## Title

Gender-based clinical differences in evidence-based treatment for adolescent anorexia nervosa: analysis of aggregated randomized controlled trials



## Journal

Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity, 27(3)

## ISSN

1124-4909

## Authors

Gorrell, Sasha
Hughes, Elizabeth K
Sawyer, Susan M
et al.

## Publication Date

2022-04-01

## DOI

10.1007/s40519-021-01257-7

Peer reviewed

HHS Public Access

Author manuscript

*Eat Weight Disord*. Author manuscript; available in PMC 2023 April 01.

Published in final edited form as:

*Eat Weight Disord*. 2022 April ; 27(3): 1123–1130. doi:10.1007/s40519-021-01257-7.

# Gender-based clinical differences in evidence-based treatment for adolescent anorexia nervosa: Analysis of aggregated randomized controlled trials

**Sasha Gorrell, PhD**[1], **Elizabeth K. Hughes, PhD**[2,3], **Susan M. Sawyer, MD**[2,3,4], **Savannah R. Roberts, BS**[5], **Jason M. Nagata, MD**[6], **Michele Yeo, PhD**[2,4], **James Lock, MD, PhD**[7], **Daniel Le Grange, PhD**[1,8]

[1]Department of Psychiatry and Behavioral Sciences, UCSF Weill Institute for Neurosciences, University of California, San Francisco, San Francisco, CA, USA

[2]Department of Paediatrics, The University of Melbourne, Melbourne, Australia

[3]Centre for Adolescent Health, Murdoch Children's Research Institute and Royal Children's Hospital, Melbourne, Australia

[4]Department of Adolescent Medicine, Royal Children's Hospital, Melbourne, Australia

[5]Department of Psychological and Brain Sciences, University of Delaware, DE, USA

[6]Department of Pediatrics, University of California, San Francisco, CA, USA

[7]Department of Psychiatry and Behavioral Sciences, Stanford University, Stanford, CA, USA

[8]Department of Psychiatry & Behavioral Neuroscience, The University of Chicago, Chicago, IL, USA (Emeritus)

## Abstract

**Purpose:** Boys represent a small proportion of samples in randomized clinical trials (RCT) investigating evidence-based treatment for adolescents with anorexia nervosa (AN). Consequently, knowledge of potential gender differences in clinical characteristics and treatment response in adolescents is considerably limited.

**Methods:** Secondary analyses of aggregated data from two RCTs were used to characterize baseline and end-of-treatment clinical features in male and female adolescents with AN ($n$ = 228, 10.53% male). Mixed analyses of variance were used to investigate potential gender differences in treatment response relative to weight outcomes (%median BMI) and eating disorder cognitions (Eating Disorder Examination Global scores; EDE).

Article Correspondence: Sasha Gorrell, Department of Psychiatry and Behavioral Sciences, University of California, San Francisco. 401 Parnassus Avenue, San Francisco, CA 94143. Phone: 917-685-5436. Sasha.Gorrell@ucsf.edu.

**Authors' contributions:** All authors contributed to the study conception and design. Data preparation and analysis were performed by SG. The first draft of the manuscript was written by SG and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

**Consent to participate:** All participants provided informed consent or assent (i.e., for minors) prior to participation.

**Ethics Approval:** Approval of study protocols was obtained from the Institutional review boards at each participating institution. The procedures used in this study adhere to the tenets of the Declaration of Helsinki.

**Results:** There were no significant gender differences in prior inpatient care, illness duration, psychiatric comorbidity, or psychotropic medication use at baseline. Nor were there significant gender differences in binge eating, purging, or driven exercise at baseline or end-of-treatment. Girls reported elevated weight and shape concern compared to boys at baseline but overall reduction in EDE Global scores over the course of treatment did not differ according to gender. Boys gained more relative weight during treatment than girls, but this difference was statistically non-significant.

**Conclusion:** Overall findings do not suggest significant differences in treatment outcome relative to weight or ED cognitions, by gender. Current evidence suggests that, with the exception of shape and weight concerns, boys present with cognitive and behavioral symptoms as severe as their female counterparts which underscores the need for increased accuracy in assessment of these disorders in boys and young men.

**Level of evidence:** Level 1, secondary data analysis of randomized controlled trials

### Keywords

Anorexia nervosa; Boys; Gender; Adolescents; Eating disorder treatment

## Introduction

Anorexia nervosa (AN) is a serious psychiatric illness that is associated with increased mortality and high treatment costs [1], and constitutes a substantial global disease burden [2]. Eating disorders (EDs) commonly present during adolescence and young adulthood [3], with consistent evidence that early intervention yields the most promising treatment outcomes [4]. As such, increasing interest has been devoted to research on the treatment of adolescent AN. Although clinical populations with AN generally reflect a 1:10 male-to-female ratio [5], in population-based research in the United States, males comprise approximately one in four clinical presentations of AN [6]. Further, a recent study in community samples indicates that the prevalence of EDs in males is increasing at a faster rate than for females, and with comparable severity of symptoms [7–8]. Despite this, less than 1% of peer-reviewed research has specifically addressed male presentations of AN [9].

