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## Frequency and patterns of eating disorder symptoms in early adolescence and associations with social, psychological and weight outcomes

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## Abstract

**Purpose:** There are still uncertainties about manifestations of early adolescent eating disorders (ED) and their effects. We aimed to determine the prevalence of ED symptoms in early adolescence, derive symptoms dimensions, and to determine their effects on social, psychological outcomes, and subsequent Body Mass Index (BMI).

**Methods:** Data on 7,082 adolescents aged 13 years from the Avon Longitudinal Study of Parents and Children (ALSPAC) were obtained on ED symptoms, resulting impairment and family burden, emotional and behavioral disorders using the parental version of the Developmental and Well-being Assessment (DAWBA). Exploratory structural equation models were used to derive ED symptoms dimensions separately by sex and relate these to contemporary outcomes: impairment, burden, emotional and behavioral disorders; and a distal outcome: objective BMI at age 15.

**Results:** Extreme levels of fear of weight gain, avoidance of fattening foods and distress about weight and shape were common amongst girls (11%). Three ED symptoms dimensions were identified: “bingeing/overeating”, “weight/shape concern and weight-control behaviors”, and “food restriction”. “Bingeing/overeating” was strongly associated with higher functional impairment, family burden and comorbid psychopathology. “Bingeing/overeating” and “weight/shape concern and weight-control behaviors” predicted higher BMI two years later, whereas “food restriction” predicted lower BMI. These effects did not change when BMI at age 13 was included in the model.

**Conclusions:** ED cognitions are common amongst young teenage girls. ED symptoms have adverse cross-sectional and distal consequences, in particular on increasing body weight two

years later. These findings have important implications for early identification of adolescents engaging in ED behaviors and for obesity prevention.

**Keywords:** eating disorders, adolescents, weight, longitudinal, ALSPAC, ESEM, dimensions

**Implications and Contribution:** This study highlights eating disorder behaviors and cognitions are common in early adolescence and they are negatively associated with a series of social and psychological outcomes and most importantly predict weight status 2 years later. Public health efforts for early identification and prevention of eating disorders are therefore crucial.

## **Introduction**

There is increasing evidence that eating disorders (ED) might be more common than previously thought [1,2]. ED have a peak of onset between ages 15-19[3]; in a recent study we highlighted that in adolescent/young adult US girls ED predicted overweight and obesity as well as psychopathology and substance use [1]. Few studies have investigated the short and long-term effects of adolescent ED behaviors on social, psychological and physical health.

Challenges to the clarification of the epidemiology and impact of adolescent ED behaviors include remaining uncertainties about classification, and whether current diagnostic systems apply to adolescents[4], as well as little knowledge about how ED behaviors present in early adolescence (13-14 years) in community samples. Understanding ED behaviors and cognitions at this developmental stage and how they impact on a series of outcomes might prove fruitful both for an increased knowledge of early constellation of symptoms that index prodromal ED or at-risk states, and to aid prevention.

To our knowledge, no population-based studies outside of the US have investigated associations between a wide range of ED symptoms in early adolescence and social, physical and psychological outcomes. Moreover few longitudinal population-based studies in the world lend themselves to a similar investigation.

This study aimed to firstly investigate ED symptoms in girls and boys from a population-based study in the UK: the Avon Longitudinal Study of Parents and Children (ALSPAC); and how they

clustered into observable dimensions (latent variables) at age 13. Secondly to determine whether identified ED symptoms dimensions would be: 1. associated with contemporary impairment, family burden and emotional and behavioral disorders; and 2. predict Body Mass Index (BMI) 2 years later.

Given the availability of statistical techniques allowing obtaining latent factors (dimensions) from observed data and jointly modelling a predictive model, we set out to use this framework to achieve the above aims.

