

Association Between Childhood to Adolescent Attention Deficit/Hyperactivity Disorder Symptom Trajectories and Late Adolescent Disordered Eating

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A B S T R A C T

Purpose: Disordered eating is more prevalent among adolescents with attention deficit/hyperactivity disorder. Both inattention and hyperactivity/impulsivity symptoms show strong associations with disordered eating, but few investigations of these associations have been longitudinal. Thus, we examined the effect of childhood to adolescent inattention and hyperactivity/impulsivity symptom trajectories on late adolescent disordered eating.

Methods: We used growth mixture modeling to identify distinct inattention and hyperactivity/impulsivity symptom trajectories (called “classes”) across three time points (ages 8–9, 13–14, and 16–17 years) in the Swedish Twin study of CHild and Adolescent Development. The resulting classes were used to predict Eating Disorder Inventory-2 Bulimia, Drive for Thinness, and Body Dissatisfaction subscales at age 16–17 years, with adjustment for sex and body mass index at age 16–17 years.

Results: The combined inattention and hyperactivity/impulsivity symptom trajectory classes included: a “low symptom” class characterized by low inattention and hyperactivity/impulsivity throughout childhood/adolescence; a “predominantly inattention” class characterized by elevated inattention, but not hyperactivity/impulsivity, throughout childhood/adolescence; a “predominantly hyp/imp” class characterized by elevated hyperactivity/impulsivity, but not inattention, throughout childhood/adolescence; and a “both inattention and hyp/imp” class characterized by elevated inattention and hyperactivity/impulsivity throughout childhood/adolescence. After adjusting for sex and body mass index or sex and anxiety/depression symptoms, the “both inattention and hyp/imp” (vs. “low symptom”) class predicted significantly higher Eating Disorder Inventory-2 subscale scores during late adolescence.

IMPLICATIONS AND CONTRIBUTION

In this longitudinal, community-based study, a combination of higher inattention and higher hyperactivity/impulsivity symptoms throughout childhood and adolescence was associated with increased disordered eating risk in late adolescence. These findings encourage increased vigilance by parents, teachers, and health care providers for the emergence of disordered eating among youth with attention deficit/hyperactivity disorder symptoms.

Conflicts of Interest: C.M.B. and H.L. are grant recipients from Shire. H.L. has also served as a speaker for Eli Lilly and Shire on topics unrelated to this submission. The other authors have no conflicts of interest to disclose.

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Conclusions: Increased vigilance for disordered eating among children who have both inattention and hyperactivity/impulsivity symptoms throughout childhood and adolescence could aid in early identification of eating disorders.

Disordered eating is more prevalent among children and adolescents with attention deficit/hyperactivity disorder (ADHD) than the general population [1]. Furthermore, several large population-based studies have indicated a prospective relationship between ADHD and varying degrees of subsequent disordered eating [2–7]; for instance, girls with ADHD may be up to six times more likely to develop an eating disorder than girls without ADHD [8]. In clinical settings, 20%–24% of adults with bulimia nervosa retrospectively report having experienced ADHD symptoms during childhood [9,10], and ADHD symptoms are associated with greater eating disorder severity [10,11]. ADHD symptoms onset in early childhood, whereas disordered eating tends to onset during adolescence/young adulthood [12]. Thus, gaining a better understanding of the nature of the association between ADHD and disordered eating using longitudinal ADHD data could provide important insight into one risk pathway leading to disordered eating and, potentially, the development of full-threshold eating disorders [13].

