Adolescent body dissatisfaction and disordered eating: Predictors of later risky health behaviours

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Abstract

Rationale

Body dissatisfaction is prevalent among teenagers, and may influence the uptake of risky health behaviours.

Objective

The study assessed the influence of body dissatisfaction on smoking, cannabis use, drug use, self-harm, gambling, and drinking and the mediating role of disordered eating in a population-based sample of British adolescents.

Method

Participants were 2,634 females and 1,684 males from the Avon Longitudinal Study of Parents and Children (ALSPAC) cohort. Logistic regression was used to test if body dissatisfaction at 14 years old predicted the onset of risky health behaviours at 21 years old. Mediation analysis tested the mediating role of disordered eating at 16 years old on each risky health behaviour.

Results

Among females, body dissatisfaction predicted smoking (OR=1.40, 95% CI = 1.15, 1.72), cannabis use (OR=1.20, 95% CI = 1.00, 1.43), drug use (OR=1.51, 95% CI = 1.20, 1.90), self-harm (OR=1.44, 95% CI = 1.13, 1.84) and high-risk drinking (OR=1.41, 95% CI = 1.10,

1.80). Disordered eating symptoms had mediating effects on some behaviours. Among males, body dissatisfaction predicted smoking (OR=1.44, 95% CI = 1.14, 1.81) and no effect of disordered eating was found on any risky health behaviour.

Conclusions

This is the first prospective study to demonstrate that body dissatisfaction in adolescence predicts the occurrence of several risky health behaviours, and elucidates the mediating role of disordered eating. The findings highlight that body dissatisfaction is a public health concern. Early interventions to promote body satisfaction may reduce the prevalence of later risky health behaviours.

Key words: Body dissatisfaction; risky health behaviours; disordered eating; ALSPAC; adolescence

Introduction

Body image relates to a person's perceptions, feelings, and thoughts about his or her body (Grogan, 2010). Body dissatisfaction is experienced by around 50% of adolescent females and 30% of adolescent males (Gallivan, 2014, Micali et al., 2014). It has a growing incidence among young populations, in both developed (Swami et al., 2010) and developing countries (e.g., Singh et al., 2017). Research has shown that body dissatisfaction has been found to predict psychological conditions such as low self-esteem (Paxton et al., 2006), depressive symptoms symptoms (Ferreiro et al., 2012), and suicidal thoughts (Crow et al., 2008; Kim, 2009). In addition, research has identified body dissatisfaction as risk factor for a series of unhealthy eating and physical activity behaviours, including disordered eating (e.g., Gardner et al., 2000, Micali et al., 2015a, Neumark-Sztainer et al., 2006a, Stice and Shaw, 2002), weight

gain (e.g., van den Berg and Neumark-Sztainer, 2007), unhealthy dieting and lower levels of physical activity (Neumark-Sztainer et al., 2006a).

Further, research has examined the role of body dissatisfaction on risky health behaviours. Risky health behaviours such as smoking, substance abuse, and drinking are prevalent during adolescence and have recognised negative effects on health (Biglan et al., 2004, Hawkins, 2012, World Health Organisation, 2018). Smoking-related pathologies cause one in five deaths in the United States (General, 2014), and heavy drinking is the leading risk factor for ill-health, early mortality and disability among those aged 15 to 49 years in England (Burton et al., 2016). Similarly to body dissatisfaction, these behaviours tend to be initiated during adolescence (Biglan et al., 2004, Chassin et al., 1996) and often continue in adulthood (McCarty et al., 2004). Neumark-Sztainer et al. (2006a) found that 13-year-old males with higher levels of body dissatisfaction were more likely to smoke at 17 years old. Similarly, Field et al. (2014) found that body image concerns were prospectively associated with drug use and binge drinking among United States (US) teenage males. Greydanus and Apple (2011) reviewed the relationship between self-harm and body dissatisfaction and noted a lack of longitudinal research on the topic, and on the prospective influence of body dissatisfaction on risky health behaviours more generally. Given the high prevalence of body dissatisfaction among young people, and in response to calls for research on the topic (Greydanus and Apple, 2011, Holzhauer et al., 2016), the first aim of the current study was to investigate the prospective association between body dissatisfaction and smoking, drug use, cannabis use, self-harming, gambling, and excessive drinking respectively.

A rich body of research indicates that eating disorders are one of the risk factors for risky health behaviours (e.g., Field et al., 2012, Micali et al., 2015b, 2017, Sonneville et al., 2013). These include drug use (Micali et al., 2015b, 2017, Sonneville et al., 2013), excessive drinking (Field et al., 2012), cannabis use (Sonneville et al., 2013), and deliberate self-harm (Micali et al.,

2015b, 2017). Adolescence is the developmental period in which eating disorders tend to peak (Micali et al., 2013); hence, it is important to monitor their rise to also prevent the increased possibility of later risky health behaviours. Given that body image concerns are a significant risk factor for disordered eating, it is possible that mediation is occurring. Therefore, the second aim of the current study was to assess whether disordered eating symptoms mediated the prospective relationship between body dissatisfaction and individual risky health behaviours.

