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SOCIAL MEDIA BEHAVIORS IN EATING DISORDERS

Protect me from my selfie: Examining the association between photo-based social media behaviors
and self-reported eating disorders in adolescence

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Abstract

Objective

This study examined whether social media behaviors were associated with higher odds of meeting criteria for an eating disorder and whether gender moderated these relationships.

Method

Australian adolescents ($N = 4209$; 53.15% girls) completed the self-report photo investment and manipulation scales. Additional self-report items assessed avoidance of posting selfies and investment in others' selfies. Eating disorders were identified by the EDE-Q and other self-report measures aligned with DSM-5 criteria.

Results

A multinomial logistic regression examining the effect of avoidance of posting selfies, photo investment, photo manipulation, and investment in others' selfies on the likelihood of meeting criteria for an eating disorder, compared to no disorder, was significant ($\chi^2(42) = 1128.93, p < .001$). Greater avoidance was associated with higher odds of meeting criteria for all disorders except clinical/subclinical binge eating disorder and purging disorder. Increased photo investment was related to greater odds of meeting criteria for all disorders. A similar relationship emerged for photo manipulation, with the exception of clinical/subclinical binge eating disorder, and UFED. Investment in others' selfies was associated with higher odds of meeting criteria for all disorders except clinical/subclinical anorexia nervosa and purging disorder. There was a significant interaction between gender and avoidance ($\chi^2(1) = 5.23, p = .025, OR = 1.74$), whereby boys were more likely to meet criteria for clinical/subclinical anorexia nervosa in the context of greater avoidance of posting selfies.

Discussion

Appearance-related social media behaviors may be indicative of eating disorder risk. Implications for clinicians and advancements for social media screening tools are discussed.

Keywords: Eating Disorders, Social Media, Selfies, Adolescents, Gender

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Protect me from my selfie: Examining the association between photo-based social media behaviors and self-reported eating disorders in adolescence

Eating disorders are a group of mental health conditions characterized by maladaptive eating behaviors and body image concerns. Eating disorders are most prevalent amongst young women between the ages of 15 and 24 (Hay et al., 2017), but may be increasing at a faster rate for men than women (Mitchison & Mond, 2015). Untreated, eating disorders endure for long periods and are associated with poor physical and mental health outcomes (Fichter & Quadflieg, 2016; Griffiths et al., 2016). In addition to the emotional and psychosocial burden of eating disorders, the economic cost to the Australian healthcare system has been estimated at \$100 million per annum (Deloitte Access Economics, 2012). As adolescence is the most common age of onset of these disorders (Hudson, Hiripi, Pope, & Kessler, 2007), examining behaviors of adolescents who meet criteria for an eating disorder may inform advancements in early intervention and prevention programs (Dahlenburg, Gleaves, & Hutchinson, 2019).

Cross-sectional research has found that engagement with photo-based social media sites, such as Instagram, is associated with poor body image (Fardouly, Willburger, & Vartanian, 2017). Experimental findings have supported this relationship, whereby posting selfies on social media worsened women's body image, including perception of fatness, physical attraction, and body size satisfaction (Mills, Musto, Williams, & Tiggemann, 2018). As body image is a key risk factor in the development and maintenance of eating disorders (Culbert et al., 2015) it is important to examine appearance-related social media behaviors, particularly those related to "selfies" and risk for eating disorder onset. In line with prior research (e.g., McLean, Paxton, Wertheim, & Masters, 2015), the current study operationalized selfies as images of oneself taken by anyone, not just the person in the image. Whilst there is no uniform definition of "photo-based social media behaviors" within current

literature, for the purposes of the current study, these behaviors broadly involve editing and posting selfies, as well as scrutinizing one's own selfies, responses to one's selfies, and others' selfies.

Existing literature has indicated that college-aged women who reported greater photo-based social media behaviors (e.g., appearance comparisons to friends' photos on social media and "untagging" their own selfies on Facebook) reported greater disordered eating attitudes and behaviors (Mabe, Forney, & Keel, 2014). Similar maladaptive Facebook behaviors have predicted bulimic symptoms and episodes of overeating over a four-week period (Smith, Hames, & Joiner, 2013). Of the few studies that have examined male users, greater use of photo-based social media platforms was associated with higher levels of body image concerns among adolescent males (de Vries, Nikken, & de Graaf, 2014) and eating disorder symptoms amongst sexual minority men (Griffiths, Murray, Krug, & McLean, 2018). There also appears to be increasing prevalence of muscularity-oriented selfies amongst males (Pila, Mond, Griffiths, Mitchison, & Murray, 2017). Preliminary cross-sectional research on the relationship with disordered eating and body image found that adolescent girls who reported greater photo investment (effort in choosing a selfie and monitoring likes/comments), and photo manipulation (digital editing of a selfie) reported greater eating and body image concerns (McLean et al., 2015). Examining how adolescents who meet criteria for an eating disorder engage with photo-based social media is an important extension of literature that has typically examined subclinical or broader eating pathology amongst adult women. This is particularly relevant as eating disorder risk is elevated during adolescence and they are the most prolific users of photo-based social media sites (Smith & Anderson, 2018).

