit could be compared between models (Singer & Willett, 2003).

Putative risk factors. In women, decreases in Bulimia and Drive for Thinness scores were associated with decreases in weight perception and dieting frequency over time. Significant interaction effects were observed as well. Lower Bulimia scores were observed in women with lower BMIs who perceived themselves as weighing less. Lower Drive for Thinness scores were observed in women who dieted more frequently and had higher BMIs or perceived themselves as being heavier. The addition of these putative risk factors significantly improved the fit to observed data compared to the unconditional growth model, $\chi^2(3, N = 624) = 673.79$, $p < .001$, for Bulimia, and, $\chi^2(4, N = 624) = 1{,}036.56$, $p < .001$, for Drive for Thinness, suggesting that decreases in disordered eating are associated with decreases in putative risk factors in women over time.

Lower Bulimia scores were observed in men with lower dieting frequency and lower BMI. Weight perception significantly influenced the association between age and Bulimia such that men who perceived themselves as weighing less demonstrated greater declines in Bulimia scores over time. The addition of these putative risk factors significantly improved fit to observed data compared to the unconditional growth model, $\chi^2(4, N = 276) = 121.67$, $p < .001$. Similarly, the addition of putative risk factors significantly improved fit to observed data on changes in Drive for Thinness over time in men, $\chi^2(3, N = 276) = 353.87$, $p < .001$. This was the only model in which the addition of between-subject parameters altered the direction of within-person growth. Within this model, increases in Drive for Thinness were observed in men with increases in weight perception and dieting frequency. Men who reported no increase in weight perception or dieting frequency reported decreases in Drive for Thinness over time. Interaction effects were observed for the combinations of weight perception with age and dieting frequency.

Life roles. In women, marriage and becoming a mother were both associated with significant decreases in Bulimia and Drive for Thinness scores. In addition, marital status significantly influenced the association between age and disordered eating. Women who remained single demonstrated higher Drive for Thinness and Bulimia across the period of observation but also demonstrated greater decreases in scores over time. Similarly, women who did not become mothers demonstrated higher Bulimia scores across the period of observation but also demonstrated greater decreases in Bulimia over time compared to women who became mothers. No other life roles were significantly associated with changes in disordered eating in women. The adult roles model provided a significantly improved fit to observed data compared to the unconditional growth model for change in Bulimia, $\chi^2(4, N = 465) = 51.59$, $p < .001$, and Drive for Thinness scores, $\chi^2(3, N = 465) = 30.37$, $p < .001$, in women. In men, becoming a father was associated with a significant decrease in Drive for Thinness scores. The addition of this parameter improved fit to observed data compared to the unconditional growth model, $\chi^2(1, N = 189) = 7.05$, $p = .008$. However, no other associations were found between life roles and changes in disordered eating in men.

Prospective Analyses

The above analyses supported significant associations between concurrent changes in putative risk factors and changes in disordered eating from late adolescence to midlife. However, these analyses do not establish temporal precedence (Singer & Willett, 2003). For example, it is possible that changes in Drive for Thinness drove changes in dieting frequency and weight perception rather than the reverse. In contrast, changes in marital and parental status temporally preceded survey assessments of disordered eating, and thus these models do not fall prey to the same concerns regarding reciprocal causation (Singer & Willett, 2003, p. 180). Nonetheless, given the 10-year interval between assessments, it remains possible that unobserved improvements in disordered eating may have facilitated changes in life roles, such as getting married or having a child, and then changes were sustained until the following assessment.

