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Decision-Making in Childhood Predicts Prodromal Eating Pathology in Adolescence

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ABSTRACT: ***Objective:*** **Differences in decision-making under conditions of risk have been observed cross-sectionally in clinical groups of people with eating disorders but have never been studied longitudinally or in large cohorts. We investigated whether responses on the Cambridge Gambling Task (CGT), measured in the Millennium Cohort Study in childhood, would predict prodromal eating pathology in adolescence.** ***Method:*** **Regression models were built to explore relationships between CGT variables at age 11 years and prodromal eating pathology (body dissatisfaction, intention to lose weight, dietary restriction, significant under/overweight, and excessive exercise) at 14 years.** ***Results:*** **In 11,303 boys and girls, those with better quality decision-making were 34% less likely to show an intention to lose weight (b = −0.40, odds ratio [OR] = 0.66, $p < 0.05$) and 34% less likely to be overweight (b = −0.41, relative risk ratio [RRR] = 0.66, $p < 0.05$). Those with higher risk-taking were 58% more likely to report dietary restriction (b = 0.45, OR = 1.58, $p < 0.05$) and 46% more likely to report excessive exercise (b = 0.38, OR = 1.46, $p < 0.05$). In the complete-cases sample, higher risk-adjustment scores were associated with a 47% increased risk of underweight (b = 0.39, RRR = 1.47, $p < 0.05$), and better quality of decision-making was associated with a 46% lower risk of overweight (b = −0.60, RRR = 0.54, $p < 0.05$).** ***Conclusion:*** **Disadvantageous decision-making in childhood may predict prodromal eating pathology in adolescence and might represent a prevention target.**

(*J Dev Behav Pediatr* 00:1–7, 2022) **Index terms:** decision-making, eating disorders, longitudinal, epidemiology, Cambridge Gambling Task, Millennium Cohort Study.

Differences in decision-making are proposed to underlie psychiatric disorders,[1] such as eating disorders (EDs). EDs are serious psychological illnesses, and their typical prodrome (symptoms that indicate the future onset of a disorder that are also a feature of the disorder) of body dissatisfaction and dietary restriction[2] emerges throughout adolescence.[3] Clinical EDs are associated with significant under or overweight and physical complications,[4] poor quality of life, social adversity,[5] and significant care needs.[6]

Contemporary models of EDs suggest that the ways individuals respond to risks and rewards may be perpetuating factors for EDs.[7,8] Past cross-sectional research indicates individuals with anorexia nervosa (AN), characterized by behaviors including nutritional restriction and excessive exercise and the overevaluation of eating, weight, and shape,[9] have high loss aversion and are extremely cautious.[10] This means these individuals are driven by fear of failure alongside low appetitive motivation. People with bulimia nervosa, characterized by episodes of binging and purging; and the overevaluation of eating, weight, and shape,[9] demonstrate high loss aversion alongside high appetitive motivation. This means these individuals show increased impulsivity, alongside the high levels of anxiety experienced by their counterparts with AN.[11] These conclusions are derived almost entirely from research involving adult populations and, as such, may be confounded by the effects of chronic or long-term intermittent starvation. This previous study on adult populations also suggests that less is known about associations between decision-making and eating pathology in childhood and adolescence. Furthermore, decision-making in the context of risks and rewards has been poorly studied longitudinally in the ED field, with the available studies focused on adult clinical samples finding that decision-making skills improve little over time with weight restoration and treatment.[12,13] Previous studies have also focused largely on clinical samples, which can be unrepresentative of the much more diverse and larger population of individuals with EDs and significant disordered eating in the community.[14]

Therefore, using data from the Millennium Cohort Study (MCS), this longitudinal, prospective, general-population

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study aimed to investigate the degree to which differences in decision-making measured experimentally using the Cambridge Gambling Task[15,16] (CGT) in childhood at age 11 years would contribute to the presence of prodromal eating pathology, measured in adolescence at age 14 years. It was hypothesized that decision-making under conditions of risk, measured by the CGT-derived variables of risk-taking, quality of decision-making, deliberation time, risk adjustment, and delay aversion[16] at age 11 years, would predict, at age 14 years, prodromal eating pathology, measured using items in the MCS endorsing the presence of body dissatisfaction, operationalized as the perception of being too overweight; intention to lose weight, operationalized as a strong desire to lose weight; dietary restriction, operationalized as an episode of reduced dietary intake to lose weight; significant under or overweight, operationalized as being at or below/above the UK90's[17] under/overweight cutoff for the child/adolescent's age and sex; and excessive exercise, operationalized as the use of driven exercise to influence body weight or shape.