In a social media environment, taking and editing selfies, and monitoring likes/comments, may reflect body image behaviors typically observed in offline settings by those with an eating disorder. Body checking (i.e., compulsive scrutiny of perceived appearance flaws or areas of

overvaluation) and avoidance (e.g., avoiding one's reflection) are prominent eating disorder maintaining factors (Fairburn, Cooper, & Shafran, 2008) that may extend in online contexts through obsessive monitoring and selection of selfies or avoidance of posting selfies (and "un-tagging"). Monitoring of likes/comments on uploaded selfies may be an online manifestation of reassurance-seeking (Chua & Chang, 2016). Finally, compulsive appearance-fixing and camouflaging, also a maintaining factor in body image disorders (Mitchison et al., 2013; Veale, 2004), may be reflected in compulsive digital manipulation of selfies prior to uploading on social media. Extending McLean and colleagues' (2015) findings, women who reported greater photo investment and manipulation also reported greater bulimic symptomology in survey research (Cohen, Newton-John, & Slater, 2018). However, in another cross-sectional study, when the construct of investment was isolated to investment in others' feedback (i.e., *not* including effort in choosing a selfie), it was found to be associated with clinical features of anorexia, but not bulimia, nervosa (Butkowski, Dixon, & Weeks, 2019). The discrepancy between Cohen et al. (2018) and Butkowski et al.'s (2019) findings may be due to measurement of investment in others' feedback; that is, effort in choosing a selfie to post to social media may tap into a different psychological process than purely monitoring likes/comments. Further research is required to elucidate whether those with diverse eating disorder presentations demonstrate greater investment in others' feedback compared to healthy peers. Another important, yet understudied, photo-based social media behavior is engagement with others' selfies independent of posting one's own selfies. For the most part, it is possible for users to scrutinize others' selfies and engage in appearance comparison without posting selfies themselves. Little is known, however, about how those with an eating disorder engage with others' selfies independently from other photo-based social media behaviors related to their own selfies.

To our knowledge, no study has investigated whether those who meet criteria for an eating disorder engage in these appearance-related online behaviors or avoid posting selfies to social media more than those who do not meet criteria. Accordingly, current treatments may fail to target social media behaviors that correspond with 'offline' body image behaviors. The need to address this gap has been echoed by concerns that few clinicians assess social media in relation to eating disorder maintenance, despite the substantial time individuals (especially adolescents) may spend on social media (Saul & Rodgers, 2018). Whether different clinical presentations of eating disorders correspond with specific social media behaviors remains unknown. There are nine eating disorders in total (American Psychiatric Association, 2013) that can be grouped into phenotypically similar presentations (e.g., anorexia nervosa and atypical anorexia nervosa; bulimia nervosa and subclinical bulimia nervosa; binge eating disorder and subclinical binge eating disorder). Investigating how these clinical groups differ in terms of their social media behavior profiles may have treatment implications by elucidating transdiagnostic and diagnostic-specific social media behaviors to be targeted in interventions.

Hypotheses

In light of research that suggested photo-based social media behaviors were related to eating disorder symptoms and behaviors (Butkowski et al., 2019; Cohen et al., 2018; Tiggemann et al., 2019), it was firstly hypothesized that greater avoidance of posting selfies, photo investment, photo manipulation, and investment in others' selfies would be associated with higher odds of meeting criteria for all eating disorders. Secondly, because male and female users have demonstrated similar relationships between photo-based social media behaviors and broader eating psychopathology (Griffiths et al., 2018; Pila et al., 2017; de Vries et al., 2014), it was hypothesized that gender would not moderate the relationship between photo-based social media behaviors and

the odds of meeting criteria for an eating disorder. Examination of these hypotheses therefore sought to address whether photo-based social media behaviors differed in a community sample of Australian adolescents who met criteria for an eating disorder compared to those who do not, and whether these relationships were different for different subgroups of eating disorder diagnoses, and for adolescent boys compared to adolescent girls.

Eating disorders were grouped based on their phenotypic similarity, as stated above. Due to their phenotypically distinct nature, night eating syndrome, purging disorder, and unspecified feeding and eating disorder (UFED) were examined separately. Given the lack (and equivocal nature) of evidence regarding differences in social media behaviors between eating disorders, no priori hypotheses were employed for analyses comparing clinical groups. And given psychosocial and developmental changes during adolescence, and that body mass index (BMI) has been related to maladaptive eating behaviors and weight loss attempts in adolescents (Golden, Schneider, & Wood, 2016; Neumark-Sztainer et al., 2006), age and BMI percentile were included as covariates.

Method

Participants and Procedure

Data were from the first wave of the EveryBODY Study, a longitudinal investigation of eating disorders among 5,075 Australian adolescents. A total of 13 Government and Independent schools participated in the study, with all high school students being invited to participate (See Trompeter et al., 2018 for detailed study methodology). All procedures were approved by the lead author's university human research ethics committee, and by the NSW Department of Education. Informed assent was obtained from all adolescents participating in the study. A passive consent procedure was used for parents, wherein parents/guardians could opt to have their adolescent not participate, prior to the study's commencement. The current study excluded data from participants who did not

assent ($n = 6$), identified their gender as “other” ($n = 32$), did not complete all social media items ($n = 741$), and, to ensure independence of diagnostic groups, those who met criteria for more than one eating disorder diagnosis ($n = 87$).