To examine how putative risk factors and life roles might prospectively predict changes in disordered eating, we used time-lagged analyses in which assessments of putative risk factors and life roles in 1982 and 1992 were used to predict changes in disordered eating (slope) from 1992 and 2002. For both Bulimia and Drive for Thinness, the unconditional means model indicated significant within-person variance in women, σ^2_ε (*SE*) = 2.15 (0.12) and 3.80 (0.21), respectively, and men, σ^2_ε (*SE*) = 1.28 (0.11) and 2.65 (0.23), from 1992 to 2002. In addition, increases in age were associated with significant decreases in Bulimia scale scores from 1992 to 2002 in women, $\gamma(SE) = -.04$ (.008); $t(628.16) = -5.51$, $p < .001$, and men, $\gamma(SE) = -.02$ (.009);

Table 5
Predictors of Changes in Disordered Eating in Women and Men

	Women						Men				
	Bulimia			Drive for thinness			Bulimia		Drive for thinness		
Parameter	A	B	C	A	B	C	A	C	A	B	C
Fixed effects	γ (SE)	γ (SE)	γ (SE)	γ (SE)	γ (SE)	γ (SE)	γ (SE)	γ (SE)	γ (SE)	γ (SE)	γ (SE)
Intercept (γ_{00})	25.98 (0.14)	26.82 (0.13)	26.36 (0.15)	26.57 (0.18)	26.82 (0.13)	26.90 (0.20)	23.12 (0.19)	23.24 (0.18)	21.10 (0.27)	21.25 (0.20)	20.94 (0.28)
Age (γ_{10})	−0.14 (0.01)	−0.07 (0.01)	−0.19 (0.01)	−0.12 (0.01)	−0.07 (0.01)	−0.15 (0.02)	−0.05 (0.01)	−0.10 (0.01)	0.03 (0.01)*	−0.04 (0.01)**	0.06 (0.02)*
Weight perception		1.53 (0.11)			1.64 (0.12)					2.52 (0.32)	
Diet frequency		1.09 (0.06)			2.09 (0.08)			0.79 (0.11)		2.68 (0.15)	
BMI								0.10 (0.04)			
Weight Perception × BMI		0.04 (0.02)									
Age × Weight Perception								0.05 (0.01)		−0.04 (0.02)	
BMI × Diet Frequency					−0.06 (0.02)						
Weight Perception × Diet Frequency					−0.42 (0.12)					−0.79 (0.20)	
Marital status			−1.40 (0.53)			−2.58 (0.48)					
Parental status			−1.57 (0.72)			−0.72 (0.32)					−0.95 (0.36)
Age × Marital Status			0.08 (0.03)			0.16 (0.03)					
Age × Parental Status			0.09 (0.04)								
Variance											
Within-person (σ^2_ε)	3.44 (0.19)	2.62 (0.15)	3.87 (0.27)	6.66 (0.37)	4.47 (0.25)	7.92 (0.52)	1.98 (0.17)	1.99 (0.17)	4.87 (0.42)	4.05 (0.34)	5.48 (0.53)
Intercept (σ^2_0)	9.07 (0.77)	5.54 (0.52)	8.94 (0.83)	12.93 (1.24)	4.39 (0.62)	12.26 (1.39)	7.33 (0.85)	6.04 (0.76)	14.18 (1.77)	6.29 (1.02)	14.15 (1.90)
Slope (σ^2_1)	0.01 (0.002)	0.01 (0.001)	0.01 (0.002)	0.01 (0.002)	0.002 (0.002)	0.01 (0.004)	0.01 (0.002)	0.01 (0.002)	0.01 (0.003)	0.01 (0.003)	0.02 (0.01)
Fit indices											
Deviance	9091.7	8417.9	7867.1	10105	9037.9	8726.0	3690.3	3568.6	4332.2	3951.4	3823.8
AIC	9103.7	8435.9	7887.1	10117	9057.9	8744.0	3702.3	3586.6	4344.2	3971.4	3837.8
BIC	9136.9	8485.7	7940.7	10150	9113.3	8792.2	3730.6	3629.1	4372.5	4018.6	3869.8