According to DSM-5, diagnostic criteria for AN includes a profound fear of weight gain, energy restriction that leads to considerable weight loss, and severe body image distortion [5]. While these are the criteria upon which diagnostic categorization is based, their use is predicated on the notion that EDs present similarly by gender. Some research has found less severe AN symptomology among adolescent boys than girls [10], though this could be due to lack of sensitivity in detecting and qualifying ED symptoms among males [11]. Perhaps as a consequence of assessment concerns, evidence from the study of gender differences in baseline clinical features of adult samples with AN is inconsistent [8]. A review of case reports of adults with AN noted many similarities between men and women, yet also highlighted important differences in clinical features [12]. For example, among many similarities, one matched clinical cohort study found lower BMI and higher weight suppression among men with AN than women upon admission to an inpatient

treatment program [13]. In contrast, in a sample of adult inpatients, no differences in AN psychopathology between men and women were evident [14].

Compared to knowledge of gender differences in adults with AN, there is considerably less knowledge about adolescents. Overall, adolescent boys with AN may be less concerned with their weight than girls [15], but more preoccupied with obtaining a masculine shape [16]. Further, biological differences may contribute to differences in anthropometric and physiological indicators of AN, such as BMI and tachycardia [16–17]. However, less than one in ten adolescent boys with an ED seeks treatment, which is half the rate seen in girls (8.9% v. 19.9%) [18]. Accordingly, boys have comprised roughly 10% of recent RCTs of treatment efficacy for adolescent AN [19–23]. Within this modest proportion, it remains unclear whether certain clinical characteristics are seen more commonly in boys who present for ED treatment, or if there are ways in which gender may contribute to treatment outcomes. Specifically, AN encompasses both cognitive and physiological features, yet most research has primarily focused on weight-based outcomes as indices of recovery [24]. With some research suggesting differences in the cognitive features of AN between adolescent girls and boys [16], both behavioral and cognitive outcomes must be considered to fully capture adolescents' treatment response [24]. In prior investigation of moderators of treatment outcome in adolescent AN, gender did not demonstrate significant effects, likely due to modest sample size [25]. Aggregating data across two AN RCTs, the current study aimed to first characterize potential baseline differences by gender among adolescents and then, to determine potential gender differences in treatment response relative to weight (i.e., %mBMI) and ED cognitions at end-of-treatment (EOT). Based upon consensus from limited adolescent literature (e.g., [26]), we anticipated that girls would demonstrate greater baseline eating pathology, as measured by standard assessment, than male counterparts. Given the nascent evidence to date on ED treatment response among adolescent boys, these hypotheses remained exploratory.

## Methods

### Participants

This study includes data from two RCTs that tested the comparative efficacy of certain adolescent ED treatments for AN. A detailed description of each study sample can be referenced in their respective main outcome reports (c.f., [19, 23]). Briefly, participants for the current analyses ($N = 228$; 10.5% boys) were aged 12–18 years, and met DSM-IV-TR criteria for AN, excluding the amenorrhea criterion [27]. Participants were randomized to one of several active treatment types: parent-focused treatment for AN (PFT; $n = 52$), adolescent focused therapy for AN (AFT; $n = 60$), or family-based treatment (FBT; $n = 116$). Treatment comprised 18 outpatient sessions over 6 months (PFT v. FBT) [23] or 24 sessions over one year (AFT v. FBT) [19], respectively. Within each study, diagnoses and symptom reports were determined by the Eating Disorder Examination interview (EDE; [28]). Institutional review boards at each participating institution approved study protocols, and all participants provided informed consent or assent (i.e., for minors) prior to participation.

### Measures and Procedure

Within each study, demographic and clinical characteristics were evaluated for all participants during an initial clinic visit (i.e., baseline), and at EOT. For the purposes of the current study, only measures of relevance to our primary research question are noted.

**Eating Disorder Examination.—**Diagnoses were determined by EDE interview, which has demonstrated good reliability and validity [29]. The EDE Global score was used to determine baseline and subsequent ED pathology.

**Weight and Height.—**Weight and height were measured at baseline, with weight regularly measured throughout the course of treatment. Based on average expected BMI at a given age and height, % median BMI (%mBMI) was calculated for each patient [30].

**Gender.—**During intake assessment, adolescents were asked to self-identify their gender. Participants were provided with response options of ‘male’ or ‘female’ and were not asked to identify their sex at birth.