In addition, most prospective studies exploring the association between eating pathology and risky health behaviours operationalise eating disorders based on the official classifications by the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-V; e.g., Anorexia Nervosa, Bulimia Nervosa, and Binge Eating Disorder) (e.g., Field et al., 2012, Micali et al., 2015b, Sonneville et al., 2013), rather than on the presence of individual disordered eating symptoms (e.g., dieting, purging, fasting, bingeing), which are arguably likely to be more common in the population. Importantly, Micali et al. (2017) found that, while purging, binge eating, and fasting behaviours in mid-adolescence were prospectively associated with drug use and self-harm, the frequency of these behaviours did not necessarily predict a greater number of adverse risky health outcomes. Arguably, a broader approach that takes disordered eating symptomatology into account can offer findings that apply to the wider population, and not only to those individuals who meet clinical diagnoses as denoted by the DSM-V. Therefore, the current study adopted a more inclusive approach to disordered eating by examining the prospective influence of a number of disordered eating symptoms on a range of risky health behaviours.

Using data from a longitudinal cohort of adolescent males and females living in the Southwest of England, UK (Avon Longitudinal Study of Parents and Children – ALSPAC; (Boyd et al., 2013, Fraser et al., 2013), this prospective study examined whether body dissatisfaction at 14 years old predicted a series of risky health behaviours (smoking, cannabis use, drug use, self-

harm, gambling, medium-risk drinking, and high-risk drinking) at 21 years old. The first hypothesis was that body dissatisfaction would predict individual risky health behaviours. The second aim was to test to what extent the prospective association between body dissatisfaction at 14 years and risky health behaviours at 21 years of age was mediated by disordered eating symptoms at 16 years. The second hypothesis was that disordered eating symptoms would mediate this relationship (Figure 1).

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Method

Study participants

The Avon Longitudinal Study of Parents and Children (ALSPAC) is a population-based prospective study of women and their children. Women living in the region of Avon, United Kingdom (UK), who were expected to deliver their baby between 1 April 1991 and 31 December 1992, were invited to take part in the study.

The children from 14,541 pregnancies were enrolled; 13,988 children were alive at 1 year. An additional 713 children were enrolled later on in childhood (phases 2 and 3). All mothers enrolled gave informed and written consent; children also confirmed their consent at later timepoints. For the current study, only adolescents who completed the questions on at least one risky health behaviour at 21 years were included (n = 4,318).

Please note that the study website contains details of all the data that is available through a fully searchable data dictionary (http://www.bris.ac.uk/alspac/researchers/data-access/data-dictionary). Ethical approval for the study was obtained from the ALSPAC Ethics and Law Committee and the Local Research Ethics Committees. A full list of the research ethics committee is available at: http://www.bristol.ac.uk/alspac/researchers/research-ethics/ .

Measures

Predictors

Body image

Body dissatisfaction at age 13 years and 11 months, hereby referred to as ‘14 years’, was assessed by a series of questions asking individuals to rate their satisfaction with nine body parts (weight, figure, body build or breasts, stomach, waist, thighs, buttocks, hips, legs, face, hair) on a 5-point Likert scale, from ‘extremely satisfied’ to ‘extremely dissatisfied’. Questions differed slightly between the female and male questionnaire version (‘body build’ in the male version was replaced by ‘breasts’ in the female version). A continuous score was derived, with higher values indicating higher dissatisfaction. Cronbach's alpha was .95 for the male version and .90 for the female version in this study.

Disordered eating behaviours

The disordered eating scale was based on six questions assessing frequency of disordered eating symptoms at 16 years and 6 months, hereby referred to as ‘16 years old’. A similar scale was employed by Micali et al. (2015) and was based on the Youth Risk Behavior Surveillance System questionnaire (Kann et al., 2012, quoted in Micali et al., 2015). The first concerned current efforts with regard to body weight (“Did you exercise in order to lose weight or avoid gaining weight?”); responses (Sometimes/Frequently/No) were collapsed to create a binary variable indicating any attempt to lose weight (‘Lose weight’ vs all other responses). Three questions assessed the frequency of engagement in particular behaviours during the previous year in attempts to lose weight or keep from gaining weight (“How often did you fast to lose weight/avoid gaining weight?”; “How often did you make yourself vomit to lose weight/avoid gaining weight?”, “Did you take laxatives (or other) to lose weight/avoid gaining weight?”). Responses (Two or more times a week/Once a week/One to three times a month/Less than once a month/No) were collapsed to create a binary variable indicating the presence of any symptom. An additional question assessed the frequency of “eating binges”, described as eating an

amount of food that most people would consider to be very large, in a short period of time ("How often did you go on an eating binge?" and follow up question: "Did you feel out of control, like you couldn't stop eating even if you wanted to stop?"). The symptom was counted if participants answered positively to both questions. A final question enquired whether the respondent had ever been suspected by others of having an eating disorder ("Has anyone ever told you that they thought that you had an eating disorder, such as anorexia or bulimia?"). This response was collapsed to create a binary variable whereby somebody (a friend, parent, doctor, nurse, or other health care provider) had suspected this. Responses were collapsed to create binary variables ('No one' vs else). The total disordered eating scale was computed as the sum of the six binary variables, and ranged from 0 (zero disordered eating symptoms) to 6 (six disordered eating symptoms).