The final sample comprised of a total of $N = 4209$ (53% adolescent girls) participants. Compared to participants who were excluded from analyses, participants in the current study were more likely to be older ($t(1146.42) = 4.90, p < .001$) and of a lower BMI percentile ($t(1080.76) = -3.32, p = .001$). A total of 22% of the initial sample met criterion for at least one eating disorder. After applying exclusion criteria, 21.6% of the sample met criterion for at least one eating disorder. “This rate of prevalence when considering major eating disorders, OSFED and UFED and in an adolescent sample is similar to previous studies in young samples (e.g., Hammerle et al., 2016; Micali et al., 2015). Most participants (89.2%) reported being born in Australia, 5.7% in Asia, 2.2% in Europe, 1.3% in Oceania/Pacific (other than Australia), 0.9% in Africa, 0.5% in North America, and 0.1% in South America. A minority of participants (0.1%) did not report their place of birth. Age ranged from 12 to 18 years ($M = 15.03, SD = 1.53$) for adolescent boys, and 11 to 19 years ($M = 14.92, SD = 1.53$) for adolescent girls. In accordance with Centre for Disease Control guidelines (Whitlock, Williams, Gold, Smith, & Shipman, 2010), 7.1% ($n = 139$) of adolescent boys and 7.4% of adolescent girls ($n = 165$) were in the ‘underweight’ (less than the 5th percentile) range. Most adolescent boys (62.4%, $n = 1230$) and adolescent girls (67.3%, $n = 1504$) self-reported BMI percentile was in the ‘normal or healthy’ (5th percentile to less than the 85th percentile) range. A total of 13.3% ($n = 263$) of adolescent boys and 11.5% ($n = 257$) of adolescent girls were in the ‘overweight’ (85th to 94th percentile) range. Fewer adolescent boys (8.8%, $n = 174$) and adolescent girls (6.7%, $n = 149$) were in the ‘obese’ (95th percentile or greater) range. Average BMI percentile

fell within the 'normal or healthy range' for adolescent boys ($M = 54.95$, $SD = 31.27$) and adolescent girls ($M = 52.46$ $SD = 30.39$).

Measures

Avoidance of Posting Selfies to Social Media. Participants responded to the item "Do you avoid putting photos of yourself on social media?" on a Likert-scale ranging from 1 ("never") to 5 ("always"). The item was developed by the authors for the purpose of the current study. Higher scores indicated greater avoidance of posting selfies to social media.

Photo Investment. The self-report photo investment scale (McLean et al., 2015) assessed participants' effort in choosing a selfie to post to social media, as well as monitoring responses to such images. Photo investment was measured by eight visual analogue items, ranging from 0 to 100, and anchored by opposing statements such as, "I worry about whether anyone will "Like" my photos" and "I don't care whether anyone will "Like" my photos". Total scores were derived from the mean of the eight items, with higher scores indicating greater photo investment. Prior research has indicated adequate internal consistency for the full measure amongst Australian adolescent girls ($\alpha = 0.82$; McLean et al., 2015) and a sample of adolescent boys and girls ($\alpha = 0.73$; Mingoia, Hutchinson, Gleaves, & Wilson, 2019). Internal consistency in the current study was 0.68 and 0.77 for adolescent boys and girls, respectively.

Photo Manipulation. The self-report photo manipulation scale (McLean et al., 2015) assessed the extent to which participants edited their selfies prior to posting images on social media. Photo manipulation was measured by 10 Likert-type items that ranged from 1 ("never") to 5 ("always"; e.g., "make specific parts of your body look larger or smaller"). Scores ranged from 10 to 50, with higher scores indicating greater photo manipulation. The measure has demonstrated adequate internal consistency amongst Australian adolescent girls ($\alpha = 0.86$; McLean et al., 2015)

and a sample of boys and girls ($\alpha = 0.77$; Mingoia et al., 2019). Internal consistency in the current study was adequate for adolescent boys ($\alpha = 0.94$) and adolescent girls ($\alpha = 0.89$).

Investment in Others' Selfies. Three Likert-scale self-report items, ranging from 1 ("not at all") to 7 ("very much"), assessed the extent to which participants carefully examined others' selfies, including comments and number of 'Likes', and commented on, or 'Liked', others' selfies. Items were developed by the authors for the purpose of the current study. Scores were averaged to produce a measure of investment in others' selfies. Internal consistency was adequate for adolescent boys ($\alpha = 0.77$) and adolescent girls ($\alpha = 0.75$).

Eating Disorder Diagnoses. Criteria for diagnostic groups were adopted from a prevalence study using the same sample (Mitchison et al., 2019). Standardized measures in conjunction with researcher-developed questions captured the diagnostic criteria of full syndrome, other specified, and unspecified eating disorders (see Table 1 of supplemental file for diagnosis operationalization). Most symptoms were captured by items of the Eating Disorder Examination Questionnaire (EDE-Q, version 6; Fairburn, Cooper, & O'Conner, 2008). The EDE-Q assessed participants' weight and height used to calculate age and gender-adjusted BMI percentiles, as well as the presence and severity of cognitive and behavioral eating disorder symptoms. The EDE-Q has been validated and shown good reliability in Australian adolescent boys and girls (Mond et al., 2014). Items used in the current study included frequencies of maladaptive eating behaviors (self-induced vomiting, laxative misuse, driven exercise, and binge eating), and the Likert-scale items (scores ranged from 0 to 6, with higher scores indicating greater weight/shape concerns) that comprised the combined weight and shape concern subscales. Internal consistency reliability for the combined weight/shape subscale in the current study was 0.91 and 0.94 for adolescent boys and girls, respectively. A BMI percentile <10 was used for the underweight criterion, as this cut-off has most frequently been used in adolescent

epidemiological studies of DSM-5 defined anorexia nervosa (e.g., Hammerle, Huss, Ernst, & Bürger, 2016). Three items from the Night Eating Questionnaire (NEQ; Allison et al., 2008) assessed symptoms of night eating syndrome, including the proportion of food intake consumed following supper, nocturnal eating (awaking in the night after going to bed to consume high calorie foods, followed by lack of appetite in the morning) and awareness during nocturnal eating. The NEQ has been validated in adolescents and is superior to parent report (Gallant et al., 2012). Internal consistency reliability for NEQ in the current study was 0.79 and 0.94 for adolescent boys and girls, respectively.

