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# *DSM–IV–TR* and *DSM-5* Eating Disorders in Adolescents: Prevalence, Stability, and Psychosocial Correlates in a Population-Based Sample of Male and Female Adolescents

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The current study aimed to compare the prevalence, stability, and psychosocial correlates of *DSM–IV–TR* and *DSM-5* eating disorders, in a population-based sample of male and female adolescents followed prospectively from 14 to 20 years of age. Participants (N = 1,383; 49% male) were drawn from the Western Australian Pregnancy Cohort (Raine) Study, a prospective, population-based cohort study that has followed participants from prebirth to young adulthood. Detailed self-report questionnaires were used to assess eating disorder symptoms when participants were aged 14, 17, and 20 years. Comparisons between *DSM–IV–TR* and *DSM-5* were conducted using McNemar chi-square tests and Fisher's exact tests. Changes in eating disorder prevalence over time were considered using generalized estimating equations. Eating disorder prevalence rates were significantly greater when using *DSM-5* than *DSM–IV–TR* criteria, at all time points for females and at age 17 only for males. "Unspecified"/"other" eating disorder diagnoses were significantly less common when applying *DSM-5* than *DSM–IV–TR* criteria, but still formed 15% to 30% of the *DSM-5* cases. Diagnostic stability was low for all disorders, and *DSM-5* binge eating disorder or purging disorder in early adolescence predicted *DSM-5* bulimia nervosa in later adolescence. Cross-over from binge eating disorder to bulimia nervosa was particularly high. Regardless of the diagnostic classification system used, all eating disorder diagnoses were associated with depressive symptoms and poor mental health quality of life. These results provide further support for the clinical utility of *DSM-5* eating disorder criteria, and for the significance of binge eating disorder and purging disorder.

*Keywords:* eating disorders, *DSM–IV–TR*, *DSM-5*, prevalence, Raine Study



It has been established that eating disorders most commonly develop during adolescence (Steinhausen, Gavez, & Metzke, 2005; Stice, Marti, Shaw, & Jaconis, 2009). Under *DSM–IV–TR* nomenclature (American Psychiatric Association, 2000), current until May, 2013, between 1% and 4% of this age group could be expected to meet criteria for anorexia nervosa (AN) or bulimia nervosa (BN; Hoek, 2006; Hoek & Van Hoeken, 2003), and at least another 5% to meet criteria for an eating disorder not otherwise specified (EDNOS; Isomaa, Isomaa, Marttunen, Kaltiala-Heino, & Bjorkqvist, 2009; Kjelsas, Bjornstrom, & Gotestam,

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2004). Conceptualizations of EDNOS have varied considerably, with some studies considering atypical AN and subthreshold BN only, and others including binge eating disorder (BED). Relatively few studies have assessed for purging disorder (PD), which was provisionally defined by Keel and colleagues in 2005 as repeated purging in the absence of objective binge eating, accompanied by the overevaluation of eating, weight, or shape (Keel, Haedt, & Edler, 2005).

One of the limitations of *DSM–IV–TR* is the overreliance on EDNOS as a diagnostic category (Fairburn et al., 2007). In clinical settings, approximately 50% of those seen for treatment receive a "not otherwise specified" diagnosis when applying *DSM–IV–TR* criteria (Fairburn et al., 2007; Turner & Bryant-Waugh, 2004). In the community, this proportion rises to over 70% of eating disorder cases (Kjelsas et al., 2004; Machado, Goncalves, & Hoek, 2013; Wade, Bergin, Tiggemann, Bulik, & Fairburn, 2006). Individuals with EDNOS appear to be broadly comparable with individuals with full AN and BN in terms of symptom severity, symptom persistence, and functional impairment (Grilo et al., 2007; Hay et al., 2010; Thomas, Vartanian, & Brownell, 2009). Thus, it is important that these individuals are appropriately recognized in eating disorder diagnostic systems.

Changes to diagnostic criteria in *DSM-5* were designed, in part, to reduce the frequency of unspecified eating disorder diagnoses (Walsh, 2009). The fifth edition of the *DSM* (American Psychiatric Association, 2013) no longer requires amenorrhea for a diagnosis of AN, and AN may be diagnosed if an individual's behavior indicates fear of weight gain and body image disturbance (e.g., continued self-imposed dietary restriction despite low body weight), even if their self-reported cognitions do not. "Significantly low body weight" has also been more flexibly defined, as "less than minimally normal" for adults, or "less than minimally expected" for children and adolescents (American Psychiatric Association, 2013). For BN, the twice per week frequency requirement for binge eating and purging has been reduced to once per week. Binge eating disorder, an example of EDNOS in *DSM–IV–TR*, has been recognized as a standalone disorder, and the required frequency of binge eating has also been set at once per week for 3 months, consistent with BN. In *DSM–IV–TR*, the provisional BED criteria required binge eating 2 days per week for 6 months (American Psychiatric Association, 2000).

The "not otherwise specified" category of *DSM-5* has been relabeled to give two separate categories. The first category, Other Specified Feeding or Eating Disorder (OSFED), incorporates specific eating disorder examples not captured by AN, BN, or BED. These include atypical AN, subthreshold BN, subthreshold BED, PD, and night eating syndrome (American Psychiatric Association, 2013). The second category, Unspecified Feeding or Eating Disorder, is intended for cases where insufficient information is available to make a specific eating disorder diagnosis, or where symptoms are genuinely unspecified and do not fit other diagnostic examples (American Psychiatric Association, 2013).

Several studies have compared the prevalence and distribution of *DSM–IV–TR* and *DSM-5* eating disorder diagnoses, using the proposed *DSM-5* criteria released ahead of 2013 publication (Walsh, 2009). Results confirm that *DSM-5* decreases the use of "unspecified" or "other" eating disorder diagnoses in treatment-seeking (Birgegard, Norring, & Clinton, 2012; Fairburn & Cooper, 2011) and community (Keel, Brown, Holm-Denoma, & Bodell, 2011; Machado et al., 2013; Stice, Marti, & Rohde, 2013) samples. However, research to date has focused almost exclusively on female participants, and only one study (Stice et al., 2013) has used prospective data to compare *DSM–IV–TR* and *DSM-5* prevalence rates over time. Stice, Marti, and Rohde's (2013) research was conducted with female adolescents ($n$ = 496), meaning that no data are available regarding developmental changes in the prevalence of *DSM-5* eating disorders in males.

Stice et al.'s (2013) research is also the only source, to date, of data on the stability of *DSM-5* eating disorders over time and on associations between *DSM-5* eating disorders and psychological distress. Findings suggest that 1-year remission rates for *DSM-5* eating disorders are high (similar to previous reports for *DSM–IV–TR* eating disorders in the community; Allen, Byrne, Oddy, & Crosby, in press; Stice et al., 2009), that cross-over between *DSM-5* BED and BN is relatively common, and that *DSM-5* eating disorders are associated with substantial psychosocial impairment (Stice et al., 2013).

The current study aimed to compare the prevalence, stability, and psychosocial correlates of *DSM–IV–TR* and *DSM-5* eating disorders in a population-based sample of male and female adolescents, followed prospectively from 14 to 20 years of age. We have previously reported on *DSM–IV–TR* disorders in this sample, including prevalence and risk factors at age 14 (Allen, Byrne, Forbes, & Oddy, 2009) and disorder stability from 14 to 20 (Allen et al., in press). For this study, it was hypothesized that:

*Hypothesis 1:* The prevalence of *DSM-5* eating disorders would be significantly greater than the prevalence of *DSM–IV–TR* eating disorders, for male and female participants.

*Hypothesis 2:* The proportion of "unspecified" or "other" eating disorder diagnoses would be significantly lower when applying *DSM-5* criteria than *DSM–IV–TR* criteria, for male and female participants.

*Hypothesis 3:* Eating disorder stability would be low, and diagnostic cross-over would be high, for *DSM-5* and *DSM–IV–TR* eating disorders, to a similar degree over 3-year and 6-year periods.

*Hypothesis 4: DSM-5* and *DSM–IV–TR* eating disorders would show similar associations with depressive symptoms and quality of life.