Outcomes

The outcomes were risky health behaviours, all measured at 20 years and 9 months of age, hereby referred to as '21 years'. Coding of these variables was similar to previous studies (Field et al., 2012, Micali et al., 2015b, 2017, Sonneville et al., 2013).

Smoking

The binary smoking behaviour variable was based on the question: "Do you smoke every week?". A positive answer was coded as 1.

Cannabis

Participants were asked whether they had used cannabis in the past year. Respondents who reported using cannabis at least once in the previous year were classified as cannabis users.

Drugs

Participants were asked about having used cocaine, crack, sedatives, opioids, inhalers, amphetamines, hallucinogens or other drugs in the previous year. Participants who reported using any of these illicit substances were classified as having used drugs.

Self-harm

Self-harm was assessed by the question: “Have you ever hurt yourself on purpose in any way (e.g., by taking an overdose of pills, or by cutting yourself)?”. Any episode of self-harm during the previous year was coded as 1.

Gambling

Gambling was assessed by the Problem Gambling Severity Index, an abbreviated version of the original tool called the Canadian Problem Gambling Index, consisting of nine items (Ferris and Wynne, 2001). Scores range from 0 (non-problem gambler) to 27 (high-risk gambler), and include questions on frequency of a series of gambling behaviours (e.g., frequency gone back to try to win back money they lost; frequency bet more than they can really afford to lose; needed to gamble with larger amounts of money to get same excitement, etc.). Participants whose level of gambling was classified as different from non-problem gambler (e.g., score > 1) were classified as gambling cases.

Medium and high-risk drinking

Two binary variables were created to assess drinking behaviours. These were based on the Alcohol Use Disorders Identification Test (AUDIT) (Bohn et al., 1995). The questionnaire includes questions on drinking habits (e.g., “How often do you have a drink containing alcohol?”, “How many drinks containing alcohol do you have on a typical day when you are drinking?”). AUDIT scores between 8 and 15 are defined as increased risk of alcoholism

(Babor et al., 2001); these were coded as medium-risk drinkers. Scores higher than 16 are defined as higher risk (Babor et al., 2001); these were coded as high-risk drinkers.

Covariates

Recognised predictors of the outcome variables were included as covariates in the final models. These included body mass index (BMI), measured by a nurse at 10 years; ethnicity of the child (White vs non-White); and maternal variables (paternal characteristics are not available in the ALSPAC cohort). These include: socio-economic status – a categorical variable based on mother's occupation (Professional; Managerial and technical; Skilled non-manual; Skilled manual; Partly skilled; Unskilled); mother's highest qualification, maternal depression, mother's history of smoking, using cannabis, and drinking. Mother's depression was assessed when the study children were a mean age of 12.1 years via postal questionnaires, and assessed whether the mother had suffered depression in the previous two years. Mother's history of smoking was measured whether respondents had ever been a smoker, while mother's cannabis use patterns was based on the 'Frequency mother has taken cannabis/marijuana in last 2 years', assessed when the study children were a mean age of 9.2 years. Finally, mother's problems with alcohol, measured when the study children were a mean age of 12.1 years, was assessed by the variable 'Mother has had an alcohol problem in last 2 years'. In order to run a prospective analysis, each risky behaviour at 14 years was also included as covariate in the relevant model, except for gambling, as gambling behaviours were not assessed at 14 years old.

Statistical Analysis

Data were analysed using STATA version 14 (StataCorp, 2015). Analyses were conducted for males and females separately, given the different health outcomes between females and males. Based on the starting sample of participants for whom a measure of risky behaviours at 21 years of age was available (n = 4,318), levels of missing information were between 0.95% and

43.89% in the female sample and between 1.43% and 29.62% in the male sample. Therefore, missing values were imputed. Procedures followed recommendations by Sidi and Harel (2018). Missing data patterns were assessed, and as is typically the case for cohort studies, the data were indicated as missing at random (MAR; Acock, 2005). Variables predicting missingness included maternal socioeconomic status (SES), maternal history of depression, and child's BMI. There were no important differences between individuals with complete and incomplete data. Data were imputed using multiple chained equations (MICE; Royston and White, 2011) following the MAR assumption. The Stata `ice` command was used, allowing inclusion of categorical variables. In addition to the predictor and outcome variables, the following variables were also included in the imputation procedure: body dissatisfaction at 16 years, disordered eating symptoms at 14 years, mother's history of eating disorders. Forty imputed datasets were created, and the Monte Carlo error estimation confirmed that the number of imputations was sufficient (White et al., 2011). There were no relevant differences between the imputed analysis (presented here), and complete case analysis (available as supplementary material).