### Analytic Plan

Mann Whitney *U*- and chi-square tests were used to explore the extent to which male and female adolescents were comparable on baseline and EOT demographic and clinical characteristics. This non-parametric approach was selected for its robustness when considering unequal samples and non-normal distributions [31]. For the purposes of the current study, AN included restrictive type, and binge eating and purging subtype, and partial AN. There were no significant differences in baseline %mBMI or EDE Global scores according to type of treatment; we considered the full sample in further analyses without covarying treatment type. Two mixed repeated measures analyses of variance (rANOVA) were conducted to evaluate the between-subject effects of Gender (boys and girls), and within-subject effects of Time (baseline and EOT), and their interaction on (i) %mBMI and (ii) Global EDE scores. Analyses followed the commonly used interpretation of effect sizes as small ($d = 0.2$; $\eta 2 = 0.01$), medium ($d = 0.5$; $\eta 2 = 0.06$), and large ($d = 0.8$; $\eta 2 = 0.14$), based on benchmarks suggested by Cohen (1988) [32]. Analyses were conducted using SPSS software (V. 27).

## Results

### Descriptive characteristics

Full descriptive results are available in Table 1. At baseline, there were no gender differences in %mBMI, prior inpatient care, duration of illness, likelihood of psychiatric comorbidity, or psychotropic medication use ($p > .05$). At baseline and EOT, boys and girls reported non-significant differences in rates of binge eating, self-induced vomiting, and driven exercise ($p > .05$). Gender differences in EDE Global scores were non-significant at baseline, but at EOT, girls reported significantly higher scores ($p = .003$, $d = 0.68$).

### Gender differences in treatment outcomes

Results from the rANOVA model for %mBMI indicated a significant main effect of Time, $F(1, 208) = 158.58$, $p < .001$ (Table 2). Although weight was increased at EOT compared to baseline across the full sample, and boys showed higher %mBMI than girls at EOT (Figure 1), effects were non-significant for Gender ($p = .17$) and the interaction of Gender X Time ($p = .09$). The rANOVA model for EDE Global scores indicated significant main effects for Gender, $F(1, 196) = 6.29$, $p = .01$, and Time, $F(1, 196) = 34.86$, $p < .001$. Girls demonstrated consistently higher EDE scores, and both boys and girls showed reduction in these scores over time, but their interaction was not significant ($p = .92$).

## Discussion

In aggregating RCT samples, the current study provides a unique opportunity to examine eating pathology in a mixed-gender sample of adolescents with AN. At baseline, all clinical characteristics (e.g., illness duration; prior hospitalization) and behavioral symptoms (e.g., binge eating; driven exercise) appeared similar by gender. EDE Global scores were comparable between girls and boys at entry to treatment, with the exception of elevated shape and weight concerns among girls. Boys gained more weight during the course of treatment than girls, but relative to gender, this difference was not significant. Notably, although girls began and ended treatment with higher ED cognitive symptoms, the reductions in these scores over time during treatment appeared to be comparable across boys and girls.

Taken together, these findings may indeed indicate that adolescent girls with restrictive EDs experience greater cognitive symptoms than boys both at baseline and at EOT. Alternatively, as boys who do not seek treatment as a result of increased stigma associated with these disorders in boys and men [33] were not captured, it might be that this underrepresented group reports elevated ED pathology on par with female counterparts. More than half of boys who first present for treatment for an ED meet hospital admission criteria [34], suggesting that a latency in illness detection or treatment seeking renders boys with vulnerability for worsening of symptoms due to a delay in care. Further, lower EDE scores reported among boys in the current study may reflect the known limitations of standard assessments in capturing body image dissatisfaction specific to a muscular ideal that may be particularly salient among boys and men with restrictive EDs [35–36]. Future work is necessary to determine which of these three possibilities, individually or in combination, might be contributing to the current study findings. Regardless of study design and sample characteristics in future investigations, a shift towards greater gender-sensitivity in the nature of questions that are routinely integrated into studies aiming to index disordered eating across gender is indicated (i.e., in an effort to improve sensitivity to a range of body image concerns that may vary across the spectrum of gender) [37].

While the current study cannot definitively explain *why* gender differences exist in treatment outcomes, the patterns demonstrated in response to treatment may be informative. Specifically, results suggest that adolescent girls' cognitive symptoms remain higher than that of boys' across treatment, and by comparison, their reduction may even be delayed. In support of this, EDE Global scores (i.e., subscale score mean) did not differ by

gender at baseline, but were significantly elevated for girls compared to boys by EOT. Therefore, adolescent boys with AN may demonstrate greater improvement in cognitive symptoms within the context of treatment than girls. Given consistent evidence that cognitive symptoms of AN typically remit more slowly than weight-related indices of recovery in specialized ED treatment [38], future work should examine gender differences in cognitive symptomology over extended trajectories of treatment response (e.g., 12-plus months post-treatment). Future work might also determine if a reduction in EDE scores reflects a true latency, or instead, if parity among boys may never come about due to normative differences across gender, even among those who are not diagnosed with an ED. Regarding weight outcomes, boys achieved nearly 95% of their mBMI by EOT, compared to only 91% achieved among girls. Although this percent change did not indicate a significant interaction relative to gender, the suggestion that it is possible that treatment response among boys with AN in both cognitive and weight outcomes may exceed that of girls is encouraging, given that there are no current ED treatments, or modifications, specifically tailored for boys or men.