Several additional researcher-developed items captured frequency of extreme weight control behaviors (fasting, strict dieting, detoxes, insulin misuse, and other drug use for weight loss), distress associated with binge eating, and additional diagnostic binge eating disorder features (e.g. eating faster than usual, eating alone due to embarrassment). Participants were also asked about weight loss in the past four weeks to assess atypical anorexia nervosa. The criteria for clinically significant distress and impairment (used in the diagnosis of night eating syndrome and unspecified feeding and eating disorder; UFED) was assessed with the K10 Psychological Distress Scale (K10; Kessler et al., 2002) and the Pediatric Quality of Life Scale Short Form 15 (Varni, Seid, & Kurtin, 2001; Varni, Burwinkle, Seid, & Skarr, 2003). The K10 assessed anxiety and depression symptoms over the past 4 weeks with 10 Likert-scale items; scores ranged from 10 to 50. Higher scores indicated greater psychological distress. The K-10 has demonstrated high internal consistency reliability and validity in predicting clinically significant levels of distress in community samples (Kessler et al., 2002). Internal consistency reliability for the K-10 for adolescent boys and girls in the present study were 0.94 and 0.93, respectively. The 12 items from the physical functioning, emotional functioning, and social functioning subscales of the PedsQL SF15 (Varni et al., 2001, 2003) were included in the study.

Participants were asked how true a series of statements were of them over the past 4 weeks. Scores were reversed and transformed on a scale of 0–100. Higher scores indicated higher functioning. The PedsQL SF15 has demonstrated good reliability and validity in adolescent studies (Varni et al., 2003). Internal consistency reliability for the PedsQL physical subscale in the current study was 0.86 for adolescent boys and 0.84 for adolescent girls. Further, internal consistency reliability for the PedsQL psychosocial subscale was 0.91 for adolescent boys and 0.90 for adolescent girls.

Data Analytic Plan

Firstly, in order to determine whether social media measures used in the study should be examined as separate constructs, a principle component analyses (PCA) with principal axis factoring and oblim rotation was performed. Items from all variables were standardized and combined into one scale. There were 22 items in total. Bartlett's test of sphericity was significant, indicating the data were sufficiently correlated, $\chi^2(210) = 29190.21, p < .001$. The Kaiser-Meyer-Olkin measure of sampling adequacy was .90, indicating the sample size was sufficient to conduct the analysis. Oblim rotation was used as it was assumed the items would be correlated. The PCA yielded a five-factor model, which loaded onto avoidance of posting selfies (one item) photo investment (positively worded items; five items), photo investment (negatively worded items; three items), photo manipulation (10 items), and investment in others' selfies (three items). No items were removed from the scale as all had loadings greater than .40. Two items demonstrated cross loadings across two different factors. These included: (i) "It's easy to choose the photo", which loaded on photo investment (positively worded items; .70) and photo investment (negatively worded items; .41); and (ii) "Use a filter to change the overall look of the photo, e.g., making it black and white, or blurring and smoothing image", which loaded on photo investment (positively worded items; .47) and photo manipulation (.59). As the full photo investment scale was used in the study, photo investment

positively and negatively worded items were combined into one scale. In accordance with McLean and colleagues' (2015) scale, and greater factor loading on the photo manipulation scale, the item "Use a filter to change the overall look of the photo, e.g., making it black and white, or blurring and smoothing image", was retained on the photo manipulation scale. Loadings are reported in Table 2 of the supplementary material.

Sample characteristics were then examined to provide descriptive statistics. Next, a multivariate *t*-test examined gender differences in major study variables. A Chi-Square test of association was then used to examine gender differences in eating disorder groups. Due to non-normal distributions, Spearman's Rho correlations were selected to assess associations between continuous variables. A multinomial logistic regression with "no disorder" as the reference group was used to investigate the first hypothesis that greater avoidance of posting selfies, photo investment, photo manipulation, and investment in others' selfies would be associated with higher odds of meeting criteria for clinical and subclinical anorexia nervosa, clinical and subclinical bulimia nervosa, clinical and subclinical binge eating disorder, night eating syndrome, purging disorder, or UFED. To address the second hypothesis, the interaction terms: (a) gender × avoidance of posting selfies; (b) gender × photo investment; (c) gender × photo manipulation; and (d) gender × investment in others' selfies were included in the multinomial logistic regression model. The interaction terms (b) gender × photo investment; (c) gender × photo manipulation; and (d) gender × investment in others' selfies were not significant and therefore removed from the final model. Preliminary analyses indicated absence of multicollinearity in the dataset. Bootstrapping analyses were used to provide bias-corrected *p* values, as the assumption of linearity was violated for some groups (Tabachnick & Fidell, 2013).

Results

Descriptive Statistics

Participants who met diagnostic criteria for an eating disorder were classified as: clinical and subclinical anorexia nervosa ($n = 81, 1.9\%$); clinical and subclinical bulimia nervosa ($n = 352, 8.4\%$); clinical and subclinical binge eating disorder ($n = 59, 1.4\%$); night eating syndrome ($n = 138, 3.3\%$); purging disorder ($n = 111, 2.6\%$); and UFED ($n = 166, 3.9\%$). Participants who did not meet criteria for an eating disorder were classified as having no disorder ($n = 3299, 78.4\%$). Table 1 provides sample characteristics of each eating disorder group.