The odds of the seven outcomes were estimated with logistic regression. These represented the total effect of body dissatisfaction on each risky health behaviour. Linear regression was used to estimate total effects of body dissatisfaction on disordered eating symptoms. Logistic regressions and odds ratios estimated the effects of the potential mediator (disordered eating symptoms) on each risky health behaviour and the indirect effect of body dissatisfaction on each risky health behaviour. Mediation is determined by testing whether the product differs from zero. Sobel tests (Preacher and Hayes, 2008) were used to ascertain presence of mediation. Separate direct effects were tested and then multiplied, following the approach outlined in VanderWeele & Vansteelandt (2010). The $\alpha\beta$ product quantifies the indirect effect of body dissatisfaction; the products and corresponding asymmetric 95% confidence intervals

were calculated using the bootstrap method, which does not make the unwarranted assumption that the sampling distribution of products is normal (MacKinnon et al., 2004). Bootstrapped CIs were calculated using a Monte Carlo approach (e.g., MacKinnon et al., 2004, Preacher & Hayes, 2004, Selig & Preacher, 2008). This approach has numerous advantages (Preacher & Selig, 2012) including the ease with which it can be applied when using multiple imputation, which made it the most suitable method to use. In the Monte Carlo approach, the distribution of the estimate is assumed to be specified (as the product of two normally-distributed estimates). Bias-corrected bootstrapping offers an improvement when the distribution of a monotone transformation of the estimate has a normal distribution. Since we cannot assume that this is the case when the distribution of the estimate is so specified, bias-corrected bootstrapping would not give any significant advantage and we have opted to use the simpler alternative.

Results

Table 1 summarises socio-demographic characteristics of respondents.

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Distribution of Frequency by Body Dissatisfaction

At 14 years old, 32.0% of females and 14.6% of males were dissatisfied with their weight; 26.5% of females and 14.9% of males were dissatisfied with their figure. The scale mean value of the body dissatisfaction scale also shows that females (M = 2.53, SD = .80) tended to be more dissatisfied overall with their body than males (M = 2.10, SD = .72), $t(3273) = 14.90$, $p < .001$.

Distribution of Frequency by Disordered Eating

At 16 years old, 45.1% of females and 19.0% of males had at least one disordered eating symptom. 38.5% of females and 19.4% of males had between one and two symptoms. Less than 1% of females had between three and six disordered eating symptoms; only 6 males in the sample (less than 0.1%) had more than two disordered eating symptoms.

Incidence of Risky Health Behaviours at 21 Years

Table 2 displays the incidence of risky health behaviours at 21 years of age. Among males, more than 30% of respondents used cannabis and/or were classified as gambling. Smoking, using drugs, and high-risk drinking had an incidence lower than 20%. Among females, smoking, cannabis use, and gambling had an incidence ranging between 20% and 27%, while drug use, self-harm, and high-risk drinking occurred in around 12% of females. In both samples, medium-risk drinking had a prevalence of more than 40%.

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Total Effects of Body Dissatisfaction on Risky Health Behaviours

Females. Body dissatisfaction at 14 years predicted smoking, cannabis use, drug use, self-harm, and high-risk drinking at 21 years old (Table 3, first column).

Males. Body dissatisfaction at 14 years predicted smoking (Table 3, first column). Cannabis use, drug use, gambling, self-harm, medium-risk drinking, and high-risk drinking were not predicted by body dissatisfaction.

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Mediation Analysis

Mediation analysis was conducted separately for females and males, to test whether the effect of body dissatisfaction on each risky health behaviour was mediated by disordered eating symptoms. Body dissatisfaction at 14 years old and disordered eating symptoms at 16 years

old had an alpha correlation of .32 in the female dataset and of .37 in the male dataset respectively.

Females. The regression of body dissatisfaction on the mediator, disordered eating, showed $b = .22$, $t(1448) = 6.52$, $p < .001$. When the potential mediator (disordered eating) was included, the direct effect of body dissatisfaction on smoking behaviours, drug use, and high-risk drinking at 21 years old remained (Table 3, second column).

Disordered eating had an effect on smoking (Table 3, third column). As an indirect effect of body dissatisfaction via disordered eating on smoking was detected, partial mediation in the model was found, confirmed by the Sobel test, $z = 2.09$, $p = .035$. Disordered eating did not predict cannabis use (Table 3). No mediation in the model was found, as shown by the Sobel test, $z = 1.34$, $p = .177$. Drug use was predicted by disordered eating (Table 3, third column), and the effect of body dissatisfaction on drug use remained when controlling for disordered eating (Table 3, second column). A Sobel test was conducted and confirmed partial mediation in the model ($z = 2.07$, $p = .038$). Self-harm was predicted by disordered eating (Table 3, third column); as body dissatisfaction did not retain an indirect effect on self-harm when controlling for disordered eating (Step 4), complete mediation in the model was found, confirmed by the Sobel test, $z = 4.19$, $p < .001$. Disordered eating did not predict high-risk drinking (Table 4). No mediation in the model was found, as shown by the Sobel test, $z = 1.44$, $p = .148$.