In addition to weight and cognitive outcomes, behavioral symptoms may provide some indication of those more severe in presentation at baseline and/or responsive to treatment. In the current study sample, boys and girls appeared to experience the same level of behavioral symptom severity (i.e., binge eating, self-induced vomiting, and driven exercise) at baseline and at EOT. These findings support prior research in adult samples indicating that men may experience equal severity in binge eating (see [8] for review) and once in treatment, men may have comparable behavioral outcomes to women [13]. The current study included both restricting and binge eating and purging subtypes within the AN group; it is possible that results may vary in future samples where behavioral symptoms may be differently represented. It is noteworthy that driven exercise was comparably reported across gender, both at baseline and EOT. These findings support evidence from prior work suggesting that while reports of eating pathology may be overall lower among men than women, exercise may be particularly problematic in the clinical profile of male EDs [39–40].

## Limitations

Although increased clinical sample size via aggregate data is a strength of the current study, the number of adolescent boys was still modest. Other limitations related to sample size include the necessity of combining all variants of AN into one group; future work may examine potential differences in presentation specific to meeting DSM-5 criteria specifically, as well as relative to restricting or binge eating and purging presentation. An additional limitation of the data was the self-report binary gender categorization, a constraint that did not allow us to examine potential differences in clinical presentation relative to a broader spectrum of gender. Further, in this particular sample, adolescents did not report sex at birth which prevented examination of any effects related to cisgender status.

## Conclusions

These results do not appear to support significant disparities in evidence-based treatment outcome across gender. Overall findings suggest that adolescent boys present to treatment with symptoms that are as severe as their female counterparts, highlighting that, in

the context of less help-seeking than in girls [18], increased awareness and accurate identification of these disorders among boys and men is crucial. It also appears that with respect to relative weight gain, and reduction in cognitive ED symptoms, boys respond similarly to girls in the context of clinical research trials specific to AN. Taken together, results support the full delineation of indices of weight, cognitive, and behavioral AN symptomatology in future research and clinical practice. Such an approach may foster a more nuanced and improved understanding of their respective presentations within gender, combined patterns of change, and the temporal relationship between them.

## Funding:

Dr. Gorrell is supported by the National Institute of Mental Health (K23MH126201). Funding support for the original studies was provided by National Institutes of Health grants R01-MH-070621 (Dr Lock) and by a grant from the Baker Foundation (Australia). The Murdoch Children's Research Institute is supported by the Victorian Government's Operational Infrastructure Support Program.

### Financial Disclosure:

Drs. Le Grange and Lock receive royalties from Guilford Press and Routledge Press for books on family-based treatment and are co-owner of the Training Institute for Child and Adolescent Eating Disorders which trains professionals in family-based treatment. On behalf of all identified authors, we wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

## Availability of data and material:

The raw data supporting the conclusions of this manuscript will be made available by the authors, without undue reservation, to any qualified researcher.

## References

1. Van Hoeken D, & Hoek HW (2020). Review of the burden of eating disorders: mortality, disability, costs, quality of life, and family burden. Current Opinion in Psychiatry, 33(6), 521–527. doi:10.1097/yco.0000000000000641 [PubMed: 32796186]
2. Erskine HE, Whiteford HA, & Pike KM (2016). The global burden of eating disorders. Current Opinion in Psychiatry, 29(6), 346–353. doi:10.1097/yco.0000000000000276 [PubMed: 27532942]
3. Swanson SA (2011). Prevalence and Correlates of Eating Disorders in Adolescents. Archives of General Psychiatry, 68(7), 714. doi:10.1001/archgenpsychiatry.2011.22 [PubMed: 21383252]
4. Treasure J, & Russell G (2011). Early intervention in anorexia nervosa. British Journal of Psychiatry, 199(5), 432–432. doi:10.1192/bjp.199.5.432a
5. American Psychiatric Association. (2013). Diagnostic and statistical manual of mental disorders (DSM-5®). doi:10.1176/appi.books.9780890425596.x00diagnosticclassification
6. Hudson JI, Hiripi E, Pope HG, & Kessler RC (2007). The Prevalence and Correlates of Eating Disorders in the National Comorbidity Survey Replication. Biological Psychiatry, 61(3), 348–358. doi:10.1016/j.biopsych.2006.03.040 [PubMed: 16815322]
7. Mitchison D, Hay P, Slewa-Younan S, & Mond J (2014). The changing demographic profile of eating disorder behaviors in the community. BMC Public Health, 14(1). doi:10.1186/1471-2458-14-943
8. Mitchison D, & Mond J (2015). Epidemiology of eating disorders, eating disordered behaviour, and body image disturbance in males: a narrative review. Journal of Eating Disorders, 3(1). doi:10.1186/s40337-015-0058-y
9. Murray SB, Griffiths S, & Mond JM (2016). Evolving eating disorder psychopathology: Conceptualising muscularity-oriented disordered eating. British Journal of Psychiatry, 208(5), 414–415. doi:10.1192/bjp.bp.115.168427