Note. The dependent variable in these analyses is the natural log of the relevant Eating Disorder Inventory subscale (to correct for positive skew) × 10 (to avoid problems with boundary constraints) (Singer & Willett, 2003). Effects of age are expressed in terms of years. Thus, intercept values in women indicate that baseline Bulimia scores were 13.4 to 14.6 across models, a range that corresponds with women's mean Bulimia scores in 1982 in Table 3. Further, parameter estimates for the effect of age indicate a decline in scores (expressed as the natural log of scores × 10) by 0.7 to 1.9% per year, or approximately 7% to 19% per decade, across models. Because Models B and C include time-varying predictors, parameter estimates for predictor variables indicate vertical adjustments in scores at the time the predictor changes whereas parameter estimates for interaction terms between predictors and age indicate adjustments to the rate of changes over time. All parameter estimates are associated with a p value $< .001$, unless otherwise noted. Data represent lambda values unless otherwise noted. Standard errors are in parentheses. A = unconditional growth model, B = putative risk factor model, C = adult roles model; BMI = body mass index; AIC = Akaike information criteria; BIC = Bayesian information criterion.
* $p < .05$. ** $p < .01$.

$t(282.68) = -2.41$, $p = .02$. In contrast, there was no significant change in Drive for Thinness scores from 1992 to 2002 in women, $\gamma(SE) = -.01$ (.01); $t(626.24) = -1.06$, $p = .29$, or men, $\gamma(SE) = -.01$ (.01); $t(282.97) = -.90$, $p = .37$. In addition, the test of covariance parameters indicated that there was no significant variance in slope in women, σ^2_1 (SE) = .01 (.01), Wald $Z = 0.76$, $p = .45$, or men, σ^2_1 (SE) = .004 (.005), Wald $Z = 0.80$, $p = .42$. Thus, there was no change in Drive for Thinness or variability in change in Drive for Thinness, for putative risk factors or life roles to predict. Thus, prospective models were conducted only for changes in Bulimia scale scores.

Putative risk factors. In women, lower weight perception predicted greater decreases in Bulimia scale scores, $\gamma(SE) = .03$ (.01); $t(588.49) = 2.49$, $p = .01$, and lower diet frequency approached

traditional thresholds for statistical significance, $\gamma(SE) = .02$ (.008); $t(607.69) = 1.92$, $p = .055$. The addition of these putative risk factors significantly improved fit of the model to observed data in women, $\chi^2(2, N = 624) = 11.24$, $p = .004$. In men, lower diet frequency from 1982 to 1992 predicted decreases in Bulimia scale scores from 1992 to 2002, $\gamma(SE) = .40$ (.11); $t(406.16) = 3.78$, $p < .001$. However, no other factor contributed to the model. The addition of this putative risk factor significantly improved the fit of the model to observed data in men, $\chi^2(1, N = 276) = 4.27$, $p = .04$.

Life roles. No significant association between changes in life roles between 1982 and 1992 and changes in Bulimia from 1992 to 2002 was found in women (all ps $> .30$). We did not conduct analyses of Bulimia in men because concurrent models indicated no significant associations between changes in life roles and changes in Bulimia scores.

Discussion

Changes in EDI Bulimia and Drive for Thinness scores indicated that women demonstrated more dramatic declines in disordered eating over follow-up than did men. Indeed, men's Drive for Thinness scores increased from baseline to 20-year follow-up. As men aged and gained weight, they perceived themselves as being heavier, became more dissatisfied with their weight, and increased their dieting frequency. In contrast, as women aged and gained weight, they became more accepting of their bodies. Despite these different developmental trajectories, women demonstrated more weight dissatisfaction, dieting, and disordered eating across the period of observation.

Consistent with research indicating that dieting and poor body image are prospective risk factors for the emergence of disordered eating (Jacobi et al., 2004), we found that decreases in disordered eating were associated with decreases in these putative risk factors in women. In addition, increases in dieting frequency and weight perception were associated with increases in drive for thinness observed in men. Of particular interest, we found prospective associations between putative risk factors and changes in disordered eating in women and men. Decreases in Bulimia scores were predicted by decreased weight perception in women and decreased dieting frequency in men. To our knowledge, this is the first study to examine whether decreases in disordered eating are associated with decreases in putative risk factors from late adolescence to midlife in women or men.