To date, few studies have evaluated whether it is the inattention versus hyperactivity/impulsivity symptoms of ADHD that serve as a risk factor for disordered eating [2,3,6]. ADHD is defined by difficulty with self-regulation, specifically in the areas of attention (i.e., inattention) and behavior regulation (i.e., impulsivity), with ADHD-related impairments also observed across a variety of other areas including motivation, emotion regulation, and organizational skills [14]. One hypothesis is that impulsivity and the related construct, lack of inhibition, may contribute to disordered eating behaviors such as binge eating [3,15]. Impulsivity is a predictor of eating disorder severity and poor treatment outcome [16], suggesting that impulsivity may influence eating disorders, especially those marked by binge eating and/or purging behaviors. Another nonmutually exclusive hypothesis is that disordered eating may be influenced by inattentiveness to the internal sense of hunger, satiety, and amount of food consumed on a daily basis, which is also a phenomenon observed in individuals with ADHD [17]. Preliminary evidence suggests that disordered eating in individuals with bulimia nervosa is associated with both inattention and hyperactivity/impulsivity; however, the association may be stronger for inattention than for impulsivity/hyperactivity [10].

Although preliminary results support both of the aforementioned hypotheses, most studies investigating the relative contributions of inattention and hyperactivity/impulsivity symptoms have examined these symptoms cross-sectionally or retrospectively. The few longitudinal studies conducted to date [2–4,6,8] have relied on broad dichotomous classifications of ADHD, thus failing to capture how the specific types of ADHD symptoms relate to disordered eating. In addition, previous studies [2,3,10,11] often recruited individuals with clinical ADHD and/or eating disorders and did not investigate these symptoms in the community, so it is unknown if these associations generalize to nonclinical populations.

Thus, the goal of the present study was to evaluate whether inattention, hyperactivity/impulsivity, or combined symptoms across childhood and early adolescence played a role in the development of disordered eating in late adolescence in a Swedish community-based cohort. We hypothesized that children with persistently high inattention and hyperactivity/impulsivity trajectories across childhood and early adolescence would be more likely to report disordered eating in late adolescence. In addition, given that ADHD symptoms are associated with higher body mass index (BMI) [18] and that higher BMI is a risk factor for disordered eating [19], we also examined if the relationship between ADHD symptoms and disordered eating remained after adjusting for BMI. Likewise, given that ADHD symptoms are also associated with higher levels of anxiety and depression [20], which are risk factors for disordered eating [21,22], we also examined if the relationship between ADHD symptoms and disordered eating remained after adjusting for anxiety and depression symptoms.

Methods

Participants

Our study sample consisted of participants from the Swedish Twin Study of Child and Adolescent Development (TCHAD). TCHAD comprises all twins born between May 1985 and December 1986 in Sweden [23]. The Swedish Medical Birth Register [24] was used to identify the twins and their parents, who were invited to participate by completing parent- and self-report questionnaires at four different time points: wave 1 (ages 8–9 years), wave 2 (ages 13–14 years), wave 3 (ages 16–17 years), and wave 4 (ages 18–19 years).

For the purpose of this study, we used data collected at waves 1–3 (see [Supplemental Figure 1](#)). Our analysis sample included 2,315 participants (78.4% of the total sample) who had all covariates observed and data on inattention or hyperactivity/impulsivity at at least one time point. Of the included participants, 50.6% were female and 39.9% were monozygotic twins, with the remaining twins belonging to either same- or opposite-sex dizygotic twin pairs. The mean ages at waves 1, 2, and 3 were $8.7 \pm .5$, $13.7 \pm .5$, and $16.7 \pm .5$ years, respectively.

Consent was obtained from all twins and their parents who participated. Ethical approval for each wave was provided by the Ethics Committee at Karolinska Institutet in Stockholm, Sweden, and the study was approved by the University of North Carolina Institutional Review Board.

Measures

Eating Disorder Inventory-2. The Swedish version of the Eating Disorder Inventory-2 (EDI-2) [25], which has been validated and shown to have good psychometric properties [26], was used to assess disordered eating attitudes and behaviors by adolescent

self-report at wave 3. Specifically, the seven-item Bulimia (tendency toward episodes of binge eating that may be followed by the impulse to induce vomiting), seven-item Drive for Thinness (excessive concern with dieting, preoccupation with weight, and an extreme pursuit of thinness), and eight-item Body Dissatisfaction (belief that specific parts of the body are too large) subscales were administered.