[INSERT TABLE 1 HERE.]

Gender Differences

The multivariate t -test revealed gender differences across demographic and social media variables. Adolescent Boys were significantly older ($F(1) = 4.63, p = 0.03$) and of a higher BMI percentile than adolescent girls ($F(1) = 5.80, p = 0.02$). However, effect sizes for these differences were weak (age: Cohen's $d = .07$; BMI percentile: Cohen's $d = .08$) suggesting minimal substantive difference in age and BMI percentile for adolescent boys and girls. Adolescent Girls reported significantly greater avoidance of posting selfies ($F(1) = 9.75, p < 0.01$), photo investment ($F(1) = 584.14, p < 0.01$), photo manipulation ($F(1) = 230.73, p < 0.01$), and investment in others' selfies ($F(1) = 488.55, p < 0.01$) compared to adolescent boys. Effect sizes ranged from small (Cohen's $d = .11$) for avoidance of selfies, to medium for photo manipulation (Cohen's $d = .47$) and investment in others' selfies (Cohen's $d = .71$), to large (Cohen's $d = .77$) for photo investment. The Chi-square test for independence indicated that adolescent boys were more likely to meet criteria for night eating

syndrome ($\chi^2(1) = 11.63, p < 0.01$; Cramer's $v = .05$) than adolescent girls. Conversely, adolescent girls were more likely than boys to meet criteria for all other eating disorders (clinical and subclinical anorexia nervosa: $\chi^2(1) = 34.06, p < 0.01$, Cramer's $v = .09$; clinical and subclinical bulimia nervosa: $\chi^2(1) = 98.52, p < 0.01$, Cramer's $v = .15$; clinical and subclinical binge eating disorder: $\chi^2(1) = 29.43, p < 0.01$, Cramer's $v = .08$; purging disorder: $\chi^2(1) = 33.48, p < 0.01$, Cramer's $v = .09$; UFED: $\chi^2(1) = 67.51, p < 0.01$, Cramer's $v = .13$). Gender differences in likelihood of meeting criteria for an eating disorder yielded weak effect sizes.

Spearman's Rho Correlations

Table 2 presents Spearman's Rho correlations between main study variables. There were weak positive associations between age and BMI percentile, photo investment, photo manipulation, and investment in others' selfies. There were also weak positive associations between BMI percentile and avoidance of posting selfies, photo investment, photo manipulation, and investment in others' selfies. Moderate positive associations emerged between the social media variables.

[INSERT TABLE 2 HERE.]

Social Media Behaviors and Odds of Meeting Criteria for an Eating Disorder

The multinomial logistic regression model examining the effect of avoidance of posting selfies, photo investment, photo manipulation, and investment in others' selfies on the likelihood of meeting criteria for an eating disorder, compared to no disorder, adjusting for age and BMI percentile, was statistically significant, $\chi^2(42) = 1128.93, p < .001$. Mostly in agreement with the first hypothesis that greater avoidance of posting selfies, photo investment, photo manipulation, and investment in others' selfies would be associated with higher odds of meeting criteria for all eating

disorders, Table 3 shows that avoidance of posting selfies was associated with greater adjusted odds of meeting criteria for all eating disorder groups except clinical and subclinical binge eating disorder and purging disorder. In agreement with the first hypothesis, photo investment was associated with greater adjusted odds of meeting criteria for all eating disorder groups. Further, photo manipulation was associated with greater adjusted odds of meeting criteria for all eating disorder groups except clinical and subclinical binge eating disorder and UFED. Finally, mostly in agreement with the first hypothesis, investment in others' selfies was associated with greater adjusted odds of meeting criteria for all eating disorder groups except clinical and subclinical anorexia nervosa and purging disorder. Regarding the lack of a priori hypotheses about group comparisons, Table 3 shows that photo-based social media behaviors appear to be common across eating disorder categories.

In general agreement with the second hypothesis that gender would *not* moderate the relationship between photo-based social media behaviors and the odds of meeting criteria for an eating disorder, Table 3 shows that most of the interaction analyses with gender and eating disorder group were not significant. This indicated that adolescent boys and girls who engage in photo-based social media behaviors have similar rates of eating disorders. There was, however, a significant interaction between gender and avoidance of posting selfies for participants who met criteria for clinical and subclinical anorexia nervosa. This indicated that adolescent boys were more likely to meet criteria for clinical and subclinical anorexia nervosa in the context of increasing avoidance of posting selfies.

Discussion

The current study presents the first comprehensive overview of photo-based social media behaviors of adolescent boys and girls who do or do not meet criteria for an eating disorder. We found that each of the social media behaviors (avoidance of posting selfies, photo investment, photo

manipulation, and investment in others' selfies) was associated with greater likelihood of meeting one or more eating disorders when adjusting for demographic factors (age and BMI percentile)." Night eating syndrome and clinical/subclinical bulimia nervosa were the only two classes of eating disorder where all of the social media behaviours were associated with greater likelihood of diagnosis. All social media behaviors were associated with greater adjusted odds of meeting criteria for clinical and subclinical bulimia nervosa and night eating syndrome, suggesting that these eating disorder presentations may be associated with a more varied social media repertoire than others. Results were consistent with research that suggests photo-based social media behaviors are related to maladaptive eating attitudes and behaviors (Butkowski et al., 2019; Cohen et al., 2018; Mabe et al., 2014; Smith et al., 2013), and that this relationship is mainly consistent across male and female users (Griffith et al., 2018; Pila et al., 2017).

