ABNORMAL WHITE MATTER PROPERTIES IN ADOLESCENT GIRLS WITH ANOREXIA NERVOSA

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Purpose: Anorexia nervosa (AN) is a serious eating disorder characterized by severe weight loss and cognitive distortions about shape and weight. Brain volumetric studies in adolescents with AN have reported changes in grey and white matter volumes. To date, no studies have investigated the possible impact of AN on white matter tissue properties during adolescence, when white matter is still under active development. The purpose of this study was to evaluate white matter tissue properties in adolescent girls with AN and healthy controls using two complementary quantitative MRI techniques, diffusion MRI with tractography and T1 relaxometry to measure R1 (1/T1), an index of myelin content. We hypothesized that there would be differences in white matter properties in AN, and that the differences would be associated with reductions in myelin content.

Methods: Fifteen adolescent girls with AN (mean age 16.6 ± 1.4 years) were recruited from the eating disorders clinic and fifteen age-matched girls with normal weight and eating behaviors (mean age 17.1 ± 1.3 years) recruited from the Teen and Young Adult clinic of Lucile Packard Children’s Hospital, Stanford. All study participants underwent a brief structured interview and physical examination and completed two self-administered validated questionnaires that quantify abnormal eating attitudes and behaviors, the Eating Attitudes Test (EAT-26) and the Eating Disorders Examination Questionnaire (EDE-Q). Diffusion MRI images and quantitative R1 were obtained in a single session. Automated Fiber Quantification was used to identify and segment 24 cerebral and callosal fiber tracts in each participant’s brain. Manual segmentation was employed to segment the fimbria-fornix bilaterally in each subject. A total of 26 tract profiles were generated by computing measures for fractional anisotropy (FA) and R1 along the trajectory of each tract.

Results: Subjects with AN and controls were similar in age but compared to controls, those with AN had significantly lower weight (p<.001), BMI (p<.001), and percent median BMI (p<.001) and higher scores of all measures of eating disorder symptomatology (p<.001). Compared to controls, FA in the AN group was significantly decreased in segments of 4 of 26 white matter tracts and significantly increased in segments of 2 of 26 white matter tracts. R1 was significantly decreased in the AN group compared to controls in 11 of 26 white matter tracts. The combination of reductions in FA and in R1 suggests that differences in white matter properties in adolescents with AN are likely due to reduction in myelin content.

Conclusions: This study is the first to assess white matter properties in adolescents with AN and to combine two complementary methods of white matter characterization. The findings suggest that weight loss and starvation in AN may lead to reduced lipid content in the brain. Alternatively, reductions in myelin content could reflect decreased myelin formation caused by AN disrupting normal myelination during adolescence. Future studies should follow adolescents with AN longitudinally to determine if
changes persist or resolve with weight restoration.

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45.

SCREENING FOR CELIAC DISEASE IN PATIENTS WITH EATING DISORDERS

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Purpose: Celiac disease (CD) affects approximately 1% of the population, and although it remains largely underdiagnosed, can have considerable long-term morbidity. Common presenting symptoms include gastrointestinal complaints and weight loss, which are also symptoms seen in patients with eating disorders (EDs). Because of this overlap, and the importance of early diagnosis of CD and identifying possible complicating factors in patients with EDs, screening in our program has become part of an initial assessment during the past 4 years. To date there have been no studies indicating whether the rate of CD is higher in patients with EDs than in the general population.

Methods: A retrospective chart review of all patients ages 7-22 years seen in our Division of Adolescent Medicine for an ED evaluation from 2011-2014 were reviewed. Screening for CD was done with tissue transglutaminase IgA antibody (TTgAb) and anti-endomysial IgA antibody (aEAb). Immunoglobulin A (IgA) was also measured.

Results: There were 1160 patients evaluated for an ED between 2011-2014, and 42.6% (494) were screened for CD during this time. Of those patients screened for CD the mean age was 16.0, compared to a mean age of 15.6 for those that were not screened, and 87.7% were female, compared to 84.7% of the unscreened group. Of the 494 screened, 10 (2%) screened positive with a TTgAb IgA EIA >20. Of those 10, all were female and the mean age was 15.1 years. One patient reported a prior diagnosis of Irritable Bowel Syndrome with the remainder not having prior care with a gastroenterologist. Reported calorie intake ranged from 500-1900 kcal/day with an average of 1100 kcal/day. Of the 10 who screened positive via blood test, 4 had biopsy confirmed CD via endoscopy, for an overall 0.8% prevalence in this cohort. One patient had endoscopy with a negative biopsy, 3 had mildly elevated TTgAb levels that were normal when repeated, and 2 patients were lost to follow-up—one was referred to a gastroenterologist and the other who was to have a repeat TTgAb as the initial one was only mildly elevated. Three patients had elevated aEAb but all 3 also had elevated TTgAb levels. Of the 457 patients who were also screened for IgA deficiency (92%), 5 (1.1%) had low IgA levels. All cases were discussed with Allergy and Immunology and no further intervention was needed after confirming that immunoglobulin levels were otherwise normal.