10. Darcy AM, Doyle AC, Lock J, Peebles R, Doyle P, & Grange DL (2012). The eating disorders examination in adolescent males with anorexia nervosa: How does it compare to adolescent females? International Journal of Eating Disorders, 45(1), 110–114. 10.1002/eat.20896
11. Darcy AM, & Lin IHJ (2012). Are we asking the right questions? A review of assessment of males with eating disorders. Eating Disorders, 20(5), 416–426. [PubMed: 22985238]
12. Crisp A, Gowers S, Joughin N, McClelland L, Rooney B, Nielsen S, … & Hartman D (2006). Anorexia nervosa in males: Similarities and differences to anorexia nervosa in females. European Eating Disorders Review, 14, 163–167. doi:10.1002/erv.703
13. Voderholzer U, Hessler JB, Naab S, Fichter M, Graetz A, Greetfeld M, … Schlegl S (2018). Are there differences between men and women in outcome of intensive inpatient treatment for anorexia nervosa? An analysis of routine data. European Eating Disorders Review, 27(1), 59–66. doi:10.1002/erv.2624 [PubMed: 30028060]
14. Zayas LV, Wang SB, Coniglio K, Becker K, Murray HB, Klosterman E, Kay B, Bean P, Weltzin T, Franko DL, Eddy KT, & Thomas JJ (2018). Gender differences in eating disorder psychopathology across DSM-5 severity categories of anorexia nervosa and bulimia nervosa. International Journal of Eating Disorders, 51(9), 1098–1102. 10.1002/eat.22941
15. Strober M, Freeman R, Lampert C, Diamond J, Teplinsky C, & DeAntonio M (2006). Are there gender differences in core symptoms, temperament, and short-term prospective outcome in anorexia nervosa? International Journal of Eating Disorders, 39(7), 570–575. doi:10.1002/eat.20293
16. Muise AM, Stein DG, & Arbess G (2003). Eating disorders in adolescent boys: a review of the adolescent and young adult literature. Journal of Adolescent Health, 33(6), 427–435. doi:10.1016/s1054-139x(03)00060-0
17. Nagata JM, Golden NH, Peebles R, Long J, Murray SB, Leonard MB, Carlson JL. Assessment of Sex Differences in Body Composition Among Adolescents With Anorexia Nervosa. J Adolesc Health. 2017 Apr;60(4):455–459. doi: 10.1016/j.jadohealth.2016.11.005. [PubMed: 28087266]
18. Forrest LN, Smith AR, & Swanson SA (2017). Characteristics of seeking treatment among US adolescents with eating disorders. International Journal of Eating Disorders, 50(7), 826–833. doi:10.1002/eat.22702
19. Lock J, Le Grange D, Agras WS, Moye A, Bryson SW, & Jo B (2010). Randomized Clinical Trial Comparing Family-Based Treatment With Adolescent-Focused Individual Therapy for Adolescents With Anorexia Nervosa. Archives of General Psychiatry, 67(10), 1025. doi:10.1001/archgenpsychiatry.2010.128 [PubMed: 20921118]
20. Agras WS, Lock J, Brandt H, Bryson SW, Dodge E, Halmi KA, … Woodside B (2014). Comparison of 2 Family Therapies for Adolescent Anorexia Nervosa. JAMA Psychiatry, 71(11), 1279. doi:10.1001/jamapsychiatry.2014.1025 [PubMed: 25250660]
21. Madden S, Miskovic-Wheatley J, Wallis A, Kohn M, Hay P, & Touyz S (2015). Early weight gain in family-based treatment predicts greater weight gain and remission at the end of treatment and remission at 12-month follow-up in adolescent anorexia nervosa. International Journal of Eating Disorders, 48(7), 919–922. doi:10.1002/eat.22414
22. Lock J, Le Grange D, Agras WS, Fitzpatrick KK, Jo B, Accurso E, … Stainer M (2015). Can adaptive treatment improve outcomes in family-based therapy for adolescents with anorexia nervosa? Feasibility and treatment effects of a multi-site treatment study. Behaviour Research and Therapy, 73, 90–95. doi:10.1016/j.brat.2015.07.015 [PubMed: 26276704]
23. Le Grange D, Hughes EK, Court A, Yeo M, Crosby RD, & Sawyer SM (2016). Randomized Clinical Trial of Parent-Focused Treatment and Family-Based Treatment for Adolescent Anorexia Nervosa. Journal of the American Academy of Child & Adolescent Psychiatry, 55(8), 683–692. doi:10.1016/j.jaac.2016.05.007 [PubMed: 27453082]
24. Murray SB, Loeb KL, & Le Grange D (2018). Treatment outcome reporting in anorexia nervosa: time for a paradigm shift?. Journal of Eating Disorders, 6(1), 1–3. [PubMed: 29344359]
25. Le Grange D, Lock J, Agras WS, Moye A, Bryson SW, Jo B, & Kraemer HC (2012). Moderators and mediators of remission in family-based treatment and adolescent focused therapy for anorexia nervosa. Behaviour research and therapy, 50(2), 85–92. [PubMed: 22172564]