## **Methods:**

### Participants:

ALSPAC is a longitudinal, population-based, study of 14,541 women and their children prospectively enrolled[5,6]. All pregnant women in the geographical area of Avon, UK, who were expected to deliver their baby between 1<sup>st</sup> April 1991 and 31<sup>st</sup> December 1992 were invited to take part in the study. All women gave informed and written consent. At 1 year 13,988 children were alive. Questionnaires were sent to parents of 10,135 children still enrolled in the cohort at age 13 and 479 children who were enrolled in ALSPAC in a second phase of the study (for details see[6]). Questionnaires were returned by 7,165 (67.5%) parents.

Mean age at data collection was 13.1 and 99% of adolescents were younger than 13.9 years at questionnaire completion. Adolescents whose data were collected at >14.5 years (N=7) were excluded.

Seventy-six (76) twin-pairs provided data, one twin per pair was randomly excluded from the current analyses. The total study size was 7,082 adolescents.

Eating Disorders symptoms: information was collected from questions on ED behaviors and cognitions from the ED section of the Developmental and Well-being assessment (DAWBA), a semi-structured interview that generates a range of psychiatric diagnoses in children and adolescents based on DSM-IV[7] and ICD-10[8] criteria. The DAWBA has a specific ED section of questions designed to obtain DSM-IV and ICD-10 diagnoses of anorexia nervosa (AN), bulimia nervosa (BN) and eating disorders not otherwise specified (EDNOS) for epidemiological studies. A questionnaire version of the ED-DAWBA was used for this study, comprising 28 questions on ED behaviors and cognitions, four questions on *impairment* on the adolescent life due to ED symptoms (detailed below), and one question on *burden* on the family or the parent caused by the symptoms[9].

Cognitions investigated were: fear about weight gain and being upset or distressed about weight and shape. Behaviors investigated were: avoidance of fattening foods, food restriction (a summary variable incorporating eating less at mealtimes, skipping meals, going without food for long periods of time (i.e. all day or most of the day)); exercising for weight loss, purging (self-induced vomiting, and use of laxatives or other medicines for weight loss).

Parents were asked to report about the child's bingeing (losing control over eating and eating a large amount of food in a short time) in terms of monthly, weekly or twice a week or more; questions on compensatory behaviors allowed answers of: no, a little, a lot, tried but not allowed (the latter category was recoded as "a little", with intention being conceptualised as indicating presence of the behavior).

Contemporary outcomes:

### *Social impairment and family burden of ED symptoms*

Impairment was derived from the ED-DAWBA questions asking “how much do you think the eating patterns/concerns about weight and shape have interfered with: how well he/she gets on with the rest of the family? making and keeping friends? learning or class work? hobbies, sports or other leisure activities?”. All stems had a 4-level Likert response (Not at all, a little, quite a lot, a great deal). A categorical summary variable was generated from the answers to these questions: “No impairment” (no impairment reported on any aspect of the adolescent’s life); “high” impairment (any question answered as “a lot” or “a great deal”); any other combination was coded as “some impairment”.

Burden to the family was derived from: “Have the eating patterns/concerns about weight and shape put a burden on you or your family?” The question had a 4-level Likert response (Not at all, a little, quite a lot, a great deal), the “quite a lot” and “a great deal” categories were combined.

### *Psychopathology: emotional and behavioral disorders*

At the same time-point parents completed a questionnaire version of the DAWBA for all other mental health disorders: as described above the DAWBA is a validated instrument to assess psychopathology in children and adolescents[10,11]. Variables indicating presence of any DSM-IV or ICD-10 emotional and behavioral disorder were obtained from the DAWBA using computer algorithms (as detailed in[9]). These diagnoses have been shown to be valid albeit likely to under-estimate psychopathology[9]. Computer-generated diagnoses using the parent rated DAWBA have been shown to have moderate to high agreement with clinician-rated multi-informant emotional and behavioural disorders diagnoses[9].