Attention deficit/hyperactivity disorder. The Diagnostic and Statistical Manual of Psychiatric Disorders, fourth edition [27] ADHD criteria were used to develop a 14-item checklist assessing the presence or absence of ADHD symptoms in the previous 6-month period. The checklist was administered to parents, who reported on their children at waves 1, 2, and 3 of TCHAD. Details regarding the development and validation of this checklist, including the inattention (six items) and hyperactivity/impulsivity (eight items) subscales, have been described in depth elsewhere [28].

Body mass index. Height and weight were provided via adolescent self-report at wave 3. We used age- and sex-specific means and standard deviations from a sample of Swedish children born in 1981 to remove values 6 standard deviations above and below the mean for height and log (weight) [29]. We then used the World Health Organization 2007 package for R to calculate age- and sex-adjusted BMI z-scores [30].

Anxiety and depression. The 14-item Anxious/Depressed subscale of the Child Behavior Checklist Youth Self-Report version [31], which has been extensively administered and shown to have good psychometric properties [32], was used to assess symptoms of anxiety and depression at wave 3.

Statistical analysis

The analyses consisted of three steps. In step 1, we used growth mixture modeling (GMM) to identify distinct groups (“classes”) of individual trajectories for ADHD symptoms across waves 1–3. In keeping with prior work characterizing ADHD symptom trajectories in TCHAD [33], we fitted a GMM with two classes to the inattention symptoms from waves 1 to 3 and a separate GMM with two classes to the hyperactivity/impulsivity symptoms from waves 1 to 3. In step 2, we combined the two inattention trajectory classes with the two hyperactivity/impulsivity trajectory classes to create four combined inattention and hyperactivity/impulsivity classes. In step 3, we used linear regression to predict each wave 3 EDI subscale as a function of the combined trajectory classes and covariates (sex; sex and BMI z-score; or sex and anxiety/depression symptoms) to examine whether ADHD symptom trajectories across childhood and adolescence predict disordered eating in late adolescence. To fit the aforementioned models (depicted in Figure 1), we used a robust maximum likelihood estimator (which corrects standard errors to account for nonindependence due to the twin design), and we handled missing data through full information maximum likelihood. Appendix A in the online supplemental materials contains additional technical details of the GMM approach.

Results

Table 1 provides descriptive summary statistics for the inattention and hyperactivity/impulsivity scores at waves 1–3

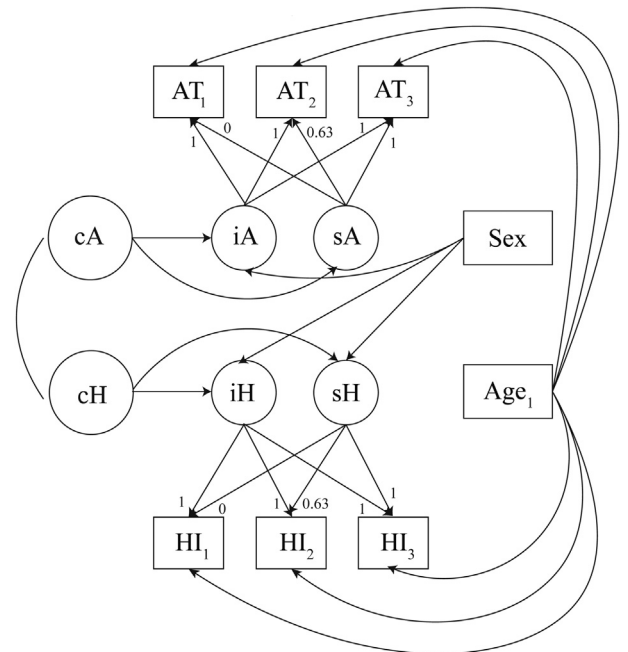


Figure 1. Distal outcome models.

and the EDI subscale scores at wave 3. On average, inattention and hyperactivity/impulsivity scores decreased from childhood to late adolescence. Inattention scores were (on average) higher for males at all three time points ($p < .001$ for each wave). Similarly, hyperactivity/impulsivity scores were higher for males at waves 1 and 2 ($p < .01$ for waves 1 and 2), but not at wave 3 ($p < .46$). All wave 3 EDI subscale scores were higher for females.