Conclusions: In this cohort of patients being evaluated for an ED, 0.8% had biopsy confirmed CD. This is similar to the reported prevalence in the general population, suggesting that routine screening of patients with EDs for CD is not indicated. We still need to be vigilant, however, for subtle symptoms that may indicate underlying CD in a small percentage of patients with EDs. There are some limitations in that fewer than 50% of patients were screened and 2 of the 10 who screened positive were lost to
follow-up. Some of the patients with EDs may have also been avoiding gluten, which could have affected the screening test.

Sources of Support: None

46.

EFFECT OF PRIOR HISTORY OF OBESITY/OVERWEIGHT ON RETURN OF MENSES IN ADOLESCENTS WITH EATING DISORDERS

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Purpose: Individuals with a history of obesity or overweight represent a substantial portion of adolescents presenting for evaluation of eating disorders (ED). One of the medical complications of weight loss in patients with ED is amenorrhea, which is associated with reduced bone mineral density and increased fracture risk. Return of menses (ROM) usually accompanies weight restoration and is a clinical marker of return to health. However, biological and behavioral factors including prior weight status could affect ROM, but these have not been examined in adolescents. We studied the relationship between prior history of overweight and ED-related behaviors on ROM in adolescents with ED.

Methods: Chart reviews of all female adolescents presenting to an academic ED program between January 2007 and June 2009 (N = 427, mean age = 16.6, ± 2.1) were conducted retrospectively. Participants who were premenarchal (N=31), age < 12 years (N=29), on oral contraceptives (N=41), menstruating regularly (N=116) or had missing data (N=47) were excluded, leaving a sample of 163 participants. Of the 163 participants with amenorrhea, 20.2% (N= 33) were previously overweight (≥ 85% percentile body mass index, BMI) and 79.8% (N=130) were not previously overweight (≤ 85% percentile BMI), based on self-reported highest weight prior to presentation. Participant’s charts were followed for 2 years or until their last clinic date if less than 2 years. ROM was defined as self-report of 1 month of return of menstruation. The primary outcome measure was % median BMI at return of menses. Charts were reviewed for purging, exercise and use of laxatives at ROM and during follow up.

Results: The mean % median BMI at presentation for those previously overweight was 97.4 ± 13.2, compared to 84 ± 9.7 for those who were not previously overweight (p<0.001). Among the previously overweight group, 42.4% (N=14) resumed menses and 57.5% (N=19) had continued amenorrhea. Among those who were not previously overweight, 36.9% (N=47) resumed menses and 63% (N=82) had continued amenorrhea. At ROM, the mean % median BMI for those who were previously overweight was 106.1± 11.7 compared to 94.2 ± 8.9 for those not previously overweight (p<0.001) There were no significant differences in purging, exercise or laxative use at follow-up among amenorrheic patients who had a past history of being overweight, compared to those who were not previously overweight.

Conclusions: Amenorrheic patients with ED who were previously overweight need to be at a higher percentage median BMI in order to resume menses compared to those who were not previously overweight. There was no difference in the weight reduction behaviors among amenorrheic patients...
based on their prior weight status. Pretreatment weight status is an important indicator for return of
menses, which is useful for assignment of treatment goal weight in adolescents with eating disorders.
Sources of Support: None

47.

DIET QUALITY OF ADOLESCENTS WITH AN EATING DISORDER
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Purpose: It has been demonstrated that patients with eating disorders present with erratic eating
patterns and suboptimal daily caloric intake. However, less is known regarding the diet quality of these
patients in terms of intake of macronutrients (i.e. protein, carbohydrate, and fats) and micronutrients
(i.e. vitamins and minerals). The purpose of this study is to determine diet quality among patients
presenting for the treatment of eating disorders using the NDSR (Nutrition Data Systems for Research)
program.

Methods: A convenience sample of adolescents referred to an Eating Disorder Program was recruited
for inclusion in this study during their initial visit. Following appropriate consent/assent, participants
completed a 24 hour dietary recall administered by a study investigator. The dietary recall was obtained
using the multiple pass method, a validated interviewing technique to determine 24 hour dietary recall.
The multiple pass method includes five steps in which the subject: (1) reports an uninterrupted list of all
foods and beverages consumed; (2) is asked about frequently forgotten items; (3) provides the time and
occasion each item was consumed; (4) provides item details including quantity and type; and (5) is
probed for additional foods or beverages not previously reported. Following completion of the 24 hour
dietary recall, the results for each participant were entered into the NDSR version 2014, which provides
a detailed nutrition analysis. The study was approved by the Health System Institutional Review Board.