METHODS

Study Sample

Data from the Millennium Cohort Study (MCS) (www.cls.ioe.ac.uk/mcs), a longitudinal survey of children born in the United Kingdom between September 2000 and January 2002, were used. The MCS sample is disproportionately stratified, first by country and then by the type of electoral ward. The sample design overrepresented families living in the areas of high child poverty, areas with high proportions of ethnic minority populations across England, and the 3 smaller UK countries.[18] There have been 6 sweeps of data collection to date. MCS children were around age 9 months at sweep 1 and age 3, 5, 7, 11, and 14 years at sweeps 2 to 6, respectively. In the MCS, prodromal eating pathology was first measured at age 14 years (Sweep 6), and the Cambridge Gambling Task (CGT) was administered at ages 11 (sweep 5) and 14 years. Therefore, data from sweeps 5 and 6 were used in this study. Our analytic sample included singletons and firstborns (if twins or triplets) with available information on prodromal eating pathology at age 14 years and with available CGT data at age 11 or 14 years (n = 11,303).

Ethical approval for sweeps 5 and 6 of the MCS was obtained from the Yorkshire and The Humber–Leeds East (ref. 11/YH/0203) and London Central (ref. 13/LO/1786) National Health Service Research Ethics Committees, respectively. The data were collected in accordance with the Declaration of Helsinki of ethical principles for research involving human participants.

Measures

Decision-Making Under Conditions of Risk

The CGT measures risk-taking behavior and decision-making under conditions of uncertainty.[15,16] Participants see a row of 10 boxes (red and blue) across the top of the computer screen and are told a token is hidden behind one of them. They have to choose (1) which color of box they believe the token is hidden behind (red or blue) and (2) the number of points they want to gamble. The 5 CGT measures, all of which were used in this study, are as follows: (1) risk-taking: the mean proportion of the current points total that the participant choses to risk on trials when the most probable color was selected; (2) quality of decision-making: the mean proportion of trials when the most likely color outcome was selected; (3) deliberation time: the mean time taken to decide which color of box is hiding the token; (4) risk adjustment: the extent to which, on trials in which a larger proportion of boxes are a certain color, participants bet a higher proportion of their points; and (5) delay aversion: the time participants are prepared to wait to place a higher or lower bet. A sixth CGT measure, overall proportion bet, was excluded from our analysis in view of its very high correlation (>0.90) with risk-taking (further details under Descriptive Analyses).

Prodromal Eating Pathology

In the MCS, when interviewed, participants were asked several questions relating to eating, dieting, and body image at age 14 years. These items form part of the larger multidisciplinary MCS survey and battery of assessments and relate to clinical features of EDs as outlined in the *DSM-5*.[9] The items used in this study to operationalize the variable prodromal eating pathology were (1) *body dissatisfaction* (whether or not the participant reported a perception of their body as being too overweight), (2) *intention to lose weight* (the presence or absence of a strong desire to lose weight), (3) *dietary restriction* (whether or not the participant had ever actively eaten less to influence their shape/weight), and (4) *excessive exercise* (whether or not the participant had ever exercised in a driven way to influence weight and shape). These items were responded to using a binary (yes/no) response scale and are provided by the young person themselves. The questions asked are similar to those included in semistructured interview assessments for eating disorders (EDs), such as the Structured Clinical Interview for *DSM-5* Disorders[19] and the EDs Examination.[20]

We used an objective measure of underweight and overweight based on the most widely used reference panel, the UK90,[17] which is sensitive to sex and age and developed for the British population and based on centile curves for British children from birth to age 23 years, from a sample of 32,222 measurements from 12 distinct surveys collected between 1978 and 1994, most of which were nationally representative.[17] Cutoffs were based on the age of the cohort member at the time of interview. The underweight cutoff point was the second centile, and the overweight cutoff point was the 85th centile, as suggested by the UK90.[17] Weight was measured using scales by the researcher on the day of the interview.

Confounders

We identified variables previously associated with exposure and outcome, including sex; ethnicity (according to

the UK census groups of White, Black, Indian, Pakistani/Bangladeshi, Mixed, or Other); family poverty (below the poverty line or not); IQ, derived in MCS at age 5 years from 3 subscales of the British Ability Scales[21]; pubertal status at age 11 years (breast growth or menstruation or hair on body for female participants and voice change or facial hair or hair on body for male participants); and internalizing and externalizing symptoms at age 11 years. Internalizing and externalizing symptoms were assessed using the parent-rated Strengths and Difficulties Questionnaire (SDQ).[22] The SDQ is a valid and reliable tool for measuring such symptoms in children.[23] It consists of 20 "difficulties" items related to behavior (in the past 6 mo), with each item scored on a 3-point scale (0 = "not true," 1 = "somewhat true," and 2 = "certainly true"). Items can be summed to form 4 scales (emotional, conduct, hyperactivity, and peer problems) or 2[24] (internalizing symptoms, the sum of the scores on the emotional and peer problem items, and externalizing symptoms, the sum of the scores on the conduct and hyperactivity problem items), which we used for this analysis.