Step 1 of our analyses involved fitting GMMs to identify inattention and hyperactivity/impulsivity trajectory classes, respectively; the final model is depicted in Figure 2. In the final model, the two inattention trajectory classes are characterized by different intercepts and slopes, as are the two hyperactivity/impulsivity trajectory classes, and inattention class membership is correlated with hyperactivity/impulsivity class membership. Although sex affected the intercepts for the two inattention classes and the intercepts and slopes for the two hyperactivity/impulsivity classes as described in the following section, it did not affect the slopes for the inattention classes—or class membership—in the final model: these paths were found to be nonsignificant during model fitting. The entropy value for the final model was .8, which is within the acceptable range.

Estimates, standard errors, and p values for the parameters in the final model are presented in Supplemental Table 1. Figure 3A depicts the symptom trajectories for the inattention classes (which we refer to as the “low inattention” class and the “high inattention” class). As illustrated, both inattention classes had effectively flat trajectories over time, although the trajectory for the “low inattention” class started lower at wave 1. Furthermore, in both inattention classes, the trajectory started significantly lower at wave 1 for females compared with males. Figure 3B depicts the symptom trajectories for the hyperactivity/impulsivity classes (which we refer to as the “low hyperactivity/impulsivity” class and the “high hyperactivity/impulsivity” class). Trajectories for both hyperactivity/impulsivity classes decreased at a similar rate over time, although the trajectory for the “low

Table 1
Summary statistics for the classification model sample by sex (N = 2,315)

	Mean	SD	Range	% Missing
Inattention (wave 1) ^a				
Males	.83	1.19	(0–6)	14.60
Females	.53	.92	(0–6)	18.10
Inattention (wave 2) ^a				
Males	.72	1.13	(0–6)	14.16
Females	.50	.95	(0–6)	13.83
Inattention (wave 3) ^a				
Males	.85	1.31	(0–6)	13.02
Females	.58	1.07	(0–6)	14.09
Hyperactivity/impulsivity (wave 1) ^b				
Males	1.13	1.67	(0–8)	14.86
Females	.92	1.46	(0–8)	18.36
Hyperactivity/impulsivity (wave 2) ^b				
Males	.57	1.27	(0–8)	14.34
Females	.43	1.05	(0–8)	13.49
Hyperactivity/impulsivity (wave 3) ^b				
Males	.35	.98	(0–8)	12.76
Females	.38	.96	(0–8)	13.83
BMI z-score (wave 3)				
Males	-.14	.98	(-4.75 to 2.86)	15.03
Females	-.24	.89	(-3.68 to 2.73)	11.44
EDI Bulimia (wave 3)				
Males	.46	1.18	(0–11)	12.76
Females	.51	1.46	(0–21)	9.14
EDI Drive for Thinness (wave 3)				
Males	.88	1.75	(0–20)	16.35
Females	2.84	4.20	(0–21)	13.49
EDI Body Dissatisfaction (wave 3)				
Males	2.24	3.66	(0–24)	11.63
Females	5.66	6.21	(0–24)	7.17
YSR anxiety/depression (wave 3)				
Males	2.89	3.37	(0–25)	11.71
Females	5.67	5.01	(0–24)	6.66

BMI = body mass index; EDI = Eating Disorder Inventory-2; SD = standard deviation; YSR = Youth Self-Report.

^a Levels of ordinal variable assigned values 0–6 to calculate summary statistics.

^b Levels of ordinal variable assigned values 0–8 to calculate summary statistics.

hyperactivity/impulsivity” class started lower at wave 1. Furthermore, for females (vs. males) in the “high hyperactivity/impulsivity” class, the trajectory started significantly lower at wave 1 and decreased significantly less steeply over time.