The hypothesis that photo-based behaviors would be associated with greater odds of eating disorder diagnosis was largely supported. All behaviors increased the odds for meeting diagnostic criteria for most eating disorders. The second hypothesis, that there would not be gender differences in the relationship between photo-based behaviors and meeting criteria for an eating disorder, was also largely supported. The exception to this was that adolescent boys were more likely to meet criteria for clinical and subclinical anorexia nervosa in the context of increasing avoidance of posting selfies on social media. However, this interaction should be interpreted with caution, as only 14 boys met criteria for clinical or subclinical anorexia nervosa. Identifying such behaviors in adolescent boys at risk for an eating disorder may nonetheless inform screening and treatment consideration.

Overall, current findings support the transdiagnostic model of eating disorders, whereby over evaluation of weight and shape to one's self-worth leads to disordered eating (Fairburn et al.,

2008). However, the link with other body image behaviors (such as avoidance, checking, reassurance seeking, camouflaging, and fixing) have not been elaborated upon within the transdiagnostic or any other model of eating disorder maintenance. These are essentially safety behaviors which illustrates parallels between eating disorder and anxiety psychopathology. Study findings therefore add to existing literature by distinguishing the types of body image behaviors that arise across and within eating disorder diagnoses. Current findings affirm overvaluation as a central feature of eating disorders, but extend this to demonstrate how overvaluation potentially manifests behaviorally within a social media environment. For example, results suggest that avoidance of posting selfies to social media may reflect “offline” body avoidance typically observed in eating disorders, particularly anorexia and bulimia nervosa (Fairburn et al., 2008; Mitchison et al., 2013). Clinicians may therefore consider assessing whether avoidance of posting selfies may contribute to the maintenance of eating disorder symptoms by preventing individuals from objectively assessing their appearance, or from collecting evidence to dispute beliefs about negative social evaluation from others. Further, the public health trend to equate greater social media use with poorer mental health may contribute to this avoidance behavior being mistakenly viewed as “healthy” by health professionals and others – when, in fact, it could be masking body image concerns. Further, avoidance of posting one’s own selfie does not preclude scrutinizing others’ selfies. This is a pertinent consideration in light of growing “thinspiration” and “fitspiration” content: images and accounts that promote extremely thin, lean and toned male and female bodies and corresponding dietary rules (Ging & Garvey, 2018; Tiggemann, & Zaccardo, 2018). Moreover, adolescents may take many selfies without posting them due to factors such as negative evaluation from others, which is strongly connected to weight and shape concerns in adolescents with eating disorders (Trompeter et al., 2019).

Current results extend prior findings that photo investment and manipulation are related to eating concerns in adolescent girls (McLean et al., 2015), as well as bulimic symptomology (Cohen et al., 2018) and features of anorexia nervosa in women (Butkowski et al., 2019). Our findings are consistent with research that suggests despite female adolescents' social media use being greater than male adolescents, the relationship between social media variables and body image concerns are consistent across male and female users (Lonergan et al., 2019), including adolescents (de Vries et al., 2014). Overall, findings indicate that effort exerted in choosing a selfie to post to social media, editing such images, and monitoring the comments/likes these images receive are pervasive appearance-based social media behaviors in adolescent boys and girls who meet criteria for an eating disorder. Transdiagnostic models of eating disorders may therefore consider targeting these behaviors in prevention and treatment settings.

That photo manipulation was not associated with greater odds of meeting criteria for subclinical or clinical binge eating disorder or UFED is a novel finding, as to our knowledge, no study has investigated how adolescents with these conditions present themselves on social media. It is noteworthy that participants who met criteria for these disorders demonstrated the highest BMI percentiles of eating disorder groups (72nd and 73rd percentile respectively). Adolescents with higher BMIs may be less likely to engage in photo manipulation due to perceived discrepancies between actual and internalized weight/shape ideals. This is consistent with a qualitative investigation of social media etiquette amongst adolescent girls (Burnette, Kwitowski, & Mazzeo, 2017), where "being artificial" was identified as an 'unacceptable' social media behavior, particularly in the context of posting selfies. However, as photo manipulation was associated with increased adjusted odds of meeting criteria for bulimia nervosa, and this group was of a similar BMI percentile to those in the subclinical or clinical binge eating disorder group, photo manipulation may be a social media

behavior specific to eating disorder presentation, and not linked to BMI per se. An alternative explanation is that adolescents who met criteria for clinical or subclinical bulimia nervosa (both characterized by weight/shape concerns) may have experienced greater body dissatisfaction than those who met criteria for clinical or subclinical binge eating disorder (not characterized by weight/shape concerns). On the other hand, evidence suggests that those diagnosed with binge eating disorder do experience weight/shape concerns (Reas, Grilo, Masheb, & Wilson, 2005; Trompeter et al., 2019), and our findings in general support this notion. Current results contribute to limited knowledge regarding the behaviors of adolescents who meet diagnostic criteria for UFED. As these individuals tend to be of a higher BMI, and experience similar impairment to those diagnosed with a major or subclinical eating disorder (Mitchison et al., 2019; Wade & O'Shea, 2015), UFED may be considered in transdiagnostic treatment and prevention programs.