Males. The regression of body dissatisfaction on the mediator, disordered eating, showed $b = .09$, $t(1466) = 3.50$, $p = .001$. When the potential mediator disordered eating was included, the direct effect of body dissatisfaction on smoking behaviours at 21 years old remained (Table 3). However, disordered eating symptoms at 16 years did not have an effect on any risky health behaviour (Table 3). Therefore, no mediation was found.

Discussion

This study explored the effect of body dissatisfaction at 14 years old on risky health behaviours at 21 years old and the potential mediating effect of disordered eating symptoms at 16 years old on British females and males. It was found that body dissatisfaction at 14 years old predicted some risky health behaviours among females (smoking, cannabis and drug use, self-harm, and high-risk drinking) and smoking among males at 21 years of age, even when controlling for each relevant behaviour at baseline, thus confirming the first hypothesis. For females, disordered eating symptoms at 16 years partially mediated the relationship between body dissatisfaction and smoking and drug use respectively, and completely mediated the effect of body dissatisfaction on self-harm (second hypothesis). Among males, disordered eating symptoms at 16 years old were not prospectively associated with any risky health behaviour, and no mediation was detected in any model. These findings are novel in identifying body dissatisfaction in adolescence as a risk factor for several later risky health behaviours. While the prospective influence of eating disorders on risky health behaviours has been recognised in the literature, the current study has uncovered a novel mechanism explaining the onset of several risky health behaviours, body dissatisfaction. Bucchianeri and Neumark-Sztainer (2013) have suggested that young people who feel worse about their bodies are more likely to engage in risky, harmful behaviours, and the current study confirms this argument. Results are discussed below by gender in the context of the literature.

The study has reported the novel finding that body dissatisfaction at 14 years old is prospectively associated with smoking, cannabis use, drug use, self-harm, and high-risk drinking for females. Each unit of body dissatisfaction led to a 40% increased odds of smoking at 21 years old. This result extends previous cross-sectional research conducted in the US (Jones et al., 2018, Ramseyer Winter et al., 2017), which found that adolescent females with higher levels of body dissatisfaction were more likely to smoke. Each unit of body dissatisfaction also led to a 20% increased odds of using cannabis, to a 51% increased odds of

using drugs, to a 44% increased odds of engaging in self-harm, and a 41% odds of being a high-risk drinker at 21 years old. While previous research has found body dissatisfaction to be prospectively associated with drug use among US adolescent males (Field et al., 2014), the current findings indicate that this is also the case among females in the UK context. Body dissatisfaction at 14 years old did not predict medium-risk drinking, but did predict high-risk drinking. This adds to previous cross-sectional research that found an association between body image concerns and binge drinking (Jones et al., 2018), thus being the first study to establish a prospective association.

When taking disordered eating symptomatology into account, disordered eating symptoms at 16 years old was also a predictor of smoking, drug use, and self-harm at 21. The effect of disordered eating symptoms on smoking is a novel finding in the European context, as no previous prospective study has examined the relationship. In Canada, recent research by Raffoul et al. (2018) found that dieting at 14-year-old predicted smoking behaviours two years later among adolescents – a finding which is in line with the current results. Each disordered eating symptom at 16 years was also prospectively associated with 27% increased odds of using drugs at 21 years old. Previous longitudinal studies have found eating disorders to predict drug use (Field et al., 2012, Micali et al., 2015b, 2017, Sonneville et al., 2013). However, the current study adds that disordered eating symptoms, in addition to clinical eating disorders, have an influence on drug use. Disordered eating symptoms at 16 years of age did not have an effect on cannabis use and high-risk drinking at 21 years. This conflicts with previous research which found that disordered eating behaviours were prospectively associated with binge drinking (Field et al., 2012, Micali et al., 2017, Raffoul et al., 2018). However, in contrast to the studies above, the current research looked at the effect of disordered eating on cannabis use and high-risk drinking symptoms controlling for body dissatisfaction, and found that body dissatisfaction, and not disordered eating, had an effect. Therefore, it is possible that previous

studies that found an influence of disordered eating on these behaviours might have been confounded by body dissatisfaction. Another possible explanation is that clinically diagnosed eating disorders, but not disordered eating symptoms, can encourage cannabis use and high-risk drinking among adolescent females.

Some mediation processes were also identified. Disordered eating partially mediated the relationship between body dissatisfaction and smoking and drug use respectively. However, body dissatisfaction retained a direct effect on smoking, drug use, and high-risk drinking even when controlling for disordered eating. This illuminates a novel mechanism originating from body dissatisfaction that explains the onset of these risky health behaviours. According to Holzhauer et al. (2016), women with poorer body image may be more prone to heavy drinking due to expectations that alcohol consumption may alleviate low self-esteem. Future research should therefore examine the role of psychological processes such as self-esteem or negative affectivity.