## Method

### Design and Participants

Data were drawn from the Western Australian Pregnancy Cohort (Raine) Study, a population-based cohort study that has followed participants from prebirth to young adulthood. The Raine Study has been described in detail previously (Allen et al., 2009; Newnham, Evans, Michael, Stanley, & Landau, 1993). In brief, 2,900 women were recruited from the antenatal booking clinics at King Edward Memorial Hospital for women (KEMH), the only public maternity hospital in Western Australia, between May, 1989 and November 1991. Of the 2,900 women enrolled, 2,804 delivered live birth babies. Due to 64 multiple births, the initial

cohort included 2,868 children. Children were assessed at birth and 1, 2, 3, 5, 8, 10, 14, 17, and 20 years.

This study had a primary focus on the 14-, 17-, and 20-year follow-ups, when eating disorder data were collected. Eating disorder data were available for 1,598 participants at age 14, 1,242 participants at age 17, and 1,243 participants at age 20. We focused on participants with data at age 14 and at least one of the subsequent follow-ups, giving an effective sample size of 1,383 (49% male). This represents 76% of the participants who completed at least one of the 14 through 20-year assessments (N = 1,878) and 59% of the participants who were eligible for participation in the 14- through 20-year assessments (i.e., not deceased or lost to follow-up prior to age 14; N = 2,344). The mean age of the sample was 14.01 years (*SD* = 0.19, range = 13.00–15.08) at the 14-year assessment, 16.92 years (*SD* = 0.24, range = 15.0–18.2) at the 17-year assessment, and 20.01 years (*SD* = 0.44, range = 19.00–22.08) at the 20-year assessment.

## Procedure

Questionnaire packages were posted to adolescents at the 14-, 17-, and 20-year assessments, for at-home completion prior to attendance at a face-to-face assessment session. Height and weight were measured during the face-to-face assessment. Body mass index was calculated using the standard formula (weight [kg]/height $[m]^2$).

Data collection occurred in accordance with Australian National Health and Medical Research Council Guidelines for Ethical Conduct and was approved by the ethics committees of KEMH and Princess Margaret Hospital for Children.

## Measures

**Eating disorders at 14, 17, and 20 years.** Eating disorder symptoms were assessed using 24 self-report items adapted from the Child Eating Disorder Examination (ChEDE; Bryant-Waugh, Cooper, Taylor, & Lask, 1996) and Eating Disorder Examination-Questionnaire (EDE-Q; Fairburn & Beglin, 1994). These items were self-report, as per the EDE-Q, but language was simplified or clarified when there was the possibility of confusion for 14-year-old adolescents. Response options were also simplified. The same four response options were used for all items: 0 = *not at all*; 1= *some of the time (once per week/a few times a month)*; 2 = *a lot of the time (a few times a week)*; and 3 = *most of the time (every day or nearly every day)*. Participants were asked to be conservative in their answers if they were unsure of the frequency of their behaviors. Questions referred to the previous month and the same items were used at all assessment points. The validity of a simplified EDE-Q rating scale for youth has been established (Goldschmidt, Doyle, & Wilfley, 2007) and support exists for the validity of self-report eating disorder assessment more generally (Berg, Peterson, Frazier, & Crow, 2011, 2012; Berg et al., 2012; Keel, Crow, Davis, & Mitchell, 2002; Mond, Hay, Rodgers, Owen, & Beumont, 2004).

The 24 self-report items assessed for *DSM–IV–TR* and *DSM-5* diagnostic criteria for AN, BN, BED, and PD, with the exception that items referred to 1 month rather than 3 to 6 months. Others have found good convergence between EDE-Q assessment with a 1 month time frame and interview assessment with a 3 to 6 month time frame, in terms of eating disorder detection and classification (Berg et al., 2012). One limitation of the EDE-Q, however, is that it does not assess criterion B of the diagnostic criteria for BED. Specifically, it does not determine whether three of the following symptoms are present: rapid eating, eating until uncomfortably full, eating large amounts when not hungry, eating alone, or feeling disgusted, depressed or guilty after overeating. When these criteria are omitted from diagnostic decision making, the prevalence of BED is inflated (Berg et al., 2012). To address this, we included the overevaluation of weight and shape as a requirement for BED diagnosis. Others have found overevaluation to be strongly associated with eating disorder psychopathology and distress about binge eating in samples of binge eaters (Hrabosky, Masheb, White, & Grilo, 2007; Mond, Hay, Rodgers, & Owen, 2007), and to reliably distinguish between individuals with BED and those who report binge eating without clinical impairment. Operationalized diagnostic requirements are summarized in Table 1. For *DSM–IV–TR*, the weight threshold for AN was set at the 3rd BMI percentile for age and sex, which is equivalent to weight at least 85% below that expected (a BMI of 17.5 in adults). An EDNOS diagnosis could be received if participants met our criteria for BED (see Table 1); fell just short of meeting full criteria for AN, either by continuing to menstruate or by losing a significant amount of weight without falling below the 3rd BMI percentile; fell just short of meeting full criteria for BN, by binge eating and purging less than twice per week; or reported recurrent purging (approximately weekly) with overevaluation of weight and shape, but without low weight or objective binge eating (see Table 1).

For *DSM-5*, two sets of criteria ("a" and "b") are presented for AN. The "a" criteria capture participants who endorsed marked fear of weight gain and body image disturbance, with a BMI below the 10th BMI percentile. This corresponds to a BMI of 18.5 in adults, which is the lower end of the World Health Organization's healthy weight range (Cole, Flegal, Nicholls, & Jackson, 2007) and may be viewed as a marker of "minimally normal" for *DSM-5* purposes (American Psychiatric Association, 2013). The "b" criteria for AN capture participants who did not endorse marked fear of weight gain, but who did demonstrate behaviors suggestive of fear of weight gain. This was defined as very low body weight (retaining the 3rd percentile in use for *DSM–IV–TR*) combined with some acknowledged fear of weight gain, some acknowledged dietary restriction, and marked body image disturbance (see Table 1).

For OSFED, we were in a position to assess PD and atypical AN, but not subthreshold BN or subthreshold BED. We did not assess for Unspecified Feeding or Eating Disorders. For PD, "recurrent purging" was defined as self-induced vomiting or laxative misuse occurring once per week or a few times per month (the same frequency criterion as for *DSM-5* BN and BED). For atypical AN, a diagnosis was made if participants had lost considerable weight over the preceding 3 to 4 years, without yet being markedly underweight, and endorsed marked fear of weight gain and body image disturbance.

For atypical AN, it was necessary to consider change in weight between assessment points. To facilitate this, percentage ideal body weight (%IBW) was calculated for each participant at each time point, by dividing actual BMI by a BMI equal to

Table 1
*Diagnostic Requirements for DSM-IV-TR and DSM-5 Eating Disorders in the Current Study*