Results: Data from 23 adolescents were analyzed. Sixteen of the subjects were females, and 14 were
non-Hispanic Whites. According to DSM-5 criteria, seven were diagnosed with Anorexia Nervosa, five
with Bulimia Nervosa, four with Avoidant Restrictive Food Intake Disorder (ARFID), six with Atypical
Anorexia Nervosa, and one with Unspecified Eating Disorder. Ages ranged from 12 to 20 years with a
median of 16 years. Body-mass-index percentiles ranged from the 1st to the 92nd percentile with four
less than the 5th percentile and one with a BMI greater than the 85th percentile. Average daily calories
were 1308. Average percentages of calories from macronutrients were 33% from fat, 47% from
carbohydrate, and 20% from protein. Micronutrient content was very low (44-52% of recommended
Daily Values) for vitamins E, D, and B12, as well as zinc and copper; low (58-71%) for calcium, potassium,
iron and magnesium; and normal (≥100%) for vitamins A and C, manganese, and selenium.

Conclusions: Despite average daily caloric intake being below recommended values in these patients
with eating disorders, as expected, the distribution of macronutrients was within the ranges
recommended for older children and adolescents by the Dietary Guidelines for Americans, 2010: 25-35%
from fat, 45-65% from carbohydrates, 10-30% from protein, which was an unexpected finding. .
Micronutrient intake varied considerably and may necessitate further investigation. Limitations of the
study include a small, convenience sample and the possibility that subjects had altered their diets knowing that they were being referred to an Eating Disorder Program.

Sources of Support: None

48.

AVOIDANT/RESTRICTIVE FOOD INTAKE DISORDER AND ANOREXIA NERVOSA SUBTYPES: HOW DO THEY COMPARE?
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Purpose: Avoidant/restrictive food intake disorder (ARFID) is a relatively new eating disorder diagnosis introduced with the publication of the DSM-5. The current literature has compared ARFID patients to anorexia nervosa (AN) and bulimia nervosa (BN) patients, but no studies have compared ARFID to AN-restricting and AN-binge/purge subtypes in presentation and treatment outcomes. This study aimed to characterize ARFID patients presenting for inpatient medical stabilization when compared to AN-restricting subtype (AN-R) and AN binge/purge subtype (AN-BP) patients.

Methods: A retrospective chart review was performed on patients with ARFID and AN hospitalized between 2008 and 2014 for acute medical stabilization of nutritional insufficiency. Patients with ARFID, AN-R, and AN-BP were compared on admission characteristics, hospitalization data, and treatment outcomes at one year following discharge using Chi-square and Fisher Exact tests for categorical characteristics and ANOVA and Kruskal-Wallis tests for continuous characteristics.

Results: Patients presenting for inpatient stabilization of AN-R (n = 145), AN-BP (n = 58), and ARFID (n = 41) were predominantly female (88% vs. 93% vs. 85%) and Caucasian (95.2% vs. 98.3% vs. 95.1%). Patients with AN-R, AN-BP, and ARFID did not differ in their presenting percent median body weight (82.3% AN-R, 85.0% AN-BP vs. 81.2% ARFID). Patients with AN-BP were older (19 years AN-BP vs. 17 years AN-R vs. 16 years ARFID, p<.0001) and had longer durations of illness (51.5 months AN-BP vs. 20.1 months AN-R vs. 21.9 months ARFID, p<.0001) than patients with restricting subtype or ARFID. Weight loss prior to presentation was greater for both AN subtypes than for ARFID, although only AN-BP vs. ARFID achieved statistical significance (14.4 kg AN-BP vs. 12.8 kg AN-R vs. 9.8 kg ARFID, p=0.06). AN-BP patients were more likely to engage in weight loss substance use (diuretics, diet pills, and laxatives), tobacco use, and alcohol use than AN-R or ARFID patients. Electrolyte abnormalities at presentation were more common in AN-BP and ARFID than AN-R, with hypokalemia the most common (21.4% AN-BP vs. 20.0% ARFID vs. 3.6% AN-R, p<0.0001). Length of stay was longer for ARFID patients than for either AN subtype (9.4 days ARFID vs. 6.0 days AN-R vs. 5.8 days AN-BP, p = 0.0006). During inpatient medical stabilization, there was no difference in caloric interventions, although ARFID patients relied more on tube feeding to meet caloric requirements than either AN subtype (31.7% ARFID vs. 2.1% AN-R vs. 13.8% AN-BP). AN-BP patients were less likely than AN-R or ARFID patients to be recovered at one year (19.5% AN-BP vs. 56.7% AN-R vs. 61.9% ARFID) and more likely to require readmission (41.5% AN-BP vs. 17.3%
Conclusions: ARFID patients exhibit similarities with AN-R patients in presentation and treatment course, with no difference in age and length of disease at presentation and readmission and recovery rates at 1 year. ARFID patients at our institution require longer hospitalizations than patients with either AN subtype. Future studies should examine treatment regimens to improve outcomes for AN-BP patients and whether AN-BP patients over time are more likely than AN-R or ARFID patients to progress to bulimia nervosa.