Improvements in disordered eating in women were associated with attainment of certain life roles, specifically marriage and motherhood. Vogeltanz-Holm et al. (2000) found that remaining single was a significant predictor of intense dieting among women in their mid-30s. Given the importance of physical appearance in attracting a partner (Walster et al., 1966), selecting a life partner may alleviate some of the pressure women feel to attain or maintain the thin ideal. In addition, adult roles such as becoming a parent may supplant weight and shape among the things that influence how women evaluate themselves during the transition from late adolescence to midlife. Of note, prospective models did not demonstrate significant associations between life roles and changes in disordered eating. Importantly, prospective analyses did not distinguish between individuals who first got married or became parents between 1992 and 2002 and those who did not, nor did these analyses capture instances in which a person may have gotten married between 1982 and 1992 and then subsequently divorced between 1992 and 2002. In addition, only enduring or delayed benefits of changes in life roles would have been detected by time-lagged analyses, and these effects were not evident in concurrent models. Thus, results from prospective analyses may underestimate the potential impact of life roles on changes in disordered eating in women. Aside from an association between becoming a parent and decreased drive for thinness in men in concurrent models, life roles did not appear to be significantly associated with changes in disordered eating in men. Educational and occupational statuses were not significant predictors of changes in disordered eating in either gender. However, participants were drawn from a selective private college that may have significantly constrained variability in educational or occupational status.

The current study has some notable strengths. This study has retained high participation rates from baseline to follow-up assessments and is the first study to examine developmental trajectories of disordered eating from young adulthood to midlife in both women and men. This represents a significant contribution to a literature in which we know a great deal about longitudinal changes in disordered eating leading up to the period of peak risk but very little about what happens following the period of peak risk. We presented analyses that supported factor invariance of the EDI for men and women over time. Although a previous study reported similar results with regard to gender (Spillane et al., 2004), this is the first study, to our knowledge, to assess the psychometric properties of this instrument at different ages. This represents a significant strength given that the EDI is one of the most frequently used instruments to assess disordered eating attitudes and behaviors in men (Spillane et al., 2004) and in longitudinal studies of nonclinical samples (Jacobi et al., 2004).

Despite study strengths, certain limitations warrant discussion, as they impact interpretation of results. First, in order to make comparisons to data collected in 1982, it was important to utilize the same method of assessment at follow-up (Singer & Willett, 2003). However, this introduced limitations in terms of the reliance on self-report measures as well as the use of single-item assessments for several variables. An additional shortcoming of the methods used in 1982 was the undersampling of men. Although inclusion of men in the current study represents a significant advantage over the many longitudinal studies that have excluded male participants (e.g., Graber et al., 1994; Herzog et al., 1999; Keel, Mitchell, Miller, Davis, & Crow, 1999; Killen et al., 1996), the relatively small sample of men may have limited power for analyses of changes in disordered eating over time.

An additional limitation is an inability to determine the impact of nonparticipation at follow-up on study results. We attempted to minimize the impact of missing data in parametric analyses by using methods recommended by Schafer and Graham (2002). However, participation at follow-up may have been related to the extent to which the survey covered topics of interest or relevance to our target sample. In this case, reports of weight and shape concerns and disordered eating during midlife may be inflated due to participation bias in this sample.

A final limitation is the nature of the population from which the sample was drawn. This is not a population-based study. All data were collected at a single prestigious university and may not

generalize to other populations. Similarly, results may not generalize to other age cohorts, given evidence that bulimia nervosa point prevalence has changed across cohorts (Keel, Heatherton, Dorer, Joiner, & Zalta, 2006) and evidence that these changes may be related to disorder chronicity (Keel, Heatherton, Dorer, Joiner, & Haedt, 2004).

Conclusions

Understanding the mechanisms by which maturational processes influence maintenance or change in disordered eating remains an important goal for future research. This work could provide important directions for the treatment and prevention of eating disorders among adolescents. To the extent that the incidence of eating disorders increased during the second half of the 20th century (Keel & Klump, 2003), it seems feasible to find ways to reverse this trend. Examining the factors associated with alleviation of disordered eating within the natural course of people's lives represents a promising avenue for this effort.

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