| *DSM-IV-TR* | *DSM-5* |
|---|---|
| Anorexia nervosa (AN) | Anorexia nervosa (AN) |
| 1. BMI < 3rd percentile for age/sex (equivalent to BMI < 17.5 in adults) | 1a. BMI < 10th percentile for age/sex (equivalent to BMI < 18.5 in adults) |
| 2. Fear of weight gain ≥ 2 | 2a. Fear of weight gain ≥ 2 |
| 3. Body image disturbance: Importance of weight ≥ 2 OR importance of shape ≥ 2 OR feelings of fatness ≥ 2 | 3a. Body image disturbance: Importance of weight ≥ 2 OR importance of shape ≥ 2 OR feelings of fatness ≥ 2 |
| 4. Amenorrhea OR on hormonal contraception. | OR |
| | 1b. BMI ≤ 3rd percentile for age/sex |
| | 2b. Fear of weight gain ≥ 1 AND trying to restrict food intake ≥ 1 |
| | 3b. Body image disturbance: Importance of weight ≥ 2 OR importance of shape ≥ 2 OR feelings of fatness ≥ 2 |
| Bulimia nervosa (BN) | Bulimia nervosa (BN) |
| 1. Objective binge eating: Eating an unusually large amount of food ≥ 2 + loss of control over eating ≥ 2 | 1. Objective binge eating: Eating an unusually large amount of food ≥ 1 + loss of control over eating ≥ 1 |
| 2. Compensatory behaviors: Self-induced vomiting ≥ 2 OR laxative/pill use ≥ 2 OR hard exercise ≥ 2 | 2. Compensatory behaviors: Self-induced vomiting ≥ 1 OR laxative/pill use ≥ 1 OR hard exercise ≥ 2 |
| 3. Over-evaluation of weight/shape: Importance of weight ≥ 2 OR importance of shape ≥ 2 | 3. Over-evaluation of weight/shape: Importance of weight ≥ 2 OR importance of shape ≥ 2 |
| 4. BMI > 3rd percentile for age/sex | 4. BMI > 10th percentile for age/sex |
| Eating disorder not otherwise specified (EDNOS) | |
| Binge eating disorder: | Binge eating disorder (BED) |
| 1. Objective binge eating: Eating an unusually large amount of food ≥ 2 + loss of control over eating ≥ 2 | 1. Objective binge eating: Eating an unusually large amount of food ≥ 1 + loss of control over eating ≥ 1 |
| 2. Distress over binge eating: Concern over loss of control over eating ≥ 2 | 2. Distress over binge eating: Concern over loss of control over eating ≥ 1 |
| 3. Over-evaluation of weight/shape: Importance of weight ≥ 2 OR importance of shape ≥ 2 | 3. Over-evaluation of weight/shape: Importance of weight ≥ 2 OR importance of shape ≥ 2 |
| 4. BMI > 3rd percentile for age/sex | 4. BMI > 10th percentile for age/sex |
| 5. No self-induced vomiting or laxative/pill use | 5. No self-induced vomiting or laxative/pill use |
| 6. Hard exercise for weight control ≤ 1 | 6. Hard exercise for weight control ≤ 1 |
| | Other Specified Feeding or Eating Disorders (OSFED) |
| Other unspecified cases: | Purging disorder: |
| 1a. All criteria for DSM-IV AN are met except for amenorrhea | 1. Purging behaviour: Self-induced vomiting ≥ 1 OR laxative/pill use ≥ 1 |
| OR | 2. Over-evaluation of weight/shape: Importance of weight ≥ 2 OR importance of shape ≥ 2 |
| 1b. All criteria for DSM-IV AN are met except BMI is > 3rd percentile despite significant weight loss[1] | 3. BMI > 10th percentile for age/sex |
| OR | 4. No objective binge eating |
| 1c. All criteria for DSM-IV BN are met except that binge eating and compensatory behavior occur less than 2x week (ratings ≥ 1) | |
| OR | |
| 1d. Regular self-induced vomiting or laxative misuse is endorsed (ratings ≥ 1) in the absence of low weight or objective binge eating, but with over-evaluation of weight/shape (importance of weight ≥ 2 OR importance of shape ≥ 2) | Atypical anorexia nervosa: |
| | 1. BMI > 10th percentile despite significant weight loss[1] |
| | 2. Fear of weight gain ≥ 2 |
| | 3. Body image disturbance: Importance of weight ≥ 2 OR importance of shape ≥ 2 OR feelings of fatness ≥ 2 |

*Note.* A score of 1 equates to symptoms occurring once per week/a few times a month, and a score of 2 equates to symptoms occurring a few times a week. Over-evaluation of weight and shape is used as a diagnostic criterion for binge eating disorder in lieu of the cognitive-emotional criteria listed in *DSM-IV-TR* and *DSM-5* (which were not assessed in this study). BMI = Body mass index.
[1] Significant weight loss is defined as a reduction in percentage Ideal Body Weight (% IBW) that is ≥ 2 standard deviations of the cohort mean for change in % IBW, between age 10 and 14, age 14 and 17, or age 17 and 20 years.

the 50th percentile for age and sex, and then multiplying by 100. At age 14, we considered change in % IBW from age 10 to age 14, by dividing % IBW at 14 by % IBW at 10. The same process was used to consider changes between ages 14 and 17, and ages 17 and 20. On average across all Raine Study participants, % IBW changed by approximately 2% between assessment points, with a standard deviation of 9%–10% (these changes included a decrease of 2% from age 10 to age 14, an increase of 2% from age 14 to age 17, and an increase of 1% from age 17 to age 20). We defined significant weight loss as a reduction in % IBW that was at least two standard deviations more than the sample mean, equating to a reduction of at least 18%–20% IBW over a 3- to 4-year time period.

The mean of items relating to dietary restraint and eating, weight and shape concerns, excluding core diagnostic items (i.e., overevaluation of shape, overevaluation of weight, fear of weight gain, feelings of fatness), was computed as a global index of eating disorder psychopathology. Diagnostic items were excluded so that the index would represent eating disorder psychopathology distinct from diagnostic requirements, facilitating the comparison of dietary restraint and eating, weight and shape concerns across different diagnostic groups.

**Depressive symptoms.** The self-report Beck Depression Inventory for Youth (BDI-Y; Beck, Beck, & Jolly, 2001) was used to assess depressive symptoms at ages 14 and 17. The BDI-Y is an adolescent adaptation of the adult Beck Depression Inventory-2

(BDI-2) and has well-established psychometric properties (Eack, Singer, & Greeno, 2008). Alpha coefficients in this sample were .97 at age 14 and .94 at age 17.

The 21-item Depression Anxiety Stress Scale (DASS; Lovibond & Lovibond, 1995) was used to assess depressive symptoms at age 20. The DASS has demonstrated reliability and validity in clinical and nonclinical samples (Henry & Crawford, 2005; Ng et al., 2007), and scores on the Depression subscale correlate highly with those on the adult BDI-2. The alpha coefficient for the Depression subscale in this sample at age 20 was .89.

**Quality of life.** The 12-item Short-Form Health Survey-12 (SF-12) (Ware, Kosinski, & Keller, 1996) was used to assess physical and mental quality of life at age 20. The SF-12 is a reliable, valid, and practical alternative to the longer SF-36 when assessing quality of life (Salyers, Bosworth, Swanson, Lamb-Pagone, & Osher, 2000; Ware et al., 1996). It makes use of norm-based scoring with a population mean of 50 ($SD$ = 10). Quality of life data were not collected at ages 14 or 17.

## Statistical Analyses

**Preliminary analyses.** Independent-samples $t$ tests were used to determine if participants included in this study (N = 1,383) differed in meaningful ways from participants who took part in none ($n$ = 961) or one ($n$ = 495) of the adolescent assessments. Participants were compared on family, parent, and psychosocial variables at ages 5, 8, and 10 years. Adolescent eating disorder symptoms were also compared across participants who provided data at two or more adolescent assessment points and those who took part in only one adolescent assessment.

After data screening, EM imputation using maximum likelihood estimation was used to impute missing eating disorder data for participants who completed two out of three adolescent assessments. Imputation was conducted using established principles and techniques (Kenward & Carpenter, 2007; Schafer & Graham, 2002) and is described below.

**Core analyses.** All core analyses were conducted for male and female participants separately.

To address Hypotheses 1 and 2, McNemar chi-square tests were used to compare the prevalence of *DSM–IV–TR* and *DSM-5* disorders at ages 14, 17, and 20. Analyses were conducted for all disorders combined and, where numbers permitted, separately for different diagnoses. To complement these analyses, generalized estimating equations were used to examine changes in eating disorder prevalence over the 6-year study period, for *DSM–IV–TR* and *DSM-5* separately. Generalized estimating equations account for correlations within individuals over time. Logistic binomial models were specified with a main effect of time, and the independence working correlation model was used (Wang & Carey, 2003).

To address Hypothesis 3, two sets of analyses were undertaken. First, logistic regression models were used to determine whether the presence of an eating disorder at one time point (e.g., age 14) predicted the presence of a disorder at a later time point (e.g., age 20). If a disorder was stable over time, early incidence of the disorder should predict later incidence of the disorder. Second, and where numbers permitted, cross-over in eating disorder diagnoses was considered. Fisher's exact tests were used to compare rates of cross-over for each eating disorder diagnosis.

To address Hypothesis 4, nonparametric Kruskal-Wallis and Mann–Whitney $U$ tests were used to compare depressive symptom scores and quality of life scores across *DSM–IV–TR* and *DSM-5* eating disorder diagnoses. Comparisons in global eating disorder symptom scores and BMI were also conducted. These analyses focused on differences *within* each of the *DSM* systems (e.g., *DSM-5* BN vs. *DSM-5* BED vs. no *DSM-5* disorder) rather than differences *across* the *DSM* systems (e.g., *DSM-5* BN vs. *DSM–IV–TR* BN). This was necessary due to overlap in group membership across *DSM–IV–TR* and *DSM-5* diagnoses.