In step 2, the inattention and hyperactivity/impulsivity classes were combined into four combined trajectory classes for ADHD symptoms: “low Inattention and low hyperactivity/impulsivity” (referred to as “low symptom”), which had a class membership probability of 72.5%; “high inattention and low hyperactivity/impulsivity” (referred to as “predominantly inattention”), which had a class membership probability of 4.7%; “low inattention and high hyperactivity/impulsivity” (referred to as “predominantly hyp/imp”), which had a class membership probability of 1.2%; and “high inattention and high hyperactivity/impulsivity” (referred to as “both inattention and hyp/imp”), which had a class membership probability of 21.6%.

Table 2 summarizes the results from step 3, which examines the relationship between the four combined trajectory classes and the EDI scores in late adolescence. Notably, scores for the Bulimia, Drive for Thinness, and Body Dissatisfaction subscales were significantly higher in the “both inattention and hyp/imp” class compared with the referent “low symptom” class, even after adjustment for sex and BMI z-score. Likewise, adjusting for anxiety/depression scores did not significantly affect the association, although anxiety/depression scores were elevated in the “both inattention and hyp/imp” class relative to the “low symptom” class (see Supplemental Table 2).

Discussion

To our knowledge, this is the first longitudinal, community-based study focusing on the prospective prediction of disordered eating in late adolescence based on ADHD symptom trajectories in childhood and early adolescence. We found that a combination of higher inattention symptoms and higher hyperactivity/impulsivity symptoms throughout childhood and adolescence was associated with increased levels of disordered eating in late adolescence. Notably, this association remained significant after controlling for BMI z-scores or for anxiety and depression symptoms, suggesting that the pathway to disordered eating attitudes and behaviors from ADHD symptoms is not simply attributable to higher BMIs or to elevated anxiety and mood symptoms among those with ADHD symptoms. Our results provide evidence that combined inattention and hyperactivity/impulsivity symptoms in childhood and early adolescence increase susceptibility to disordered eating (as measured

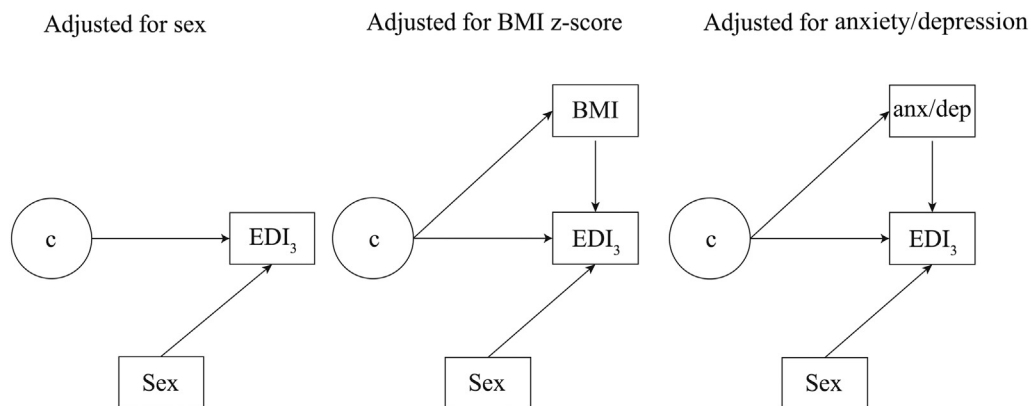


Figure 2. Step 1 classification model (growth mixture model approach). BMI = body mass index z-score; c = latent trajectory classes; EDI₃ = Eating Disorder Inventory-2 at wave 3; anx/dep = anxiety/depression.