26. Timko CA, DeFilipp L, & Dakanalis A (2019). Sex Differences in Adolescent Anorexia and Bulimia Nervosa: Beyond the Signs and Symptoms. Current Psychiatry Reports, 21(1). doi:10.1007/s11920-019-0988-1
27. American Psychiatric Association. (2000). Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR). doi:10.1176/appi.books.9780890423349
28. Cooper Z, & Fairburn CG (1987). The eating disorder examination: A semi-structured interview for the assessment of specific psychopathology of eating disorders. International Journal of Eating Disorders, 6, 1–8. 10.1002/1098-108X(198701)6:1<1::AID-EAT2260060102>3.0.CO;2-9
29. Berg KC, Peterson CB, Frazier P, & Crow SJ (2011). Psychometric evaluation of the eating disorder examination and eating disorder examination-questionnaire: A systematic review of the literature. International Journal of Eating Disorders, 45(3), 428–438. doi:10.1002/eat.20931
30. Ogden CL, Kuczmarski RJ, Flegal KM, Mei Z, Guo S, Wei R, … Johnson CL (2002). Centers for Disease Control and Prevention 2000 Growth Charts for the United States: Improvements to the 1977 National Center for Health Statistics Version. Pediatrics, 109(1), 45–60. doi:10.1542/peds.109.1.45 [PubMed: 11773541]
31. Erceg-Hurn DM, & Mirosevich VM (2008). Modern robust statistical methods: an easy way to maximize the accuracy and power of your research. American Psychologist, 63, 591–601. doi:10.1037/0003-066x.63.7.591
32. Cohen J (1988). Statistical Power Analysis for the Behavioral Sciences. New York, NY: Routledge Academic.
33. Griffiths S, Mond JM, Murray SB, & Touyz S (2014). The prevalence and adverse associations of stigmatization in people with eating disorders. International Journal of Eating Disorders, 48(6), 767–774. doi:10.1002/eat.22353
34. Vo M, Lau J, & Rubinstein M (2016). Eating Disorders in Adolescent and Young Adult Males: Presenting Characteristics. Journal of Adolescent Health, 59(4), 397–400. doi:10.1016/j.jadohealth.2016.04.005
35. Murray SB, Nagata JM, Griffiths S, Calzo JP, Brown TA, Mitchison D, … Mond JM (2017). The enigma of male eating disorders: A critical review and synthesis. Clinical Psychology Review, 57, 1–11. doi:10.1016/j.cpr.2017.08.001 [PubMed: 28800416]
36. Smith KE, Mason TB, Murray SB, Griffiths S, Leonard RC, Wetterneck CT, … Lavender JM (2017). Male clinical norms and sex differences on the Eating Disorder Inventory (EDI) and Eating Disorder Examination Questionnaire (EDE-Q). International Journal of Eating Disorders, 50(7), 769–775. doi:10.1002/eat.22716
37. Murray SB, Griffiths S, & Nagata JM (2018). Community-Based Eating Disorder Research in Males: A Call to Action. Journal of Adolescent Health, 62(6), 649–650. doi:10.1016/j.jadohealth.2018.03.008
38. Murray S, Quintana D, Loeb K, Griffiths S, & Le Grange D (2019). Treatment outcomes for anorexia nervosa: A systematic review and meta-analysis of randomized controlled trials. Psychological Medicine,49(4), 535–544. doi:10.1017/S0033291718002088 [PubMed: 30101734]
39. Allen KL, Byrne SM, Oddy WH, & Crosby RD (2013). Early Onset Binge Eating and Purging Eating Disorders: Course and Outcome in a Population-Based Study of Adolescents. Journal of Abnormal Child Psychology, 41(7), 1083–1096. doi:10.1007/s10802-013-9747-7 [PubMed: 23605960]
40. Goodwin H, Haycraft E, & Meyer C (2012). The relationship between compulsive exercise and emotion regulation in adolescents. British Journal of Health Psychology, 17(4), 699–710. doi:10.1111/j.2044-8287.2012.02066.x [PubMed: 22385050]

**What is already known on this subject?**

Limited evidence suggests that there may be meaningful clinical differences in eating disorder symptomology between boys and girls diagnosed with anorexia nervosa both at presentation for treatment, as well as in treatment response.