For *DSM-5*, we distinguish between atypical AN and PD when discussing OSFED diagnoses.

All analyses were conducted in SPSS Statistics Version 20. Alpha was set at $p < .05$.

# Results

## Preliminary Analyses

**Participant characteristics.** Compared with participants included in this study (who completed two or more adolescent assessments), participants who completed no adolescent assessments were significantly more likely to be from single-parent families at 5, 8, and 10 years ($p < .001$), were significantly less likely to have employed parents at 5, 8, and 10 years ($p < .001$), had significantly lower family incomes at 5, 8, and 10 years ($p < .001$), and had significantly higher CBCL Externalizing Problem scores at 5, 8, and 10 years ($p$s = .001–.007). Results were similar for participants who completed one adolescent assessment, with the exception that this group was not more likely to be from a single parent family than participants who completed two or more adolescent assessments. These findings are consistent with the tendency for socially disadvantaged families to be lost to follow-up over time (Wolke et al., 2009).

When comparing eating disorder data across participants who completed one adolescent assessment (excluded from the current study) and those who completed two or more (included in the study), there were no significant between-groups differences in eating disorder symptom scores, or in the proportion of participants meeting criteria for an eating disorder ($p$s = .187–.986).

**Data imputation.** Missing eating disorder data were imputed for participants who completed two of the three adolescent assessments, using EM imputation with maximum likelihood estimation. Data were screened for patterns of missing variables prior to imputation. No evidence was found to suggest that data were not missing at random and Little's MCAR test was nonsignificant, $\chi^2(1399) = 1376$, $p = .664$. Data were imputed for 281 participants in total (141 participants at age 17 and 140 participants at age 20). The original raw dataset and imputed EM dataset were highly comparable in terms of estimated means and standard deviations for the eating disorder variables, eating disorder prevalence rates, and associations between eating disorder variables, depressive symptoms and quality of life. All subsequent analyses make use of the full, imputed data set.

## Hypotheses 1 and 2: Eating Disorder Prevalence Rates

**Male participants.** Prevalence rates for *DSM–IV–TR* and *DSM-5* eating disorders in males are shown in Figures 1a and 1b,

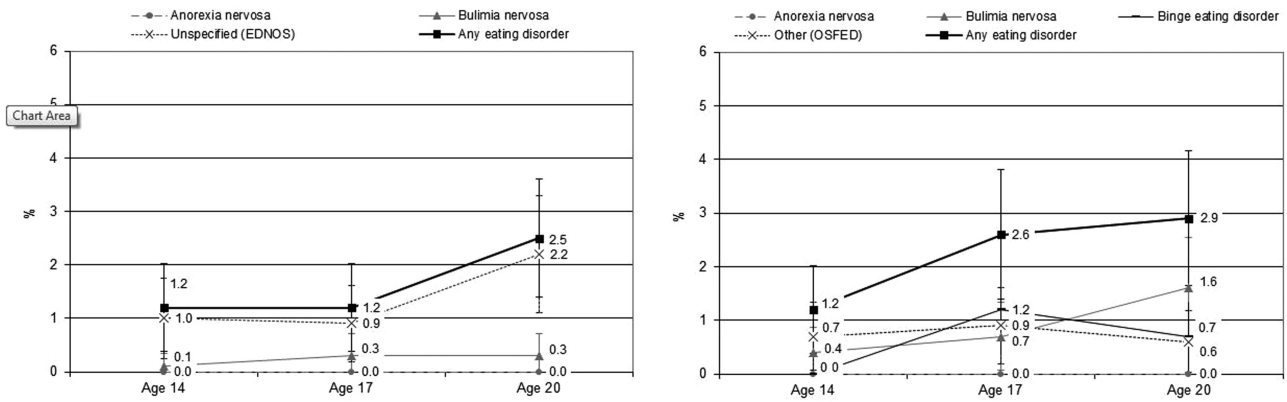


*Figure 1.* Prevalence rates (%, with 95% confidence intervals) for *DSM–IV–TR* eating disorders (Figure 1a) and *DSM-5* eating disorders (Figure 1b) in males ($n$ = 680) at ages 14, 17, and 20 years. EDNOS refers to Eating Disorder Not Otherwise Specified, and OSFED refers to Other Specified Feeding or Eating Disorder. Prevalence rates for *DSM–IV–TR* EDNOS disorders, and for *DSM-5* bulimia nervosa, increased significantly from age 14 to age 20.

respectively. When comparing total prevalence rates, there were no significant differences between *DSM–IV–TR* and *DSM-5* at age 14 (McNemar $\chi^2$ = 0.50, $p$ = .480) or age 20 (McNemar $\chi^2$ = 1.33, $p$ = .248). Rates were significantly higher when using *DSM-5* than *DSM–IV–TR* criteria at age 17 (McNemar $\chi^2$ = 8.10, $p$ = .004; see Figure 1).

Rates for *DSM-5* OSFED ("other" eating disorders) were significantly lower than rates for *DSM–IV–TR* EDNOS ("unspecified" eating disorders) at age 20 (McNemar $\chi^2$ = 6.67, $p$ = .010), but not at ages 14 (McNemar $\chi^2$ = 0.50, $p$ = .479) or 17 (McNemar $\chi^2$ = 0.10, $p$ = .752). Conversely, rates of BN were significantly higher under *DSM-5* than *DSM–IV–TR* at age 20 (McNemar $\chi^2$ = 7.11, $p$ = .008), but not at ages 14 (McNemar $\chi^2$ = 0.50, $p$ = .480) or 17 (McNemar $\chi^2$ = 2.25, $p$ = .134).

The prevalence of *DSM–IV–TR* eating disorders in males increased significantly from age 14 to age 20, Wald $\chi^2(2)$ = 7.54, $p$ = .023). As no boys met *DSM–IV–TR* criteria for AN, and very few met criteria for BN, this was largely due to a significant increase in the prevalence of unspecified EDNOS cases, Wald $\chi^2(2)$ = 7.02, $p$ = .030 (see Figure 1a).

The prevalence of *DSM-5* eating disorders did not change significantly between age 14 and age 20, overall, Wald $\chi^2(2)$ = 5.42, $p$ = .066), and there were also no significant changes in the prevalence of OSFED cases, Wald $\chi^2(2)$ = 0.17, $p$ = .919. The prevalence of BN did increase significantly from age 14 to age 20, Wald $\chi^2(2)$ = 6.55, $p$ = .038 (see Figure 1b). Group sizes were not sufficient to examine changes in *DSM-5* AN, BED, or specific OSFED categories in boys. Within the *DSM-5* OSFED category, there were three boys with PD at age 14 (0.4%), four with PD at age 17 (0.6%), and two with PD at age 20 (0.3%). At ages 14 and 20, two boys were classified with Atypical AN (0.3%), with no male participants receiving the diagnosis at age 17.

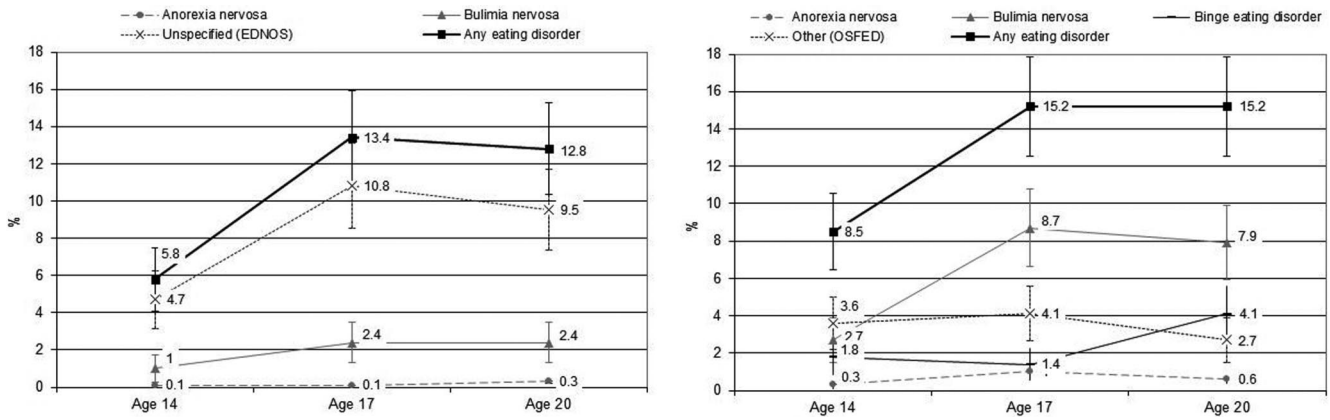


*Figure 2.* Prevalence rates (%, with 95% confidence intervals) for *DSM–IV–TR* eating disorders (Figure 1a) and *DSM-5* eating disorders (Figure 1b) in females ($n$ = 703) at ages 14, 17, and 20 years. EDNOS refers to Eating Disorder Not Otherwise Specified, and OSFED refers to Other Specified Feeding or Eating Disorder. Prevalence rates for *DSM–IV–TR* EDNOS, and for *DSM-5* bulimia nervosa and binge eating disorder, increased significantly from age 14 to age 20.