A different picture emerged for self-harm. Body dissatisfaction predicted self-harm – a novel finding which confirms previous untested ideas (Greydanus and Apple, 2011). Nevertheless, the current study found that disordered eating symptoms completely mediated the effect of body dissatisfaction on self-harm, with each disordered eating symptom associated with a 66% increase in odds of engaging in self-harm at 21 years old. Whilst previous longitudinal studies found eating disorders to predict self-harm (Micali et al., 2015b, 2017), the current study also indicates that population-level disordered eating symptoms can have an influence on these risky health behaviours. Hence, the severity of the disordered eating symptomatology seems to be reflected in the outcome of self-harm.

Finally, body dissatisfaction and disordered eating were not prospectively associated with gambling and medium-risk drinking. It is possible that there are other risk factors for gambling,

such as poor grades at school and a family history in gambling (Griffiths and Wood, 2000). Nonetheless, this was the first study to look at the association. As for medium-risk drinking, as suggested by previous contributors (Micali et al., 2015b), this might be encouraged by cultural factors rather than psychological processes. In line with this idea, it should be noted that more than 40% of females and males were classified as medium-risk drinkers.

In the male sample, body dissatisfaction at 14 years old predicted smoking behaviour, with each unit of increase in the body dissatisfaction scale associated with a 44% increased odds of smoking at 21 years old. This supports research by Neumark-Sztainer et al. (2006a) based on US adolescents born in the 1980s, and extends these findings to a UK-based sample of adolescents born in more recent years. Ramseyer Winter et al. (2017) have also found that males who identified their body size as too thin were more likely to be smokers, and suggested that societal pressures toward muscularity might encourage smoking as means to conform. Hence, it is possible that similarly to females, adolescent males who feel dissatisfied with their body might engage in later smoking behaviours due to negative affectivity, peer influence, and low self-esteem.

However, cannabis use, drug use, self-harm, and medium and high-risk drinking were not predicted by body dissatisfaction nor disordered eating among males. These findings contradict US research which found that body dissatisfaction predicted drug use among adolescent males (Field et al., 2014). The present results did not confirm research that adolescent males and females with eating disorders were more likely to use marijuana (in a US-based sample – Sonneville et al., 2013) and drug use and self-harm (in a UK-based sample – Micali et al., 2017). These discrepancies could be due to cultural differences and/or to methodological differences in the assessment of disordered eating symptoms between the current and previous studies. This may also be due to the very low numbers of males engaging in cannabis use, drug use, and self-harm. Another potential explanation is that, among males, there are additional

factors other than body dissatisfaction that encourage the engagement of risky health behaviours, notably, peer relationships (Ramseyer Winter et al., 2017).

Limitations

There are several limitations within the current study that warrant consideration. First, the sample lacked ethnic and socio-economic diversity, with a large majority of White participants from medium-high socio-economic backgrounds, thus reducing generalisability. Second, the measures of body dissatisfaction and disordered eating were not validated tools. However, these were similar to validated instruments (Body Shape Satisfaction Scale; Pingitore et al., 1997; Youth Risk Behavior Surveillance System questionnaire, Kann et al. 2012, quoted in Micali et al., 2015) and demonstrated excellent reliability in the current study. Third, there was a relatively high level of attrition, which is common in longitudinal studies. This was addressed with multiple imputation, and multiply imputed analyses and complete case and imputed analyses did not vary substantially. In addition, the male sample was smaller than the female one, and presented low endorsement of disordered eating symptoms and body dissatisfaction. This may be due to the questionnaires being geared towards female-specific disordered eating behaviours and body dissatisfaction, as noted by Micali et al. (2017). Therefore, this should be taken into account in similar studies. Fourth, the data on body dissatisfaction at 14 years old were collected in the early 2000s. Future research exploring the influence of adolescent body dissatisfaction in late 2000s on later risky health behaviours is therefore warranted, in order to account for the influence of internet and social media, which is associated with internalisation of thin ideals among adolescent females (Tiggemann and Slater, 2013). Fifth, we classified as cannabis users those respondents who made use of cannabis in the previous year at least once, and it can be argued that this does not reflect regular use. Future research might look specifically at frequent cannabis use.

This study has several notable strengths. First, this is the first study to examine the prospective influence of body dissatisfaction on a range of risky health behaviours in a population-based sample. The use of longitudinal, population-based samples has the advantage of including those individuals who present disordered eating symptoms but do not access treatment (Micali et al., 2017), and it was found that body dissatisfaction encourages risky health behaviours in general populations. The public health burden of the risky health behaviours examined in the current study is relevant worldwide and targeting body dissatisfaction from early adolescence may help alleviate this. Hence, the current findings strengthen the case that body dissatisfaction should be viewed as a stand-alone issue in public health (Bucchianeri and Neumark-Sztainer, 2014), particularly given its high prevalence worldwide.

Second, this study is the first to investigate the mediating role of disordered eating on the relationship between body dissatisfaction and risky health behaviours. The mediation analysis has contributed to understanding the longitudinal pathways of body dissatisfaction, disordered eating, and risky health behaviours. This suggests a new avenue of research that examines risk factors for risky health behaviours which are related to psychological processes (e.g., negative affectivity and low self-esteem).