**What this study adds?**

This study suggests that adolescent boys with anorexia nervosa present to treatment with symptoms that are as severe as their female counterparts, highlighting that increased awareness and accurate identification of these disorders among boys and men is crucial. It also appears that with respect to relative weight gain, and reduction in cognitive eating disorder symptoms, boys respond similarly to girls in the context of clinical research trials specific to anorexia nervosa.

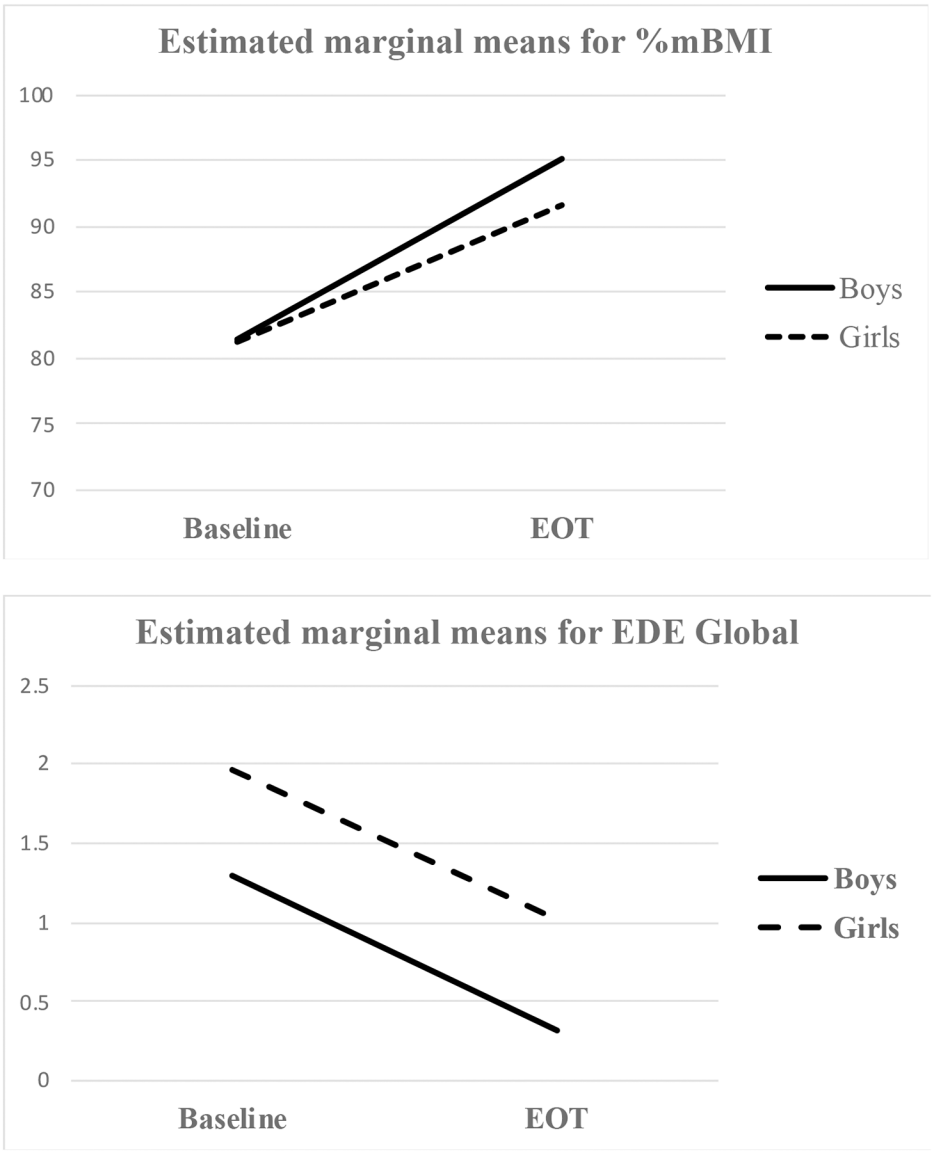


**Figure 1.**

Gender differences in weight and ED cognitions during treatment

*Note*: EDE = Eating Disorders Examination; EOT = end-of-treatment; %mBMI = percent median body mass index