### Distal outcome- BMI at age 15

All children still enrolled in the study were measured at the ALSPAC base at age 15. Data were available on 4,467 adolescents included in this study (63% of the total). Not attending was predicted by socio-demographic characteristics such as ethnicity and family income (for details see[6]). Mean age of assessment was 15.3 years, with 90% of adolescents aged  $\leq 15.9$  years at assessment. There was no overlap between this assessment and age at assessment of ED symptoms. Age and gender adjusted BMI Z-scores (using UK references) were obtained from the Stata user-defined program "Z-anthro"[11,12].

### BMI at age 13

Objective weight and height measured at the ALSPAC base were also available on 5,481 adolescents at age 13. Age and gender adjusted BMI Z-scores were obtained as above.

### Socio-demographic data

Socio-demographic data were obtained from parents either during pregnancy (maternal age at enrolment, parity, maternal highest education, parental social class), at birth (birth-weight, gender) or throughout childhood (child ethnicity, family income).

### Statistical analyses

All analyses were run separately in boys and girls because of expected differences in behaviors and correlates.

*Exploratory factor analysis:* In order to identify latent dimensions of ED symptoms we selected all questions from the ED-DAWBA about ED cognitions and behaviors to conduct an exploratory

factor analysis (EFA) (using a Geomin rotation (oblique)). We selected factors with a corresponding eigenvalue > 1.

*Exploratory Structural equation modelling (ESEM)* is a method that combines features of unrestrictive measurement models (EFA) with restrictive measurement models (confirmatory factors analysis-CFA)[13]. ESEM allows part of the structural model to be exploratory, in the sense that no constraints are imposed on whether factor loadings that capture the association between latent factors and manifest indicators should be fixed at 0, akin to CFA, whilst latent factors are allowed to influence all manifest indicators according to a pre-defined number of latent factors. ESEM therefore combines the flexibility of EFA with statistical properties that were previously only available in restrictive CFA models [13]. Similarly to traditional EFA and CFA, ESEM results in the derivation of latent factors from observed variables, but crucially it allows the selected measurement model to be included jointly - or in two step approaches - in predictive models where external variables are modelled as outcomes of the ESEM measurement structure[14][15].

We used ESEM to investigate the associations between ED symptoms dimensions and contemporary correlates and a distal outcome.

All models were fitted using Mplus version 6.1 [16] by Weighted least squares mean and variance adjusted estimator (WLSMV).

Contemporary and distal outcomes were jointly modelled; paths from contemporary (psychopathology, impact and burden) to the distal outcome (BMI at 15) were constrained to

zero in order to estimate the effect of the latent factors on each outcome separately but within the same model.

All models were estimated separately by sex.

Model fit was assessed using the Root Mean Square of Approximation (RMSEA, a parsimony adjusted index) and the Tucker-Lewis Index (TLI).

#### Attrition:

Complete data on ED symptoms and contemporary outcomes was available on 2,990 girls and 3,006 boys.

Complete data on ED symptoms, contemporary outcomes, the distal outcome and socio-demographic covariates were available on 1,856 boys and 1,997 girls, respectively 86% and 87% of those with BMI data at age 15.

Predictors for missing data were: maternal age, parity, maternal education, parental social class (for girls and boys), and child ethnicity (for boys only).

Analyses were carried out using incomplete records (2,990 girls and 3,006 boys), including all predictors of missingness in the ESEM models, under the missing at random (MAR) assumption. Sensitivity analyses compared these results with those obtained on the restricted datasets with complete information.

The study was approved by the Institute of Psychiatry Ethics committee (Ref. 110/02), the ALSPAC Law and Ethics Committee and the Local Research Ethics Committees.

## **Results:**

Sample characteristics: The available sample had similar numbers of boys (49.9%) and girls (50.1%). Boys and girls were comparable on all socio-demographic and childhood characteristics. As expected boys had a slightly higher birth-weight compared to girls (Table 1). Emotional disorders at age 13 were similarly prevalent across genders; behavioral disorders were more common in boys.

Table 1 about here

### Eating disorders behaviors and cognitions

ED behaviors and cognitions overall were more common in girls. At age 13 63.2% of girls were described as being afraid of gaining weight or getting fat, 11.5% as being extremely afraid/terrified of gaining weight or becoming fat; percentages were lower amongst boys (see Table 2).