Limitations

The study contained several limitations. Given small numbers of probable eating disorder cases, combining phenotypically similar diagnoses was required for statistical analyses. As such, examination of differences in photo-based social media behaviors between subclinical and clinical presentations was beyond the scope of the current study. Another contributor to small sample sizes was exclusion of participants who met criteria for more than one eating disorder ($n = 87$). Typically, this was due to meeting criteria for a major eating disorder and an other specified feeding and eating disorder diagnosis (e.g., bulimia nervosa with comorbid night eating syndrome), which reduced the sample size in some diagnostic groups, particularly for adolescent boys. Further, muscle dysmorphia, which may relate to increased muscle-oriented selfies amongst boys (Pila et al., 2017), was not examined in the current study. Another limitation was reliance on self-report measures of social media behaviors and items to determine eating disorder diagnosis, which may have been

impacted by literacy and comprehension, particularly for younger participants. Use of self-report measures may also have contributed to underreporting of symptoms commonly identified in eating disorder literature (e.g., Mond, Owen, Hay, Rodgers, & Beumont, 2004), particularly amongst male samples (Mitchison & Mond, 2015; Strother, Lemberg, Stanford, & Turberville, 2012). Moreover, the study did not examine social media behaviors in relation to online content known to be related to eating disorders, such as thinspiration and fitspiration. Further, two of the social media measures used in the current study have not been subjected to validation research. This reflects a broader limitation within existing literature, as there is scant psychometric information regarding items that assess evolving appearance-based social media behaviors in the context of eating disorders. Another drawback was the use of one item to assess avoidance of posting selfies, which impacted construct reliability and internal-consistency reliability. Interpretation of findings regarding the photo investment scale should be interpreted with caution given lower internal consistency reliability than what has been reported in previous studies (McLean et al., 2015; Mingoia et al., 2019). Importantly, inferences from the current study are limited by its cross-sectional design. It thus remains unclear whether social media behaviors contribute to the development and maintenance of eating disorders in adolescents or are part of the sequelae of eating disorder psychopathology in general.

Implications and Future Research

The current study provides empirical support for recommendations (Saul & Rodgers, 2018) that social media behaviors should be assessed in eating disorder treatment settings. Results further contribute to the perspective (Chancellor, Kalantidis, Pater, De Choudhury, & Shamma, 2017; Tao, Brede, Ianni, & Mentzakis, 2017) that social media posts could be used to screen for potential eating disorder risk and to thus prompt help seeking. Given the pioneering nature of current findings, additional research is needed to ascertain whether the results are replicable. Reproduction is

important to further determine whether certain appearance-based social media behaviors are distinct, or cut across, eating disorder diagnostic categories. Current findings extend literature (Griffiths et al., 2018; Pila et al., 2017) that suggests the relationships between photo-based social media behaviors and eating psychopathology are similar for male and female users, thus highlighting the need to include adolescent boys in eating disorder and social media literacy interventions.

Present findings also suggest that clinicians may consider assessment of appearance-related social media behaviors in the maintenance of eating disorder symptoms amongst adolescents in treatment settings. Clinicians themselves may benefit from training to identify harmful social media behaviors.”

In order to overcome study limitations, future research may conduct clinical interviews, and objectively observe posts of adolescents referred to treatment settings to better elucidate engagement with photo-based social media behaviors within clinical samples. This strategy may help to circumvent difficulties with attaining a sufficient sample size for statistical analyses, whilst maintaining integrity of eating disorder assessment and diagnosis. Future research could also employ a longitudinal design to examine whether photo-based social media behaviors predict increased odds of developing an eating disorder. Investigating these relationships over time will provide scope to examine underlying mechanisms that may mediate the relationships between photo-based social media behaviors and eating disorders for adolescent boys and girls. Finally, such longitudinal analysis could be employed to investigate the specific burden that these social media behaviors impart on eating disorder sufferers in terms of added psychological distress and quality of life impairment.

In conclusion, the present study examined whether photo-based social media behaviors differed for adolescents who met criteria for a probable eating disorder compared to those who did not, whether these relationships were different across subgroups of eating disorder diagnoses, as

well as for adolescent boys compared to adolescent girls. Results showed that greater avoidance of posting selfies, photo investment, photo manipulation, and investment in others' selfies were associated with greater odds of meeting criteria for probable eating disorders. Further, adolescent boys who reported greater avoidance of posting selfies were more than likely than adolescent girls to meet criteria for clinical and subclinical anorexia nervosa.

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Table 1.

Descriptive Statistics for Eating Disorder Diagnostic Groups

Diagnostic Group	Age in years <i>M (SD)</i>	Girls (%)	BMI Percentile Median (IQR)	Avoidance of Posting Selfies <i>M (SD)</i>	Photo Investment <i>M (SD)</i>	Photo Manipulation <i>M (SD)</i>	Investment in Others' Selfies <i>M (SD)</i>
Clinical/subclinical Anorexia Nervosa	15.05 (1.48)	85.2	43.90 (79.95)	3.00 (1.25)	62.86 (19.85)	19.85 (9.51)	10.62 (5.00)
Clinical/subclinical Bulimia Nervosa	15.28 (1.38)	78.4	72.50 (44.10)	3.10 (1.21)	64.75 (17.87)	22.35 (10.59)	11.77 (5.13)
Clinical/subclinical Binge Eating Disorder	15.61 (1.53)	88.1	72.70 (38.10)	3.03 (1.27)	66.04 (17.71)	18.66 (8.10)	11.03 (4.53)
Night Eating Syndrome	15.08 (1.38)	39.7	63.70 (57.73)	2.89 (1.41)	49.76 (19.13)	18.88 (10.75)	9.25 (5.66)
Purging Disorder	15.14 (1.41)	80.1	65.20 (44.00)	2.70 (1.23)	57.41 (17.92)	19.85 (9.94)	9.79 (4.80)
UFED	15.04 (1.41)	84.3	73.20 (38.68)	3.21 (1.18)	63.52 (18.41)	18.84 (8.19)	11.13 (4.88)
No Diagnosis	14.9 (1.56)	69.6	52.70 (54.00)	2.41 (1.37)	42.37 (19.60)	14.10 (6.431)	7.14 (4.19)

Note. UFED: Unspecified Eating Disorder.