Sources of Support: None

49.

ASSESSMENT OF PARENTAL KNOWLEDGE AND UNDERSTANDING OF EATING DISORDERS
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Purpose: Family-based treatment (FBT) and other forms of family therapy are effective and recommended in the management of adolescent eating disorders. Although parents are expected to play an important role in their children’s treatment process, few studies have investigated parental knowledge and understanding of eating disorders. One recent study demonstrated an increase in parental self-efficacy and knowledge through a psycho-education program prior to formal eating disorder treatment. The purpose of this study was to assess baseline parental knowledge and understanding of eating disorders and to examine how it is impacted by participation in treatment.

Methods: A cross-sectional and prospective cohort study comparing the parents of children ages 8 to 18 seeking initial evaluation for an eating disorder at an Adolescent Medicine clinic (ED) to those attending appointments at a General Pediatrics clinic (GP) was performed. An online survey containing demographic information and a 20-item questionnaire about the signs/symptoms, popular myths, and complications of eating disorders was administered via REDCapTM to parents at both clinics on a provided computer. A second survey containing the same questionnaire, as well as specific questions related to their children’s treatment for the ED group, was automatically sent via e-mail two months later to be completed on a personal computer. Eating disorder treatment mainly took place in the outpatient setting only, with a smaller percentage of patients participating in a family-centered day program; both included varying degrees of psychoeducation. Statistical analyses included two-sample t-tests, ANOVA, or chi-squared tests for analysis of data at a single time point and linear mixed effect models, GEE models, or McNemar’s tests for analysis of data from both surveys.

Results: At baseline, when all participants who completed the first survey (N=172 [82 ED, 90 GP]) were considered, the ED group had a higher mean score than the GP group (83.16% vs. 77.09%; p=0.010). When limiting the analysis to participants who completed both surveys (N=101 [48 ED, 53 GP]), there was no difference between the mean scores at baseline between the two groups (83.00% vs. 80.42%; p=0.306). After two months, the mean score of the ED group was significantly higher (83.00% vs. 89.45%; p<0.001), while that of the GP group was not (80.42% vs. 81.91%; p=0.250). The change in mean
score from the first to second survey of the ED group was significantly greater than that of the GP group (p=0.009).

**Conclusions:** Before treatment, parents of children with eating disorders have more knowledge and understanding of the illness than parents with unaffected children. After participating in treatment, parents of children with eating disorders gained knowledge, while parents in the control group did not. Increased knowledge may improve self-efficacy, which plays a critical role in parents’ ability to effectively adopt eating disorder treatments like FBT and other family-centered models. This study has implications to include parental psycho-education in all levels of eating disorder care. Furthermore, as the control group had lower baseline knowledge, this study may have implications for including knowledge about eating disorders in anticipatory guidance at well-child visits.

**Sources of Support:** None

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**COLLEGE SCREENING PRACTICES FOR EATING DISORDERS: A CONTENT ANALYSIS OF COLLEGE ENTRY HEALTH FORMS.**

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**Purpose:** Eating disorders commonly emerge during adolescence and often require treatment simultaneously with college matriculation. As older adolescents with eating disorders transition to college, lack of screening and proactive identification of youth that may require additional support around a previously diagnosed eating disorder may lead to relapse or worsening of their condition. We sought to quantify the proportion of a nationally representative sample of college health entrance forms that included screening questions related to eating disorders.

**Methods:** Colleges were identified using publically available online directories of colleges (ie. Higher Education Online Directory: www.ehes.hepinc.com and www.univsource.com/region.htm). Census Bureau designated regions were used to categorize colleges by location. Available health forms were downloaded and reviewed for screening questions regarding history of an eating disorder. Items that specifically asked about an eating disorder were quantified. If a health form asked about eating “issues”, “frequencies” or “habits” it was not considered a specific screening item for an eating disorder. We also quantified general items regarding mental health history, including emotional disorders, previous psychiatric treatment, and mental health impairment. Technical, online, and community colleges were not included in this analysis. Descriptive analysis using chi squared comparisons were performed.