Being upset or distressed about weight and shape was reported at a high level (a lot) for 4.9% of girls and 2.4% of boys; with a positive association with female gender (Table 2).

In relation to ED behaviors: more girls than boys were described as engaging in fat-food avoidance. Food restriction was reported at a high level (a lot) in 2.4% of girls and 1.8% of boys, with a significant gender difference. Exercise for weight loss was similarly prevalent in boys and girls, however more boys than girls were engaging in high level exercise for weight loss (4.8% vs. 3.8%) (Table 2).

Purging (self-induced vomiting and use of laxatives for weight loss) was rare: 7 (0.23%) girls and 5 (0.16%) boys. Bingeing was present at a similar level amongst girls and boys; bingeing once a week or more in 1.2% of boys and 0.8% of girls (see Table 2).

[Table 2 about here](#)

#### Exploratory factor analysis (EFA)

Items from the ED-DAWBA were included in an EFA for boys and girls separately. Three factors with eigenvalues  $>1$  were identified. The item loadings on these factors suggested gender differences. One item was extremely rare amongst boys, did not load on any factors and was excluded from later analyses in boys (“Has your child ever deliberately made themselves sick?”).

We named the three latent factors identified: “binge eating/overeating”; “weight and shape concern with weight control behaviors (WCB)”, and “food restriction”.

#### Exploratory Structural Equation Modelling (ESEM)

Given results from the EFA, three latent factors were included in gender-stratified ESEM analyses. As shown in figure 1 and 2, where the details of the latent factors specification of the two ESEMs are shown, all items loaded highly on specific factors ( $p$  values  $<0.001$ ), although with slightly different loadings for boys and girls. Fit indices indicated very good fit of the models (in girls, RMSEA=0.026, TLI=0.96; in boys RMSEA=0.025, TLI=0.97).

There was a moderate correlation between factors, with gender differences i.e. stronger correlations in boys. “Bingeing/overeating” was correlated with “weight and shape concern and

WCB" (0.53 in girls and 0.58 in boys) and with "food restriction" (0.37 in girls, 0.54 in boys).

"Weight and shape concern and WCB" was moderately correlated with "food restriction" in boys (0.59), but only marginally in girls (0.26).

[Figure 1 and 2 about here](#)

### Contemporary outcomes

Table 3 shows the association between ED symptoms dimensions identified and contemporary outcomes.

#### *Girls:*

"Bingeing/overeating" was associated with impairment and burden; with the estimated coefficients implying that a 1SD score increase in bingeing/overeating would increase the predicted probability of having impairment by 47% and the predicted probability of burden by 60%, compared to girls with a bingeing/overeating score of 0.

"Bingeing/overeating" was associated with both emotional disorders and behavioral disorders (Table 3).

"Weight and shape concern and WCB" was associated with burden to parents and with impairment; but not with emotional or behavioral disorders. "Food restriction" was associated with burden to parents and behavioral disorders (see Table 3).

[Table 3 about here](#)

#### *Boys:*

“Bingeing/overeating” was significantly associated with impairment and burden to parents; with the estimated coefficients implying that for a 1SD increase in the score for bingeing/overeating the predicted probability of impairment increased by 47%, and the predicted probability of family burden increased by 61%.

As with girls, “bingeing/overeating” was associated with both emotional disorders and behavioral disorders (Table 3).

“Weight and shape concern and WCB” was associated with impairment but not burden; it was not associated with emotional disorders and negatively associated with behavioral disorders (Table 3).

“Food restriction” in boys was associated with all four contemporary outcomes (Table 3).