Table 2
*Univariate Associations (Odds Ratios [With 95% CI]) Between DSM-I-TRV and DSM-5 Eating Disorder Diagnoses at Ages 14 and 17, and Diagnoses at Ages 17 and 20, For Female Participants*

| | Age 14 to age 17 | | | Age 14 to age 20 | | |
|---|---|---|---|---|---|---|
| *DSM-IV* | Any | BN | EDNOS | Any | BN | EDNOS |
| Any | 4.84** [2.53, 9.24] | 4.72* [1.47, 15.10] | 3.64** [1.79, 7.42] | 2.66* [1.32, 5.35] | 4.72* [1.47, 15.10] | 2.65* [1.24, 5.66] |
| BN | 9.71* [2.14, 44.16] | 7.08 [0.80, 42.30] | 7.04* [1.54, 32.13] | 2.80 [0.53, 14.66] | 7.08 [0.80, 62.30] | 1.51 [0.18, 12.76] |
| EDNOS | 3.58* [1.73, 7.38] | 3.99* [1.09, 14.51] | 3.07* [1.39, 6.79] | 2.65* [1.24, 5.66] | 3.99* [1.09, 14.52] | 1.76 [0.71, 4.37] |

| | Age 14 to age 17 | | | | Age 14 to age 20 | |
|---|---|---|---|---|---|---|
| *DSM-5* | Any | BN | BED | PD± | Any | BN |
| Any | 4.83** [2.74, 8.55] | 5.41** [2.92, 10.00] | .02 [.01–.03] | 2.82 [0.77, 10.29] | 1.82 [0.96, 3.45] | 2.24* [1.04, 4.82] |
| BN | 4.46* [1.75, 11.36] | 5.65** [2.15, 14.86] | .01 [.00–.01] | 2.66 [0.33, 21.33] | 1.49 [0.48, 4.57] | 2.19 [0.62, 7.74] |
| BED | 9.90** [3.17, 30.89] | 15.92** [5.06, 50.14] | .01 [.00–.01] | .01 [.00–.01] | 2.50 [0.76, 8.28] | 2.10 [0.45, 9.71] |
| PD± | 3.53* [1.36, 9.19] | 2.46 [0.79, 7.61] | .01 [.00–.01] | 6.07* [1.27, 29.03] | 2.64 [0.98, 7.09] | 3.18* [1.02, 9.91] |

*Note.* Any = any eating disorder; BED = binge eating disorder; BN = bulimia nervosa; EDNOS = eating disorder not otherwise specified; PD = purging disorder. Diagnoses in the leftmost column were predictor variables, and diagnoses along the upper rows were dependent variables. Separate models were run to examine associations between 14-year diagnoses and 17-year diagnoses, 14-year diagnoses and 20-year diagnoses, and 17-year diagnoses and 20-year diagnoses.
* $p < .05$. ** $p < .01$. ± PD is an example of the Other Specified Feeding or Eating Disorder category in *DSM-5*.

**Female participants.** Prevalence rates for *DSM–IV–TR* and *DSM-5* eating disorders in females are summarized in Figures 2a and 2b, respectively.

Total prevalence rates were significantly greater when applying *DSM-5* than *DSM–IV–TR* criteria, at ages 14 (McNemar $\chi^2 = 11.08$, $p < .001$), 17 (McNemar $\chi^2 = 14.06$, $p < .001$), and 20 (McNemar $\chi^2 = 17.05$, $p < .001$). In large part, this was due to higher rates of BN when applying *DSM-5* criteria, at ages 14 (McNemar $\chi^2 = 10.08$, $p = .001$), 17 (McNemar $\chi^2 = 52.02$, $p < .001$), and 20 (McNemar $\chi^2 = 38.02$, $p < .001$). Rates of "unspecified"/"other" eating disorders were significantly lower when applying *DSM-5* than *DSM–IV–TR* criteria, at ages 14 (McNemar $\chi^2 = 8.47$, $p = .004$), 17 (McNemar $\chi^2 = 37.96$, $p < .001$), and 20 (McNemar $\chi^2 = 38.25$, $p < .001$).

The prevalence of *DSM–IV–TR* eating disorders in females increased significantly from age 14 to ages 17 and 20, Wald $\chi^2(2) = 19.33$, $p < 001$. This shift was largely accounted for by increases in the prevalence of unspecified EDNOS cases, Wald $\chi^2(2) = 12.49$, $p = 002$. The prevalence of AN was low and did not change significantly over time, Wald $\chi^2(2) = 0.32$, $p = .571$, nor did the prevalence of BN, Wald $\chi^2(2) = 4.94$, $p = .085$.

The prevalence of *DSM-5* eating disorders in females also increased significantly from age 14 to ages 17 and 20, Wald $\chi^2(2) = 19.66$, $p < .001$. There were no significant changes in the prevalence of OSFED cases, Wald $\chi^2(2) = 2.36$, $p = .307$. Instead, the prevalence of BN increased significantly from age 14 to ages 17 and 20, Wald $\chi^2(2) = 32.33$, $p < .001$, and the prevalence of BED increased significantly from age 14 to age 20, Wald $\chi^2(2) = 12.09$, $p = .002$. There were no significant changes in the prevalence of AN, which remained low, Wald $\chi^2(2) = 3.52$, $p = .172$.

Within the *DSM-5* OSFED category, the prevalence of PD was 2.7% ($n = 19$) at age 14, 2.1% ($n = 15$) at age 17, and 1.6% ($n = 11$) at age 20. These changes over time were not significant, Wald $\chi^2(2) = 2.09$, $p = .352$. The prevalence of atypical AN was low, at 0.9% ($n = 6$) at age 14, 0% at age 17, and 0.1% ($n = 1$) at age 20.

## Hypothesis 3: Eating Disorder Stability and Diagnostic Cross-Over

**Males.** Given the small number of male eating disorder cases, diagnosis-specific stability, and rates of diagnostic cross-over, were not considered for male participants. At an overall level, there was evidence of eating disorder continuity from age 14 to age 17, and from age 17 to age 20, among males. A *DSM–IV–TR* eating disorder at 14 significantly predicted a disorder at age 17 (OR 47.00, 95% CIs [10.66, 207.20], $p < .001$), and a *DSM–IV–TR* disorder at age 17 significantly predicted a disorder at age 20 (OR 46.43, 95% CIs [10.53, 204.69], $p < .001$). However, 95% confidence intervals for odds ratios were extremely large, suggesting considerable uncertainty in the magnitude of associations. There was no significant association between 14-year eating disorder status and 20-year eating disorder status ($p = .511$).

The presence of a *DSM-5* eating disorder at age 17 was also significant in predicting a *DSM-5* disorder at age 20 (OR 39.45, 95% CIs [13.40, 116.12], $p < .001$), but there were no significant associations between a *DSM-5* eating disorder at age 14 and a disorder at either 17 ($p = .999$) or 20 ($p = .999$).