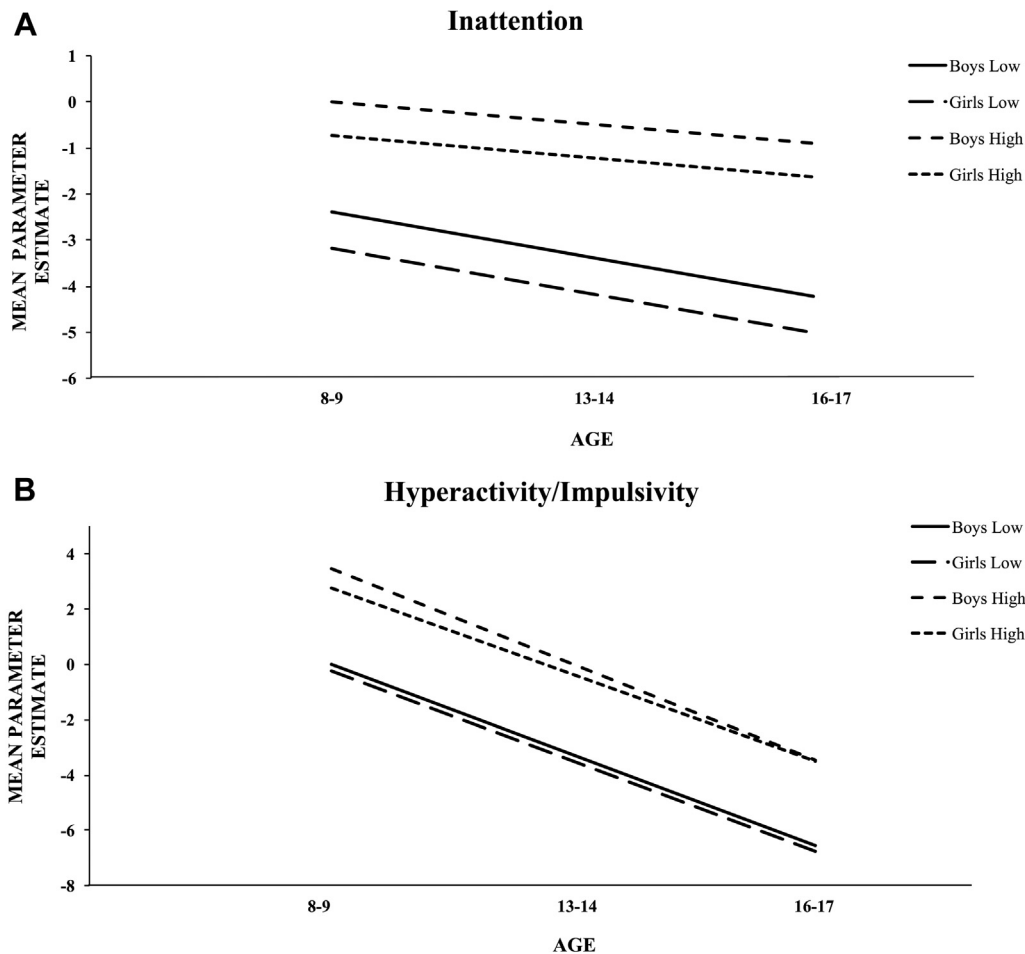


Figure 3. Trajectories of (A) inattention and (B) hyperactivity/impulsivity for boys and girls aged between 8–9 years and 16–17 years.

by the three EDI subscales) in late adolescence, consistent with our hypothesis and in line with previous findings on children with ADHD diagnoses [2,3].

Our findings did not suggest that either inattention or hyperactivity/impulsivity on its own is associated with significant elevations in disordered eating in late adolescence. As previously hypothesized, impulsivity may contribute to severity through lack of inhibition, whereas inattention could contribute to disordered eating pathology through a lack of awareness of hunger or the amount of food consumed. Furthermore, both inattention and hyperactivity/impulsivity are associated with poor organizational skills [34] and emotional dysregulation [35], which can contribute to disordered eating [36]. Although deficits in either domain alone may not serve as risk factors, their combination appears to be sufficient for increased susceptibility to disordered eating. Another possibility is that although each ADHD subtype contributes to disordered eating through a distinct set of cognitive vulnerabilities, the EDI subscales we studied fail to capture these distinct contributions. Alternatively, it is plausible that the differential effects of inattention and hyperactivity/impulsivity on disordered eating attitudes and behaviors could be present only when the clinical threshold for ADHD or an eating disorder is reached. Finally, it is possible that we did not have sufficient power to examine the individual

contributions of inattention and hyperactivity/impulsivity trajectories to disordered eating, as only a small percentage of our participants were in the “predominantly hyp/imp” (1.2%) and the “predominantly inattention” (4.7%) trajectory classes.