**Table 1.**

Descriptive characteristics relative to gender

| | Male (*n* = 24) | Female (*n* = 204) | *p* | *Cohen's d* |
|---|---|---|---|---|
| **Baseline** | | | | |
| Age; *M* (*SD*) | 14.77 (1.70) | 14.97 (1.65) | .57 | |
| % mBMI; *M* (*SD*) | 81.46 (3.44) | 81.15 (5.18) | .61 | |
| Diagnosis | | | | |
| AN-restricting or partial | 22 | 157 | | |
| AN-binge/purge | 2 | 47 | | |
| EDE Pathology; *M* (*SD*) | | | | |
| *Global score* | 1.35 (1.28) | 2.01 (1.59) | .06 | |
| *Weight Concern* | 1.19 (1.33) | 1.94 (1.65) | **.03** | 0.50 |
| *Shape Concern* | 1.48 (1.49) | 2.26 (1.85) | **.045** | 0.46 |
| *Eating Concern* | 1.13 (1.43) | 1.48 (1.51) | .24 | |
| *Restraint* | 1.60 (1.45) | 2.35 (1.96) | .06 | |
| Driven exercise; (*n*, %) | 13 (54.2) | 97 (47.5) | .54 | |
| Objective binge eating; *M* (*SD*) | .25 (.73) | .97 (5.50) | .21 | |
| Self-induced vomiting; *M* (*SD*) | 4.13 (17.12) | 3.43 (12.46) | .99 | |
| Prior inpatient; (*n*, %) | 13 (54) | 85 (42) | .24 | |
| Illness duration; *M* (*SD*) | 10.38 (9.44) | 10.99 (8.61) | .59 | |
| Comorbidity; (*n*, %) | 8 (33.3) | 60 (29.4) | .69 | |
| Psychotropic use; (*n*, %) | 5 (20.8) | 23 (11.3) | .18 | |
| **End-of-treatment** | | | | |
| % mBMI; *M* (*SD*) | 95.19 (10.00) | 91.64 (9.70) | .06 | |
| EDE Pathology; *M* (*SD*) | | | | |
| *Global score* | .32 (.68) | 1.01 (1.27) | **.003** | 0.68 |
| *Weight Concern* | .45 (.98) | 1.18 (1.46) | **.01** | 0.59 |
| *Shape Concern* | .40 (.87) | 1.41 (1.63) | **.001** | 0.77 |
| *Eating Concern* | .21 (.60) | .59 (1.05) | **.03** | 0.44 |
| *Restraint* | .20 (.46) | .86 (1.38) | **.04** | 0.64 |
| Driven exercise; (*n*, %) | 3 (12.5) | 41 (20) | .37 | |
| Objective binge eating; *M* (*SD*) | .05 (.21) | .52 (3.10) | .88 | |
| Self-induced vomiting; *M* (*SD*) | .27 (.77) | .44 (2.14) | .29 | |

*Note*: **Bold** values indicate $p < .05$; %mBMI = percent median body mass index; EDE = Eating Disorders Examination, with subscale scores indicated in *italics*; Driven exercise refers to those who endorsed ≥ 1 episode of compulsive exercise on EDE. Comorbidity refers to psychiatric illness; illness duration represents months.

**Table 2.**

Results from mixed repeated measures ANOVA

| Variable | Sum of Squares | df | Mean square | *F* | *p* | Partial η2 |
|---|---|---|---|---|---|---|
| **Model 1: %mBMI** | | | | | | |
| *Between-subjects* | | | | | | |
| Gender | 154.25 | 1 | 154.25 | 1.90 | .17 | 0.009 |
| Error | 16905.54 | 208 | 81.28 | | | |
| *Within-subjects* | | | | | | |
| Time | 6201.56 | 1 | 6201.56 | 158.58 | **< .001** | 0.43 |
| Gender X Time | 116.30 | 1 | 116.30 | 2.97 | .09 | 0.01 |
| Error | 8134.49 | 208 | 39.11 | | | |
| **Model 2: EDE Global score** | | | | | | |
| *Between-subjects* | | | | | | |
| Gender | 18.07 | 1 | 18.07 | 6.29 | **.01** | 0.03 |
| Error | 563.06 | 196 | 2.87 | | | |
| *Within-subjects* | | | | | | |
| Time | 36.36 | 1 | 36.36 | 34.86 | **< .001** | 0.15 |
| Gender X Time | 0.01 | 1 | 0.01 | 0.009 | .92 | 0.00 |
| Error | 204.45 | 196 | 1.04 | | | |

Note: **Bold** values indicate $p < .05$; %mBMI = percent median body mass index; EDE = Eating Disorders Examination