Table 2.

Spearman's Rho intercorrelations amongst gender, age, BMI percentile, avoidance of posting selfies, photo investment, photo manipulation, and investment in others' selfies

Variables	1.	2.	3.	4.	5.	6.
1. Gender	-					
2. Age	-.04*	-				
3. BMI percentile	-.04**	.13***	-			
4. Avoidance of posting selfies	.08***	.02	.05**	-		
5. Photo Investment	.37***	.13***	.04*	.27***	-	
6. Photo Manipulation	.36***	.07***	.04*	.16***	.45***	-
7. Investment in others' selfies	.37***	.18***	.04*	.10***	.48***	.51***

Note. Cases excluded pairwise; $N = 4206$. Boys were coded as "0", girls were coded as "1". BMI: Body Mass Index. * $p < .05$; ** $p < .01$ *** $p < .001$.

Table 3.
 Multinomial logistic regression for avoidance of posting selfies, photo investment, photo manipulation, and investment in others' selfies predicting eating disorder group

Diagnostic group	Clinical/Subclinical Anorexia Nervosa			Clinical/Subclinical Bulimia Nervosa			Clinical/Subclinical Binge Eating Disorder			Night Eating Syndrome			Purging Disorder			UFED		
	B	Odds Ratio	95% CI	B	Odds Ratio	95% CI	B	Odds Ratio	95% CI	B	Odds Ratio	95% CI	B	Odds Ratio	95% CI	B	Odds Ratio	95% CI
Age	.00	1.00	[-.01, .01]	.00	1.01	[-.00, .01]	.01	1.01	[-.00, .03]	.00	1.00	[-.01, .01]	.00	1.00	[-.01, .01]	-.01	1.00	[-.02, .01]
Gender	1.24	3.44** *	[.71, 2.06]	.80	2.23** *	[.47, 1.14]	1.67	5.32** *	[.97, 2.86]	-.78	.46***	[-1.24, -.32]	1.11	3.02** *	[.65, 1.74]	1.28	3.60** *	[.85, 1.83]
BMI Percentile	.00	1.00	[-.01, .01]	.02	1.02** *	[.02, .03]	.02	1.02** *	[.01, .04]	.01	1.01	[-.00, .01]	.02	1.02** *	[.01, .02]	.02	1.02** *	[.02, .03]
Avoid Posting Selfies	.22	1.24**	[.03, .40]	.20	1.22***	[.10, .30]	.21	1.24	[-.03, .45]	.19	1.21*	[.04, .35]	.08	1.08	[-.08, .23]	.36	1.43***	[.21, .50]
Photo Investment	.03	1.03***	[.02, .05]	.04	1.04***	[.03, .05]	.04	1.04***	[.02, .060]	.01	1.01*	[.00, .02]	.02	1.02***	[.01, .03]	.04	1.04***	[.02, .05]
Photo Manipulation	.04	1.04**	[.01, .07]	.05	1.05***	[.04, .07]	.01	1.01	[-.03, .05]	.05	1.06***	[.03, .08]	.06	1.06***	[.03, .08]	.01	1.01	[-.01, .03]
Investment in Others' Selfies	.04	1.05	[-.09, .10]	.07	1.08***	[.04, .11]	.07	1.07*	[.01, .13]	.05	1.05*	[-.01, .11]	.01	1.01	[-.04, .06]	.08	1.09***	[.04, .12]
Gender*Avoid Posting Selfies	.56	1.74*	[.11, 1.13]	-.03	.97	[-.26, .17]	.25	1.28	[-.51, 12.72]	-.12	.88	[-.43, .21]	-.13	.88	[-.52, .19]	.39	1.48	[.02, .80]
Gender*Photo Investment	.01	1.01	[-.03, .06]	.00	1.00	[-.01, .02]	-.01	1.00	[-.06, .06]	.02	1.02	[-.01, .04]	-.01	.99	[-.04, .02]	.01	1.01	[-.02, .05]

SOCIAL MEDIA BEHAVIORS IN EATING DISORDERS

Gender*Photo Manipulation	.01	1.01	[-.09, .07]	.00	1.00	[-.03, .04]	-.07	.93	[-10.47, .05]	.00	1.00	[-.05, .06]	.01	1.01	[-.04, .07]	.01	1.01	[-.04, .07]
Gender*Investment in Others' Selfies	-.13	.88	[-.36, .02]	-.03	.97	[-.11, .05]	-.10	.90	[-.38, .04]	.05	1.05	[-.06, .17]	.03	1.03	[-.08, .14]	.05	1.05	[-.11, .19]

Note. Multinomial logistic regression coefficients and confidence intervals from bootstrapped analyses are presented. * $p < .05$; ** $p < .01$; *** $p < .001$. Reference Group: No disorder; UFED: Unspecified Eating Disorder.



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