**Females.** For females, it was possible to consider the stability of eating disorders overall and by diagnosis. Results are summarized in Table 2. Overall, a *DSM–IV–TR* eating disorder at age 14 significantly predicted a disorder at ages 17 and 20, and a *DSM–IV–TR* disorder at age 17 significantly predicted a disorder at age 20 (see Table 2). When considering specific diagnoses, BN at age 14 predicted EDNOS (but not BN) at age 17, and BN at age 17 predicted EDNOS disorder (but not BN) at age 20. There were no significant associations between BN at age 14 and *DSM–IV* disorders at age 20. An unspecified EDNOS diagnosis at age 14 predicted EDNOS and BN at age 17, and BN only at age 20. An unspecified EDNOS diagnosis at age 17 predicted EDNOS and BN at age 20.

| Age 17 to age 20 | | |
|---|---|---|
| Any | BN | EDNOS |
| 10.30** [6.18, 17.20] | 6.73** [2.53, 17.95] | 9.37** [5.44, 16.16] |
| 8.52** [3.20, 22.72] | 10.29 [2.65, 39.86] | 5.30* [1.90, 14.81] |
| 8.51** [4.94, 14.65] | 3.98* [1.36, 11.65] | 8.62** [4.86, 14.27] |

| Age 14 to age 20 | | Age 17 to age 20 | | | |
|---|---|---|---|---|---|
| BED | PD± | Any | BN | BED | PD± |
| 1.27 [0.37, 4.34] | 0.01 [0.00, 0.01] | 11.56** [8.18, 18.64] | 17.58** [9.58, 32.24] | 1.89 [0.79, 4.55] | 7.27* [2.18, 24.29] |
| 1.30 [0.17, 10.10] | 0.01 [0.00, 0.01] | 8.00** [4.73, 13.54] | 12.31** [6.74, 22.51] | 1.03 [0.30, 3.49] | 3.44 [0.89, 13.28] |
| 1.97 [0.25, 15.69] | 0.01 [0.00, 0.01] | 5.73* [1.63, 20.14] | 5.07* [1.28, 20.17] | 2.64 [0.32, 21.56] | 7.59 [0.88, 55.59] |
| 1.30 [0.17, 10.10] | 0.01 [0.00, 0.01] | 6.72** [2.38, 18.94] | 6.11* [2.01, 18.56] | 1.68 [0.21, 13.26] | 11.61* [2.28, 49.09] |

For *DSM-5*, an eating disorder at age 14 significantly predicted a disorder at age 17, but not at age 20, and a disorder at age 17 significantly predicted a disorder at age 20 (see Table 2). The 3-year stability of BN was strong, with significant associations between BN at 14 and BN at 17, and between BN at 17 and BN at 20. A BN diagnosis at 14 did not predict any other eating disorder diagnosis at age 17, and it did not predict BN or other diagnoses at age 20. Although no diagnoses were significant in predicting BED over time, BED at age 14 was a significant predictor of BN at age 17, and BED at age 17 was a significant predictor of BN at age 20. Purging disorder at age 14 predicted PD at age 17 and BN at age 20, and PD at age 17 predicted PD and BN at age 20.

Patterns of diagnostic cross-over for female participants are summarized in Table 3. Statistical comparisons were not conducted for AN or atypical AN, due to small group sizes.

For *DSM–IV–TR*, there were no significant differences in diagnostic cross-over rates for BN and those for unspecified disorders (Fisher's exact test $p = .610$).

For *DSM-5*, cross-over rates were significantly lower for participants with an initial diagnosis of BN compared with participants with an initial diagnosis of BED (Fisher's exact test $p = .009$) or PD (Fisher's exact test $p = .009$). Cross-over was comparable for BED and PD (Fisher's exact test $p = .692$), and the likelihood of progressing to BN did not differ significantly across those with an initial diagnosis of BED and those with an initial diagnosis of PD (Fisher's exact test $p = .086$). Nonetheless, it is worth noting that the proportion of BED participants progressing to a BN diagnosis was double the proportion of PD participants making this transition (52% vs. 26%; see Table 3).

When comparing *DSM–IV–TR* and *DSM-5* directly, cross-over was significantly more likely for *DSM–IV–TR* BN than for *DSM-5*

Table 3
*Diagnostic Cross-Over From Initial DSM-IV-TR or DSM-5 Eating Disorder Diagnosis to Later Diagnoses, for Female Participants (*N *[% of Initial Diagnosis])*

| Initial diagnosis | Subsequent diagnosis | | | |
|---|---|---|---|---|
| *DSM-IV* | Anorexia nervosa | Bulimia nervosa | Unspecified (EDNOS) | No disorder |
| Anorexia nervosa ($n = 1$) | 1 (100%) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) |
| Bulimia nervosa ($n = 20$) | 0 (0.0%) | 2 (10.0%) | 8 (40.0%) | 10 (50.0%) |
| Unspecified (EDNOS) ($n = 96$) | 1 (1.0%) | 6 (6.2%) | 32 (33.3%) | 57 (59.4%) |

| | | | | Other (OSFED) | | |
|---|---|---|---|---|---|---|
| *DSM-5* | Anorexia nervosa | Bulimia nervosa | Binge eating disorder | Atypical anorexia± | Purging disorder± | No disorder |
| Anorexia nervosa ($n = 7$) | 1 (14.3%) | 2 (28.6%) | 1 (14.3%) | 1 (14.3%) | 0 (0.0%) | 2 (28.6%) |
| Bulimia nervosa ($n = 71$) | 1 (1.4%) | 28 (39.4%) | 2 (2.8%) | 0 (0.0%) | 4 (5.6%) | 36 (50.7%) |
| Binge eating disorder ($n = 23$) | 0 (0%) | 12 (52.2%) | 2 (8.7%) | 0 (0.0%) | 1 (4.3%) | 8 (34.8%) |
| Atypical anorexia ± ($n = 7$) | 0 (0%) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) | 7 (100%) |
| Purging disorder ± ($n = 31$) | 1 (3.2%) | 8 (25.9%) | 2 (6.4%) | 0 (0.0%) | 4 (12.9%) | 16 (51.6%) |

*Note.* EDNOS = eating disorder not otherwise specified (*DSM-IV-TR*); OSFED = Other Specified Feeding or Eating Disorder (*DSM-5*).
± Atypical anorexia nervosa and purging disorder are examples of OSFED in *DSM-5*.

Table 4
*Depressive Symptoms, Quality of Life, Global Eating Disorder Symptoms, and BMI in Males (M(SD)), by DSM-I-TRV and DSM-5 Diagnoses*

| | Age 14 | | | | Age 17 | | | |
|---|---|---|---|---|---|---|---|---|
| | *n* | BMI | Global ED | BDI-Y | *n* | BMI | Global ED | BDI-Y |
| *DSM-IV* | | | | | | | | |
| Any disorder | 8 | 22.50 (3.99) | 1.47 $_{a}$ (0.66) | 15.37 (12.05) | 8 | 27.32 $_{a}$ (5.16) | 1.49 $_{a}$ (0.68) | 16.00 $_{a}$ (10.75) |
| No disorder | 635 | 20.89 (3.91) | 0.25 $_{b}$ (0.30) | 4.93 (5.08) | 672 | 22.70 $_{b}$ (4.13) | 0.24 $_{b}$ (0.34) | 5.95 $_{b}$ (7.27) |
| *DSM-5* | | | | | | | | |
| Any disorder | 8 | 22.50 (3.99) | 1.47 $_{a}$ (0.66) | 15.37 (12.05) | 18 | 26.81 $_{a}$ (4.31) | 1.30 $_{a}$ (0.53) | 16.80 $_{a}$ (5.03) |
| No disorder | 672 | 20.89 (3.91) | 0.25 $_{b}$ (0.30) | 4.93 (5.08) | 662 | 22.65 $_{b}$ (4.11) | 0.23 $_{b}$ (0.32) | 5.01 $_{b}$ (5.33) |

*Note.* Within *DSM-IV* and *DSM-5*, rows with different subscripts differ significantly at $p < .05$, as determined using non-parametric Mann-Whitney U tests. BMI = Body Mass Index; BDI-Y = Beck Depression Inventory-Youth; DASS = Depression Anxiety Stress Scale; Global ED = Global index of eating disorder symptoms; QoL = Quality of Life.



BN (Fisher's exact test $p = .015$), and movement from BN to an "unspecified" or "other" disorder was also significantly more likely with *DSM–IV–TR* than with *DSM-5* (Fisher's exact test $p < .001$). Conversely, diagnostic cross-over was significantly *less* likely for *DSM–IV* EDNOS than for *DSM-5* OSFED (Fisher's exact test $p = .009$; see Table 3).