Confounders included in the models (maternal age at enrolment, maternal education, parity, and parental social class) showed associations only with some dimensions. Low parental social class was associated with higher “bingeing/overeating” scores in girls (standardised coefficient=0.22,  $p=0.006$ ) and lower “food restriction” scores in boys (standardised coefficient=-0.21 ( $p=0.04$ )). In boys only, higher maternal age and maternal primiparity were associated with higher “weight and shape concern and WCB” scores (respectively standardised coefficients=0.014 ( $p=0.02$ ); -0.13 ( $p=0.008$ )); Caucasian ethnicity with higher “food restriction” (standardised coefficient=0.60 ( $p<0.0001$ )).

### Distal outcome-BMI at age 15

“Bingeing/overeating” in girls was strongly associated with higher BMI z-scores at 15; i.e. 1SD increase in the bingeing/overeating score corresponded to an expected 0.24 increase in BMI z-score. A similar strong association was seen in boys.

“Weight/shape concern and WCB” was also associated with higher BMI z-score at age 15 across genders (Table 3).

The “food restriction” dimension on the other hand predicted a lower BMI z-score in girls and boys. In girls 1SD increase in the food restriction score corresponded to an expected 0.15 decrease in BMI z-score 2 years later, in boys to a 0.24 decrease. (Table 3)

BMI z-score at 15 was associated with younger maternal age (standardised coefficient=-0.01,  $p=0.02$ ) and lower parental social class (standardised coefficient for manual versus non-manual=0.16,  $p=0.04$ ) in boys, and younger maternal age (standardised coefficient=-0.02,  $p=0.007$ ) in girls.

In order to determine whether contemporary associations with BMI at age 13 explained the associations found with BMI at age 15, we re-run all ESEM models by including a direct path from the ED clusters to BMI at age 13 and allowing BMI at age 13 and BMI at age 15 to be correlated. Although BMI at age 13 was associated with all three ED clusters (positively with bingeing/overeating and weight and shape concern and weight control behaviors and negatively with food restriction); adding these paths did not make any difference to the results shown in Table 3.



We also performed a sensitivity analysis by including only complete records in the ESEM, however no substantial differences in factor loadings nor in the associations with contemporary and distal variables were apparent.

## **Discussion**

This study used novel methodology to identify ED symptoms dimensions at age 13, whilst simultaneously determining their relationship with contemporary social (impairment and family burden), psychological (presence of an emotional or behavioral disorder), and a distal physical (BMI z-score two years later) outcome in a community-based longitudinal sample. Three ED symptom dimensions were identified: “bingeing/overeating”, “weight and shape concern and WCB” and “food restriction”. Different associations were identified between the three dimension and studied outcomes. Dimensions characterised by bingeing and weight and shape concern and WCB predicted later high BMI for boys and girls. Food restriction on the other hand predicted lower BMI two years later. Bingeing/overeating was associated with emotional and behavioral disorders across genders. Social impairment was associated with bingeing/overeating and weight and shape concern and WCB across genders, but food restriction in boys only. Family burden was associated with all ED symptoms dimensions.

### ED symptoms dimensions at age 13

Although the ED symptoms dimensions identified showed moderate correlations (especially amongst boys) they were quite distinct. Largely, these might reflect broader early ED phenotypes indexing risk for clinical disorders. “Bingeing/overeating” did not have a

compensatory behavior component, and has similarities to BED; “weight and shape concern and WCB” included both weight and shape concern, fear of weight gain, avoidance of fattening foods and compensatory behaviors, a dimension possibly akin to ED such as EDNOS (or BN). “Food restriction” on the other hand was characterised by fasting, skipping meals and throwing away food with no ED cognitions; possibly resembling food avoidant emotional disorder (FAED)[17] and the newly defined Avoidant /Restrictive Food Intake disorder (ARFID)[18] and AN.

Dimensions identified were comparable to those identified in two studies using latent profile analysis and principal component analysis in adolescent clinical ED samples[19-20]; which found a dimension characterised by ED cognitions and excessive exercise; similar to our “weight/shape concern and WCB” pattern. Both studies also identified a component with no ED cognitions but some ED behaviors, similar to our “food restriction” dimension.