Finally, the current study has focused on disordered eating symptoms, in place of clinically diagnosed eating disorders, following previous contributors (Micali et al., 2017). This has enabled a broader investigation of how disordered eating symptoms can influence risky health behaviours at a population level. Given this, important population-based public health implications are suggested for the prevention of risky health behaviours.

The identification of body dissatisfaction as a risk factor for several risky health behaviours indicates that interventions targeting body dissatisfaction from early adolescence should be implemented. In line with this, research has found body appreciation to have a protective effect towards smoking and drinking (Andrew et al., 2016). Therefore, interventions from early

adolescence, such as school-based programs to foster body confidence and body appreciation, are recommended. In comparison with preventing disordered eating symptomatology, targeting body dissatisfaction has the advantages of potentially benefiting more individuals and being more acceptable to policy makers, educators, and parents. Also, professionals working with adolescents suffering from addictions should consider body dissatisfaction as a psychological process that encourages risky health behaviours, and this can inform prevention and recovery programmes. On the other hand, results suggest that deliberate self-harm might be prevented by targeting eating disturbances in adolescence, rather than body dissatisfaction. In addition, since the presence of disordered eating symptoms was prospectively associated with self-harm, smoking, and drug use, public health benefits might be obtained by improving identification of individual disordered eating symptoms and by promoting interventions that target disordered eating symptoms in non-clinical populations.

With regards to implications for research, we recommend exploring the influence of risk factors for body dissatisfaction (e.g., low self-esteem, negative affect) on individual risky health behaviours. The current study employed an overall measure of body dissatisfaction; and future work could assess whether each item of the scale (e.g., satisfaction with weight) predicts specific risky health behaviours and extend existing cross-sectional research on satisfaction with weight and perceived attractiveness and risky health behaviours (Jones et al., 2018, Ramseyer Winter et al., 2017). Finally, research could test whether interventions designed to boost body appreciation in early adolescence can prevent risky health behaviours developing later.

Conclusions

This longitudinal study is the first to explore the influence of body dissatisfaction in adolescence on a number of later risky health behaviours using a robust, longitudinal,

population-based sample (ALSPAC cohort, UK). It revealed novel findings, whereby body image concerns at 14 years old predicted smoking, cannabis and drug use, self-harm, and high-risk drinking at 21 years old among a sample of British females, and smoking among British males. Amongst females, disordered eating symptoms at 16 years adopted a mediating role in some risky health behaviours, but only self-harm was completely mediated. These findings reveal a novel mechanism that explains the onset of several risky health behaviours, and this originates from body dissatisfaction in early-mid adolescence. Body image concerns are prevalent in multiple geographical contexts; hence, this should be considered an important public health issue. Preventing body dissatisfaction from adolescence may discourage later risky health behaviours, thus reducing their global public health burden.

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Figures and tables

Figure 1: Proposed relationship between variables

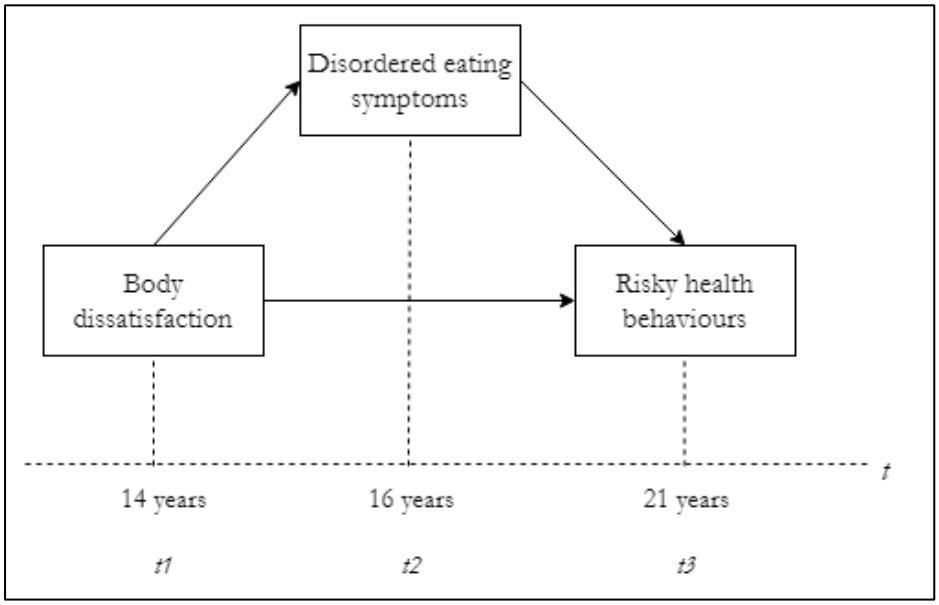

Figure 1: Proposed relationship between variables

Table 1: Descriptive statistics

Table 1: Descriptive statistics	
	***n* = 4,318**
Age, M	20.9
Females, %	61.0
Child ethnicity, %	
White	96.1
Non-White	3.9
Mother's risky health behaviours and mental health, %	
Mother had eating disorder	4.1
Mother had history of depression	20.4
Mother has been a smoker	39.2