## Hypothesis 4: Associations Between Eating Disorders, Depressive Symptoms, and Quality of Life

**Males.** Table 4 summarizes depressive symptom, quality of life scores, global eating disorder symptom, and BMI scores for male participants with and without an eating disorder, at ages 14, 17, and 20 and for *DSM–IV–TR* and *DSM-5* disorders separately. Global eating disorder symptom scores were significantly higher for boys with an eating disorder, at all ages and regardless of the diagnostic system used, than for boys without an eating disorder. Depression scores were also significantly higher for boys with an eating disorder, regardless of the diagnostic system used, at ages 17 and 20 but not at age 14. At age 20, physical health quality of life did not differ significantly by eating disorder category, but mental health quality of life was significantly lower for males with a *DSM–IV–TR* eating disorder and for those with a *DSM-5* eating disorder, compared with noneating disordered participants (see Table 4).

**Females.** Table 5 summarizes results for female participants by eating disorder diagnosis. Girls with *DSM–IV–TR* BN and EDNOS had significantly higher global eating disorder scores and depression scores at all time points than girls without a *DSM–IV–TR* disorder. At age 20, *DSM–IV–TR* BN and EDNOS were also associated with lower mental health quality of life, although not physical health quality of life (see Table 5). The only significant difference identified between *DSM–IV–TR* BN and EDNOS

Table 5
*Depressive Symptoms, Quality of Life, Global Eating Disorder Symptoms, and BMI in Females (M(SD)), by DSM-IV-TR and DSM-5 Diagnoses*

| | Age 14 | | | | Age 17 | | | |
|---|---|---|---|---|---|---|---|---|
| | *n* | BMI | Global ED | BDI-Y | *n* | BMI | Global ED | BDI-Y |
| *DSM-IV* | | | | | | | | |
| AN[1] | 1 | 15.58 | 2.67 | 20.00 | 1 | 16.91 | 1.78 | 34.00 |
| BN | 7 | 22.47 $_{a}$ (5.09) | 2.06 $_{a}$ (0.29) | 19.29 $_{a}$ (10.18) | 17 | 24.79 $_{a}$ (7.04) | 1.85 $_{a}$ (0.58) | 19.12 $_{a}$ (12.35) |
| EDNOS | 33 | 24.16 (5.69) | 1.46 $_{b}$ (0.54) | 13.73 $_{b}$ (9.19) | 76 | 24.45 $_{a}$ (5.18) | 1.56 $_{a}$ (0.52) | 19.05 $_{a}$ (11.68) |
| No disorder | 657 | 21.33 $_{b}$ (4.00) | 0.43 $_{c}$ (0.40) | 7.38 $_{c}$ (7.44) | 615 | 22.92 $_{b}$ (4.30) | 0.56 $_{b}$ (0.47) | 9.15 $_{b}$ (8.17) |
| *DSM-5* | | | | | | | | |
| AN[1] | 2 | 15.37 (0.31) | 1.39 (1.81) | 13.00 (9.90) | 7 | 18.01 (0.61) | 1.92 (0.67) | 25.67 (14.31) |
| BN | 19 | 25.60 $_{a}$ (6.67) | 1.74 $_{a}$ (0.44) | 14.17 $_{a}$ (9.47) | 61 | 24.90 $_{a}$ (5.49) | 1.64 $_{a}$ (0.53) | 19.17 $_{a}$ (12.03) |
| BED | 13 | 23.29 $_{a}$ (3.27) | 1.37 $_{a}$ (0.51) | 15.77 $_{a}$ (7.73) | 10 | 23.96 (3.78) | 1.22 $_{b}$ (0.34) | 14.40 $_{a}$ (7.21) |
| Atypical anorexia[1, ±] | 6 | 20.59 (3.31) | 0.69 (0.31) | 9.17 (2.49) | 0 | | | |
| PD[±] | 19 | 24.07 $_{a}$ (4.28) | 1.54 $_{a}$ (0.37) | 15.05 $_{a}$ (10.78) | 15 | 24.17 (3.86) | 1.37 $_{b}$ (0.36) | 18.13 $_{a}$ (10.90) |
| No disorder | 644 | 22.89 $_{b}$ (4.23) | 0.41 $_{b}$ (0.39) | 7.27 $_{b}$ (7.40) | 599 | 22.88 $_{b}$ (4.28) | 0.54 $_{c}$ (0.45) | 8.88 $_{b}$ (7.94) |

*Note.* Within *DSM-IV* and *DSM-5*, rows with different subscripts differ significantly at $p < .05$, as determined using non-parametric Mann-Whitney U tests. Between-group differences also persisted when analyses were re-run using Multivariate Analysis of Variance with BMI as a covariate. AN = anorexia nervosa; BED = binge eating disorder; BDI-Y = Beck Depression Inventory-Youth; BMI = Body Mass Index; BN = bulimia nervosa; DASS = Depression Anxiety Stress Scale; EDNOS = eating disorder not otherwise specified; Global ED = Global index of eating disorder symptoms; PD = purging disorder; QoL = Quality of Life.
[1] Details for these groups are provided for reference, but small group sizes precluded statistical comparisons with other diagnoses.
[±] Atypical anorexia nervosa and purging disorder are examples of the Other Specified Feeding or Eating Disorder category in *DSM-5*.

| | Age 20 | | | | |
|---|---|---|---|---|---|
| *n* | BMI | Global ED | DASS | Physical QoL | Mental QoL |
| 17 | 28.95 $_{a}$ (5.97) | 1.86 $_{a}$ (0.54) | 18.14 $_{a}$ (14.28) | 50.59 (7.95) | 41.17 $_{a}$ (11.03) |
| 662 | 24.33 $_{b}$ (4.48) | 0.30 $_{b}$ (0.37) | 5.56 $_{b}$ (6.75) | 53.62 (5.63) | 49.44 $_{b}$ (9.28) |
| 20 | 29.19 $_{a}$ (5.69) | 1.76 $_{a}$ (0.58) | 17.12 $_{a}$ (13.58) | 50.14 (8.22) | 41.71 $_{a}$ (10.72) |
| 659 | 24.30 $_{b}$ (4.46) | 0.29 $_{b}$ (0.37) | 6.76 $_{b}$ (0.31) | 53.65 (5.60) | 49.46 $_{b}$ (9.28) |

was at age 14, where participants with BN had higher global eating disorder scores than participants with EDNOS.

Girls with *DSM-5* BN, BED, and PD also had significantly higher global eating disorder symptom scores and depression scores at all time points than girls without a *DSM-5* disorder. Again, BN, BED, and PD were associated with lower mental health quality of life, but not physical health quality of life, at age 20. The only significant difference identified between *DSM-5* BN, BED, and PD was at age 17, where participants with BN had higher global eating disorder scores than participants with BED and PD (see Table 5).

## Discussion

This study is unique in describing the prevalence, stability, and psychosocial correlates of *DSM–IV–TR* and *DSM-5* eating disorders in male and female adolescents, using prospective data collected over 6 years. Consistent with Hypotheses 1 and 2, and with previous studies (Keel et al., 2011; Machado et al., 2013; Stice et al., 2013), eating disorder prevalence rates were significantly greater for female adolescents when applying *DSM-5* than *DSM–IV–TR* criteria, at all time points assessed, and a greater proportion of female eating disorder cases received an AN, BN, or BED diagnosis rather than an "unspecified" or "other" diagnosis. For males, partial support was obtained for the first two hypotheses, with *DSM-5* criteria associated with higher prevalence rates at age 17 but not ages 14 or 20, and lower rates of unspecified/other disorders at age 20 but not ages 14 or 17. Consistent with Hypothesis 3, there was evidence of moderate eating disorder stability and high rates of diagnostic cross-over. Consistent with Hypothesis 4, depressive symptoms and mental health quality of life were associated with *DSM–IV–TR* and *DSM-5* eating disorder diagnoses in males and in females.