#### Associations with contemporary and distal outcomes

We found clear distinctions between ED symptoms dimensions in terms of their associations with adverse contemporary outcomes: “bingeing/overeating” was highly associated with impact to the adolescent and burden to the family. This dimension was highly associated with emotional and behavioral disorders in boys and girls; moreover it predicted a higher BMI z-score two years later.

“Weight and shape concern and WCB” seemed a relatively “benign” dimension cross-sectionally, as it was not associated with psychopathology in girls and with lower probability of

disorder in boys. Importantly however, it had the strongest effect on higher BMI at 15, similarly across genders.

“Food restriction” was differentially associated with impairment and burden across genders, with a strong association in boys, but less so in girls. In boys it was highly associated with psychopathology. The association between “food restriction” and emotional disorders suggests this pattern might be akin to FAED, as highlighted above[17].

Contrary to the other 2 dimensions “food restriction” predicted lower BMI z-scores two years later. Post-hoc analyses were carried out to determine whether this association could be explained by “healthy” weight-loss strategies in subjects who were overweight at age 13 or “unhealthy” weight-control strategies in adolescents at normal weight/underweight at age 13. These analyses showed an association amongst boys between high scores on the food restriction dimension and overweight/obesity (BMI>25) at age 13. In girls high scores on the food restriction dimension were associated with normal weight (BMI between 18.5-25) at 13. “Food restriction” might therefore index different phenotypes in girls and boys: “healthy” weight loss for boys and “unhealthy” weight-control strategies for girls. This might also explain differences in associations with contemporary variables.

There is evidence that ED across adolescence and unhealthy weight control behaviors in middle adolescence predict overweight and obesity[1, 21-22]. Our study confirms and extends these findings by suggesting that both bingeing/overeating and weight concern and WCB patterns predict higher BMI two-years later and might be risk factors for obesity.

Our findings have to be interpreted taking into account relevant strengths and limitations. The main strengths include a large community-based sample of adolescents, representative of the UK geographical area under study. We used a validated measure that closely reflects DSM and ICD diagnostic criteria for ED. BMI was measured objectively at face-to-face assessments. A wealth of data is available on potential confounders.

The study also has some limitations: parental report was used to measure ED symptoms, psychopathology, impairment and burden. Although parental report can be extremely useful in diagnosing ED[23], there is some evidence that parents might be better informants about some ED behaviors (for example fasting, poor eating) but not about more secretive behaviors (such as purging)[24]. This could have resulted in an underestimation of purging and related behaviors. Although response rates were high given the longitudinal nature of this sample (67.5%), attrition was present. However, socio-demographic variables predictive of attrition were included in all analyses.

Early adolescence is an age of major changes and transitions; therefore the social and psychological implications of ED psychopathology need consideration. Given the public health impact of obesity, it is important to understand pathways that might lead to adolescent obesity and prevention of disordered eating might need to be included in obesity prevention strategies. Future work should clarify whether the dimensions identified are themselves precursors or early manifestations of full-blown ED that could be targeted for prevention.