The present study has notable strengths. Most importantly, the longitudinal design of the ADHD data collection allowed us to make prospective predictions about the emergence of disordered eating in late adolescence from core ADHD symptom developmental trajectories throughout childhood and adolescence. TCHAD also has high response rates for both self- and parent-report measures [23]. Having both self-report and parent report available allowed us to use different informants for the predictor (i.e., ADHD) and the outcomes (i.e., EDI subscale scores), thus reducing bias due to shared method variance. Instead of viewing ADHD as a single construct, we examined inattention and hyperactivity/impulsivity separately to carefully assess the individual contribution of each joint trajectory class to disordered eating risk. Also, our large sample included both boys and girls. Unlike clinical studies which often focus on threshold ADHD and/or eating disorders in treatment-seeking individuals with increased disorder severity and chronicity, TCHAD is a community-based cohort that allowed for the examination of the subthreshold ADHD symptom trajectories, dysfunctional eating attitudes, and disordered eating behaviors.

Table 2Coefficient^a estimates (standard errors) and *p* values from model for wave 3 EDI-2 subscales as a function of joint inattention and hyperactivity/impulsivity class^b

	Outcomes: wave 3 EDI-2 subscales		
	Bulimia	Drive For Thinness	Body Dissatisfaction
Model adjusted for sex			
"Low symptom" (≈72% of sample ^c)	.34 (.10); —	−1.30 (.21); —	−1.55 (.35); —
"Predominantly inattention" (≈5% of sample ^c)	.21 (.17); <i>p</i> < .46	−1.42 (.46); <i>p</i> < .79	−1.02 (.78); <i>p</i> < .49
"Predominantly hyp/imp" (≈1% of sample ^c)	.60 (.48); <i>p</i> < .59	−.64 (1.90); <i>p</i> < .74	−2.78 (1.43); <i>p</i> < .39
"Both inattention and hyp/imp" (≈22% of sample ^c)	.73 (.12); <i>p</i> < .01	−.14 (.31); <i>p</i> < .01	.43 (.50); <i>p</i> < .01
Model adjusted for sex and BMI z-score			
"Low symptom" (≈72% of sample ^c)	.35 (.10); —	−1.24 (.21); —	−1.48 (.34); —
"Predominantly inattention" (≈5% of sample ^c)	.23 (.18); <i>p</i> < .48	−1.26 (.46); <i>p</i> < .98	−.83 (.77); <i>p</i> < .38
"Predominantly hyp/imp" (≈1% of sample ^c)	.63 (.49); <i>p</i> < .56	−.57 (1.88); <i>p</i> < .72	−2.71 (1.37); <i>p</i> < .37
"Both inattention and hyp/imp" (≈22% of sample ^c)	.73 (.12); <i>p</i> < .01	−.21 (.30); <i>p</i> < .01	.19 (.47); <i>p</i> < .01
Model adjusted for sex and YSR anxiety/depression			
"Low symptom" (≈72% of sample ^c)	.36 (.09); —	−1.22 (.20); —	−1.45 (.34); —
"Predominantly inattention" (≈5% of sample ^c)	.09 (.17); <i>p</i> < .11	−1.81 (.48); <i>p</i> < .21	−1.67 (.81); <i>p</i> < .79
"Predominantly hyp/imp" (≈1% of sample ^c)	.68 (.44); <i>p</i> < .47	−.39 (1.65); <i>p</i> < .62	−2.40 (1.24); <i>p</i> < .44
"Both inattention and hyp/imp" (≈22% of sample ^c)	.65 (.12); <i>p</i> < .01	−.39 (.30); <i>p</i> < .01	.01 (.46); <i>p</i> < .001

BMI = body mass index; EDI-2 = Eating Disorder Inventory-2; Hyp/imp = hyperactivity/impulsivity; YSR = Youth Self-Report.