We observed high rates of eating disorders in female participants irrespective of the diagnostic system applied. Our *DSM–*

| | Age 20 | | | | |
|---|---|---|---|---|---|
| *n* | BMI | Global ED | DASS | Physical QoL | Mental QoL |
| 2 | 16.54 (0.81) | 0.90 (1.00) | 8.00 (9.50) | 53.59 (10.90) | 46.21 (6.43) |
| 17 | 24.28 (4.47) | 2.04 $_{a}$ (0.54) | 14.43 $_{a}$ (10.62) | 53.18 (6.05) | 38.89 $_{a}$ (11.11) |
| 67 | 25.49 (5.90) | 1.63 $_{a}$ (0.50) | 15.41 $_{a}$ (11.30) | 50.80 (7.65) | 38.65 $_{a}$ (12.79) |
| 614 | 24.27 (5.13) | 0.65 $_{b}$ (0.51) | 6.58 $_{b}$ (6.82) | 42.53 (6.62) | 46.36 $_{b}$ (9.34) |
| 4 | 17.29 (1.04) | 1.04 (0.36) | 12.00 (8.72) | 47.40 (8.80) | 45.21 (3.71) |
| 55 | 24.34 (4.03) | 1.80 $_{a}$ (0.53) | 13.31 $_{a}$ (11.03) | 52.30 (7.19) | 39.36 $_{a}$ (12.53) |
| 29 | 27.89 $_{a}$ (6.83) | 1.40 $_{a}$ (0.46) | 15.31 $_{a}$ (10.70) | 48.99 (8.26) | 38.33 $_{a}$ (10.40) |
| 1 | 18.96 | 0.67 | 32.00 | 65.51 | 14.61 |
| 11 | 29.03 $_{a}$ (4.37) | 1.24 $_{a}$ (0.49) | 16.40 $_{a}$ (9.56) | 47.88 (7.50) | 43.08 $_{a}$ (11.27) |
| 595 | 24.14 $_{b}$ (5.06) | 0.63 $_{b}$ (0.50) | 6.33 $_{b}$ (6.61) | 52.68 (6.47) | 46.58 $_{b}$ (9.26) |

*IV–TR* rates are comparable with those from previous studies that assessed for broadly defined EDNOS as well as AN and BN (e.g., Isomaa et al., 2009; Kjelsas et al., 2004). However, our rates for *DSM-5* eating disorders are higher than those reported in Stice et al. (2013), the only prior study to undertake a longitudinal analysis of *DSM-5* disorders across adolescence. When considering differences between the two studies, prevalence rates for AN, BED, Atypical AN, and PD were broadly similar across the current study and Stice et al. (2013). Prevalence rates for BN were higher in this sample, although rates for OSFED disorders were higher in Stice et al. (2013). The higher incidence of OSFED cases in Stice et al.'s study (2013) can be explained readily, as their research assessed for subthreshold BN and BED where we did not. This stemmed from our frequency assessments not being fine-grained enough to detect binge eating and compensatory behaviors that occurred less often than weekly. Our frequency assessments may also account for the higher incidence of BN in this study, as we assessed binge eating and compensatory behavior "weekly or a few times per month" over a 1-month period. Stice et al. (2013) assessment converges with the *DSM-5* requirement of weekly episodes over a 3-month period, suggesting that our estimate of BN prevalence may be slightly inflated and/or capture some cases that would be better conceptualized as subthreshold BN.

This study did converge with Stice et al. (2013) in showing high rates of diagnostic cross-over from *DSM-5* BED to *DSM-5* BN in females, and high rates of disorder remission over 3 and 6 years. In our sample, diagnostic cross-over was lower for *DSM-5* BN than *DSM–IV–TR* BN, suggesting that the reduced frequency requirements of *DSM-5* may strengthen, rather than reduce, the continuity of BN over time. We also found *DSM-5* BN to have lower rates of cross-over than *DSM-5* BED or PD. Interestingly, BED and PD in early adolescence were significant in predicting BN in later adolescence, whereas BN in early adolescence did not predict other disorders at later time points. As with Stice et al. (2013), we observed depressive symptoms and impaired mental health quality of life for females with all forms of *DSM-5* eating disorders (as well as all forms of *DSM–IV–TR* eating disorders). Thus, the new *DSM-5* diagnoses appear to be capturing individuals with clinically significant difficulties.

For male participants, eating disorder prevalence rates were low irrespective of the diagnostic system applied and, contrary to predictions, *DSM-5* was associated with higher prevalence rates at age 17 only. There was also a greater proportion of BN cases, relative to OSFED cases, when applying *DSM-5* criteria at age 20. These results suggest that *DSM-5* may not impact on the assessment of male eating disorders in early adolescence, but could have benefits in detecting and/or defining symptoms in middle to late adolescence. Depressive symptoms and impairments in mental health quality of life were also linked to eating disorders in middle and late adolescent boys, for *DSM–IV–TR* and *DSM-5*, although 14-year cases showed nonsignificant trends toward distress.

There are four main implications arising from this research. First, the study provides the most comprehensive data to date on differences between *DSM–IV–TR* and *DSM-5* eating disorder rates, at different time points and for male and female participants separately. Results suggest that with *DSM-5*, marked increases in eating disorder prevalence may be expected for adolescent females in middle adolescence, particularly for BN, and that girls who develop BED or PD may be at risk for later BN. As with *DSM–IV–TR*, middle adolescence remains a potent period for prevention and intervention efforts with females. For males, *DSM-5* prevalence rates only increased after age 17, suggesting that research on male eating pathology may best be targeted to middle adolescence and early adulthood. Second, "other" eating disorder cases (OSFED) still make up a modest proportion of individuals receiving an eating disorder diagnosis under *DSM-5*. In this sample, the proportion was greater at age 14 (approximately 50% in males and 40% in females) than ages 17 or 20 (15% to 30%). Ongoing attention to eating disorder classification systems is therefore important, and further revision or specification of diagnostic categories may be possible in future *DSM* revisions. Third, the stability of *DSM–IV–TR* and *DSM-5* eating disorders in the community is low. For *DSM-5*, cross-over from BED to BN is common, and BED and PD in early adolescence predict BN in later adolescence. Fourth, depressive symptoms and poor mental health quality of life appear to be comparable across *DSM–IV–TR* and *DSM-5* diagnoses. This provides further support for the clinical significance of previously "unspecified" cases and suggests that any increases in the prevalence of eating disorders in *DSM-5*, relative to *DSM–IV–TR*, may be warranted.

There are also limitations of this research that deserve note. First, we assessed for eating disorder symptoms over 1 month, rather than 3 months, and our frequency categories approximated rather than matched *DSM* requirements. Others have found good convergence between self-report assessment of a 1 month time frame and interview assessment of a 3-month time frame (Berg et al., 2012), but replication of our results with a 3-month assessment period, and with strictly defined frequency criteria, is important. As noted, differences between our frequency assessments and those of Stice et al. (2013) may have contributed to the prevalence differences between these studies. They also prevented us from assessing for subthreshold BED or BN. Second, we did not directly address criterion B for *DSM-5* BED. Instead, we used overevaluation of weight or shape as a proxy marker for this criterion. This may be viewed as a conservative assessment approach, but means that our definition should be taken as an approximation, rather than strict assessment, of *DSM-5* BED. It may also have contributed to the tendency for participants with BED in early adolescence to transition to BN (where overevaluation of weight and shape is a diagnostic criterion) with time. Research that directly assesses all BED criteria is clearly important. Third, group sizes for eating disorder diagnoses varied and at times were small, particularly for male participants. Our reported prevalence rates should be interpreted with this in mind, and in the context of 95% confidence intervals. Fourth, we did not assess night eating syndrome, which is included as an example of OSFED in *DSM-5*. Fifth, the loss of disadvantaged families is a well-replicated phenomenon in longitudinal cohort studies (Wolke et al., 2009) and was observed here. Notably, the Raine Study initially oversampled socially disadvantaged women, meaning that attrition has served to increase the representativeness of the cohort over time. Previous analyses have shown that participants who remained in the study to adolescence are broadly comparable with the Western Australian population on a range of sociodemographic indicators (Li et al., 2008). Despite this, replication of our results in other cohorts is important and would help to strengthen the findings observed here.

In summary, we have provided new data on the prevalence, stability, and psychosocial impact of *DSM–IV–TR* and *DSM-5* eating disorders in male and female adolescents. Results confirm that eating disorder rates are likely to increase slightly, overall, with the release of *DSM-5*. Rates for BN may be expected to increase markedly in middle adolescent females. Binge eating or purging alone in initial presentation appear to predict binge eating and purging in combination with time. All *DSM–IV–TR* and *DSM-5* eating disorder diagnoses were associated with psychological distress in this sample, confirming the clinical significance of BED and "other" (including PD) disorders.

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