## References

1. Field AE, Sonneville KR, Micali N, et al. Prospective association of common eating disorders and adverse outcomes. *Pediatrics*. Aug 2012;130(2):e289-295.
2. Swanson SA, Crow SJ, Le Grange D, et al. Prevalence and correlates of eating disorders in adolescents. Results from the national comorbidity survey replication adolescent supplement. *Arch Gen Psychiatry*. Jul 2011;68(7):714-723.
3. Micali, N., Hagberg, K.W., Petersen, I., et al. The Incidence of Eating Disorders in the UK in 2000-2009: findings from the General Practice Research Database. 2013; 3:e002646. doi:10.1136/bmjopen-2013-002646
4. Nicholls D, Chater R, Lask B. Children into DSM don't go: a comparison of classification systems for eating disorders in childhood and early adolescence. *Int J Eat Disord*. Nov 2000;28(3):317-324.
5. Golding J, Pembrey M, Jones R. ALSPAC--the Avon Longitudinal Study of Parents and Children. I. Study methodology. *Paediatr Perinat Epidemiol*. 2001;15(1):74-87.
6. Boyd A, Golding J, Macleod J, et al. Cohort Profile: The 'Children of the 90s'--the index offspring of the Avon Longitudinal Study of Parents and Children. *Int J Epidemiol*. Apr 16 2012.
7. American Psychiatric Association (1994). Diagnostic and statistical manual of mental disorders (4<sup>th</sup> ed.) Author: Washington, DC.
8. World Health Organisation (1992). International Statistical Classification of Diseases and Related Health Problems, 10<sup>th</sup> revision. WHO: Geneva.
9. Goodman A, Heiervang E, Collishaw S, et al. The 'DAWBA bands' as an ordered-categorical measure of child mental health: description and validation in British and Norwegian samples. *Soc Psychiatry Psychiatr Epidemiol*. Jun 2011;46(6):521-532.
10. Goodman R, Ford T, Richards H, et al. The Development and Well-Being Assessment: description and initial validation of an integrated assessment of child and adolescent psychopathology. *J Child Psychol. Psychiatry*. 2000;41(5):645-655.
11. Ford T, Goodman R, Meltzer H. The British Child and Adolescent Mental Health Survey 1999: the prevalence of DSM-IV disorders. *J Am Acad Child Adolesc Psychiatry*. 2003 Oct; 42(10):1203-11.
12. Cole TJ, Flegal KM, Nicholls D, et al. Body mass index cut offs to define thinness in children and adolescents: international survey. *Bmj*. Jul 28 2007;335(7612):194.
13. Cole TJ, Bellizzi MC, Flegal KM, et al. Establishing a standard definition for child overweight and obesity worldwide: international survey. *Bmj*. May 6 2000;320(7244):1240-1243.
14. Marsh, H.W., et al., *A New Look at the Big Five Factor Structure Through Exploratory Structural Equation Modeling*. Psychological Assessment, 2010. 22(3): p. 471-491.
15. Marsh, H.W., et al., *Exploratory Structural Equation Modeling, Integrating CFA and EFA: Application to Students' Evaluations of University Teaching*. Structural Equation Modeling-a Multidisciplinary Journal, 2009. 16(3): p. 439-476.
16. Asparouhov T, Muthén B (2009). Exploratory structural equation modeling. *Structural Equation Modeling*, 16, 397-438.
17. Muthén, B.O. & Muthén, L. K. (2012) Mplus 6 User's Guide. Muthén & Muthén: Los Angeles, CA
18. Bryant-Waugh R, Lask B. Overview of the eating disorders (2007). In *Eating disorders in childhood and adolescence*. 3rd ed. (ed. B. Lask, R. Bryant-Waugh), p., 35-50. Routledge: New York and London.
19. American Psychiatric Association (2013). Diagnostic and Statistic Manual (DSM-5 )

20. Eddy KT, Swanson, S.A., Crosby, R.D, et al. How should DSM-V classify eating disorder not otherwise specified (EDNOS) presentations in women with lifetime anorexia or bulimia nervosa? *Psychol Med.* 2010 2010;40:1735-1744.
21. Nicholls DE, Lynn R, Viner RM. Childhood eating disorders: British national surveillance study. *Br J Psychiatry.* Apr 2011;198(4):295-301.
22. Neumark-Sztainer D, Wall M, Guo J, et al. Obesity, disordered eating, and eating disorders in a longitudinal study of adolescents: how do dieters fare 5 years later? *J Am Diet Assoc.* Apr 2006;106(4):559-568.
23. Johnson JG, Cohen P, Kasen S, et al. Eating disorders during adolescence and the risk for physical and mental disorders during early adulthood. *Arch Gen Psychiatry.* Jun 2002;59(6):545-552.
24. House J, Eisler I, Simic M, Micali N. Diagnosing eating disorders in adolescents: a comparison of the eating disorder examination and the development and well-being assessment. *Int J Eat Disord.* Sep 2008;41(6):535-541.