^a Coefficients represent the means of the EDI subscales for a particular class, after adjustment for covariates. The table also presents the coefficients' standard errors (in parentheses) and the *p* values from a two-sided test of the hypothesis that the difference between the coefficient for the given class and the referent class ("low symptom") equals 0. The coefficients come from a model for each EDI-2 subscale as a function of covariates (sex or sex and BMI z-score) and the joint inattention—hyperactivity classes (treated as a four-level categorical variable, with "low symptom" as the reference category).

^b To determine the classes for inattention (and hyperactivity/impulsivity), we fitted a growth mixture model to the inattention (and hyperactivity/impulsivity) symptoms from waves 1 to 3. The model empirically determined two classes characterizing the trajectories of the inattention (and hyperactivity/impulsivity) symptoms across the three time points: a declining trajectory with low levels of symptoms at all time points, referred to as the "low" class, and a declining trajectory with higher levels of symptoms at all time points, referred to as the "high" class. We created the joint inattention and hyperactivity/impulsivity classes by combining the inattention classes with the hyperactivity/impulsivity classes, such that there were four joint classes ("low symptom"; "predominantly inattention"; "predominantly hyp/imp"; and "both inattention and hyp/imp").

^c Percentage represents the proportion of the sample most likely to be assigned to the relevant class.

An additional strength of our study is that the potential confounding effects of psychostimulants on eating behavior and body weight are unlikely to affect our findings: during the TCHAD data collection period (i.e., mid-1990s and late 1990s), the rate of psychostimulant prescription for the treatment of ADHD was around .08% in Sweden, which was 35 times lower than the rate in the United States for this same period [37]. Thus, the percentage of children and adolescents on psychostimulants is likely to be very low in our cohort (although this was not directly assessed).

Despite its strengths, our study also has limitations that merit consideration. We were unable to test for sex differences in the effect of ADHD trajectory class on disordered eating due to a lack of statistical power. Simulations revealed that, even with such a large sample size, we had limited power to detect a sex by trajectory class interaction due to a variety of factors including low class membership for some of the trajectory classes, missing EDI outcomes, and the nonindependence of twin data. Because there were no behavioral data on ADHD symptoms, parental report of ADHD symptoms formed the basis of our inattention and hyperactivity/impulsivity trajectories. Also, since inattention is more difficult to observe than hyperactivity/impulsivity, parental report of inattention may not capture the full picture of the twins' inattention symptoms, thus potentially leading to under-reporting [38]. In the absence of behavioral data, inclusion of a second measure, such as teacher ratings, could have potentially provided a more complete ADHD assessment [39]. We were also unable to distinguish the effects of hyperactivity versus impulsivity on disordered eating. This is a notable limitation in light of a previous report on childhood impulsivity being a better predictor of bulimic symptoms than inattention or hyperactivity in girls with ADHD [3]. Also, because the EDI was administered only at wave 3, we were unable to account for disordered eating

in childhood and early adolescence in the model or examine the bidirectional relationship between disordered eating and ADHD symptoms.

In conclusion, higher inattention combined with higher hyperactivity/impulsivity throughout childhood and adolescence was associated with increased disordered eating in late adolescence in a large Swedish population cohort. One important research implication of our results is that ADHD-related constructs should be considered in etiologic models of disordered eating, as ADHD symptoms may be one of many pathways to disordered eating. Our results, coupled with previous reports, may also have implications for prevention, detection, and treatment. In addition, our results argue for increased vigilance by parents, teachers, and health care providers for the emergence of disordered eating attitudes and behaviors among children and adolescents who present with elevated inattention and hyperactivity/impulsivity symptoms. Whereas depression and anxiety have historically been associated with the emergence of disordered eating in youth, ADHD symptoms have received far less attention. Given the high inter-relatedness of all psychiatric syndromes on both a genetic and a symptom level [40], it is critical to continue to monitor youth for the emergence of symptoms that fall outside the narrow profile of their primary diagnosis. Such broad monitoring and rapid response may help halt the progression of emergent symptoms into full-blown disorders.

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Supplementary Data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.jadohealth.2017.04.001>.

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