**Results:** Out of 3,026 four-year colleges in the United States, 10% (n=306) of colleges with health forms available on line were randomly selected for this content analysis. Forms from colleges located in 43 states and the District of Columbia were included. Less than half of all forms (n=143; 46.7%) had screening questions related to an eating disorder diagnosis. Regionally, colleges located in the South (n=123) were less likely to have forms including eating disorder screening items (34.4% of forms) than colleges located in the Midwest (n=70; 51.4% of forms), Northeast (n=90; 58.8% of forms), or Western (n=23; n=60.9% of forms) regions (p<0.005). Not including forms that screened for an eating disorder, 15.3% (n=47) of forms screened for general mental health issues. More than a third of all college forms...
(n=116; 37.9%) had no screening items for eating disorders or mental health conditions.

**Conclusions:** Despite the fact that eating disorders are common health concerns in college-bound adolescents and young adults, the majority of pre-matriculation health forms we examined lack screening items related to eating disorders. This lack of screening represents a missed opportunity to identify students requiring additional support and resources during the transition to college. Data regarding available eating disorder and mental health services by college and region may help to better understand correlations between pre-matriculation screening and the ability to offer appropriate services.

**Sources of Support:**

51.

**WEIGHT AND SYMPTOM OUTCOMES AT FOLLOW-UP OF YOUNG PATIENTS TREATED IN A FAMILY-CENTERED PARTIAL HOSPITALIZATION PROGRAM FOR EATING DISORDERS**

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**Purpose:** Eating disorders (EDs) are associated with significant morbidity and mortality. There has been an increased incidence of EDs in younger patients, but there is limited research on outcomes after treatment. The purpose of this study was to determine outcomes at one year or more in young patients admitted to a family-centered Partial Hospitalization Program (PHP) for EDs; to compare those patients who were still being followed to those who were not; and to investigate predictors for good prognosis.

**Methods:** A prospective cohort study was conducted, comparing patients who were followed up in the Eating Disorders Clinic (EDC) to those who were not (NF), after discharge from the PHP for ≥ 1 year (N=187). Contact was made via telephone or in person, and 81 patients consented to participate, yielding a 43% response rate. Baseline demographic, historical, and anthropometric information, as well as Children’s Eating Attitudes Test (ChEAT) scores, were obtained from the existing PHP database. The only significant difference between patients who participated and those who did not was length of stay (LOS) in PHP (p=0.003). Interviews were conducted in-person or by telephone, and a ChEAT was completed. Anthropometric measurements were performed in clinic or obtained from primary care providers, and % Median Body Weight (%MBW) was determined. Primary outcome variables were ≥ 95% MBW and ChEAT score < 20 (clinical cutoff) at follow-up. Data were entered into REDCap™ and analysis included paired and two-sample t-tests, chi-square, Wilcoxon Rank Sum, Kruskal Wallis, ANOVA, and Spearman correlation.

**Results:** Participants were 89% female with an average age of 16 ± 2.2 years at follow-up, which occurred at 28.4 ± 13.2 months post-discharge. At intake, the EDC group presented with more weight loss (p=0.029) and the NF group was younger (p=0.025); there were no differences at discharge. Current ED symptoms included: restriction (32%), recent weight loss (21%), purging (11%), and binging (7%). Almost 65% were ≥ 95 %MBW and 85% had ChEAT scores <20. The EDC group had a significantly higher percentage of participants who were ≥ 95% MBW at follow-up than the NF group (p=0.039), but both
had a significant increase in %MBW since discharge (p=0.035 and 0.017, respectively). %MBW at intake (p<0.001) and at discharge (p<0.001) was greater in the participants who were ≥ 95% MBW at follow up. Those with follow-up ChEAT scores <20 had lower ChEAT discharge scores (p=0.002) and shorter LOS (p=0.038), but were not different in terms of %MBW at follow-up. Time interval since discharge was longer for the NF group (p=0.001), but this variable did not influence primary outcomes.

Conclusions: Young ED patients treated in a family-centered PHP had good outcomes at follow-up, with ≥ 95% MBW and ChEAT scores < 20 serving as markers of recovery. Both intake and discharge %MBW were predictors of weight normalization at follow-up. Continued care at the EDC did not influence outcomes. The low patient response rate highlights the need for better methods of follow-up and has implications for the development of a prospective registry for EDs.

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