Mother's occupation, %	
Professional	5.3
Managerial and technical	34.3
Skilled non-manual	41.6
Skilled manual	3.4
Partly skilled	12.8
Unskilled	2.6
Mother's educational qualification, %	
Up to 16 years	50.9
Up to 18 years	28.6
Post 18 years	20.5
Maternal age at delivery, %	
<25 years	13.1
25-29 years	39.3
30-34 years	34.2
35+	13.4

706 **Table 2: Prevalence of risky health behaviours at 21 years by gender**

Table 2: Prevalence of risky health behaviours at 21 years by gender				
	Females		**Males**	
	%	***n***	**%**	***n***
Smoking	20.1	514	18.2	300
Cannabis	26.2	668	35.6	585
Drug use	11.8	249	14.0	175
Self-harm	12.1	315	5.0	83
Gambling	22.1	327	37.6	431

Alcohol-medium risk	41.6	998	43.5	672
Alcohol-high risk	12.5	301	18.2	281

707

708 **Table 3: Total, direct, and indirect effects of predictors on individual risky health**

709 **behaviours**

710 (next page)

Table 3: Total, direct, and indirect effects of predictors on individual risky health behaviours

		Total effect of body dissatisfaction on risky health behaviours (OR)		Direct effect of body dissatisfaction on risky health behaviours (OR)		Effect of disordered eating on risky health behaviours (OR)		Indirect effect body dissatisfaction on the risky health behaviour		
Sample	**Outcome**	**OR (95% CI)**	***p***	**OR (95% CI)**	***p***	**OR (95% CI)**	***p***	**OR (95% CI)**	***p***	***% total effect mediated***
Females	**Smoking[1]**	1.40 (1.15, 1.72)	.001	1.56 (1.23, 1.97)	.000	1.18 (1.01, 1.38)	.028	1.02 (1.00, 1.08)	.035	10.82
	Cannabis use[2]	1.20 (1.00, 1.43)	.042	1.15 (.95, 1.39)	.128	1.15 (.93, 1.43)	.119	1.01 (.99, 1.08)	.177	16.86
	Drug use[3]	1.51 (1.20, 1.90)	.000	1.43 (1.06, 1.92)	.017	1.26 (1.02, 1.57)	.032	1.02 (1.01, 1.11)	.038	12.34
	Self-harm[4]	1.44 (1.13, 1.84)	.003	1.75 (.89, 1.53)	.239	1.66 (1.39, 1.98)	.000	1.05 (1.06, 1.08)	.000	29.48
	Gambling[5]	1.06 (.80, 1.40)	.644	1.23 (.92, 1.65)	.155	1.02 (.79, 1.32)	.830	1.00 (.95, 1.06)	.809	7.48
	Medium-risk drinking[6]	.95 (.83, 1.10)	.534	1.06 (.90, 1.26)	.447	1.08 (.95, 1.23)	.190	1.01 (.99, 1.05)	.198	33.01
	High-risk drinking[6]	1.41 (1.10, 1.80)	.006	1.27 (1.00, 1.63)	.049	1.20 (.93, 1.54)	.143	1.02 (.99, 1.10)	.148	11.67
Males	**Smoking[1]**	1.44 (1.14, 1.81)	.002	1.41 (1.11, 1.79)	.004	1.20 (.90, 1.61)	.203	1.01 (.99, 1.04)	.195	4.70
	Cannabis use[2]	1.17 (.97, 1.42)	.088	1.16 (.96, 1.40)	.107	1.09 (.96, 1.40)	.107	1.00 (.98, 1.03)	.289	5.16
	Drug use[3]	1.21 (.93, 1.59)	.144	1.20 (.91, 1.57)	.182	1.15 (.91, 1.57)	.368	1.01 (.98, 1.04)	.399	6.89
	Self-harm[4]	.97 (.66, 1.42	.897	.94 (.65, 1.38)	.789	1.29 (.82, 2.03)	.262	1.01 (.99, 1.07)	.367	78.58
	Gambling[5]	1.17 (.96, 1.43)	.105	1.16 (.95, 1.42)	.127	1.09 (.84, 1.41)	.500	1.00 (.98, 1.03)	.499	5.16
	Medium-risk drinking[6]	.99 (.84, 1.16)	.921	.99 (.84, .1.17)	.959	.99 (.80, 1.23)	.980	1.00 (.98, 1.01)	1.00	9.40
	High-risk drinking[6]	1.01 (.81, 1.24)	.921	1.00 (.80, 1.24)	.996	1.10 (.82, 1.48)	.491	1.00 (.98, 1.03)	.498	90.4

Note: Models adjusted for BMI, child ethnicity, mother socio-economic status, mother's history of depression, mother's smoking behaviours, mother's history of cannabis use, mother's smoking behaviours and history of drug use, mother's highest qualification, mother's drinking problems. Smoking, cannabis use, drug use, self-harm, and drinking models also adjusted for previous risky health behaviour at t_1.

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