Statistical Analysis

All analyses were performed in STATA 16.0.[25] The missingness ranged from 0.1% (ethnicity) to 28.7% (risk adjustment at age 11 yrs). We imputed missing data (20 imputed data sets) using multiple imputation by chained equations.[26] The total percentage of imputed data sets was 8%. We ran a series of logistic regression models to examine the association between decision-making under conditions of risk measured with the CGT at age 11 years and prodromal eating pathology items measured at age 14 years. The first models (model 1 in Supplemental Digital Content, http://links.lww.com/JDBP/A353) included only CGT measures as predictors of each form of (dichotomized) prodromal eating pathology items. We adjusted our next model (model 2 in Supplemental Digital Content, http://links.lww.com/JDBP/A353) for sex, ethnicity, family poverty, IQ, pubertal status, and exact age (in yrs). In the final model (model 3, Table 2), we further adjusted for internalizing and externalizing symptoms measured using the SDQ at age 11 years. In Table 2, we report the odds ratio (OR) and relative risk ratio. These indicators are both measures of the association between an exposure and an outcome. All regression models were weighted to adjust for possible biases generated by systematic unit nonresponse. Stratification variables were also used to account for the complex sample design of MCS. The final models were also tested separately for male participants and female participants, shown in Table S6, Supplemental Digital Content, http://links.lww.com/JDBP/A353. We report the results from the models fitted in the complete-cases sample and the imputed sample.

RESULTS

Descriptive Analyses

A total of 11,303 participants (our analytic sample) had valid data on at least 1 prodromal eating pathology at age 14 years and on at least 1 Cambridge Gambling Task (CGT) measure at age 11 years. Multicollinearity among CGT measures was assessed by inspecting variance inflation factors (VIFs). Risk-taking and overall proportion bet showed a VIF of 13.82. Therefore, as explained, we excluded overall proportion bet from further analyses.

Table 1 lists descriptive statistics, including means and proportions for all exposures, outcomes, and covariates. Around a third of participants' weight was in the overweight range, and a small subgroup (n = 169, 1.56%) were underweight according to the UK90 reference panel. A small proportion of our sample reported a perception of their body weight as very overweight (reflecting *body dissatisfaction*), whereas almost half of our sample reported having the desire/intention to lose weight and dietary restriction (actively reducing nutritional intake to influence shape/weight). Finally, most of the participants in our analytic sample reported the use of driven exercise to influence body weight (*excessive exercise*).

Logistic Regression Models with Prodromal Eating Pathology as Dependent Variables

Body Dissatisfaction (the Perception of Being Too Overweight)

As shown in Table 2 and Table S1, Supplemental Digital Content, http://links.lww.com/JDBP/A353, none of the CGT measures at age 11 years were significant predictors of body dissatisfaction at age 14 years in any of our models.

Intention to Lose Weight (a Strong Desire to Lose Weight)

In our final fully adjusted model (Table 2), lower scores on quality of decision-making predicted the intention to lose weight at age 14 years. The same pattern was shown in male participants only (Table S6, Supplemental Digital Content, http://links.lww.com/JDBP/A353). Table S2, Supplemental Digital Content, http://links.lww.com/JDBP/A353, shows the results in the unadjusted (model 1) and partially adjusted (model 2) models.

Dietary Restriction (Actively Reducing Nutritional Intake to Influence Shape/Weight)

Risk-taking was a significant predictor of dietary restriction in our final fully adjusted model (Table 2). We also found it to be significant in the unadjusted complete-cases analysis along with lower scores in risk adjustment (Table S3, Supplemental Digital Content, http://links.lww.com/JDBP/A353).

Significant Underweight/Significant Overweight

In our final, imputed and fully adjusted model, lower scores on quality of decision-making were associated with significant overweight (Table 2). This result was also consistent in our partially adjusted and unadjusted models (model 2 and model 1), as displayed in Table S4, Supplemental Digital Content, http://links.lww.com/JDBP/A353. In the reduced sample of participants with complete information, we also found that higher scores

Table 1. Descriptive Statistics (Unweighted Data) in the Analytic Sample (N = 11,303)

Continuous Variables	N	M (SD)
CGT risk-taking, age 11 yrs	10,301	0.52 (0.16)
CGT deliberation time, age 11 yrs	10,302	3329.90 (1328.43)
CGT risk adjustment, age 11 yrs	8052	1.02 (0.82)
CGT delay aversion, age 11 yrs	9201	0.33 (0.19)
CGT quality of decision-making, age 11 yrs	10,302	0.80 (0.16)
CGT overall proportion bet, age 11 yrs	10,301	0.48 (0.15)
IQ, age 5 yrs	10,505	101.15 (14.81)

Categorical Variables	N	%
Body dissatisfaction (perception of weight as very overweight)	510	4.61
Intention to lose weight (a strong desire to lose weight)	4659	42.05
Dietary restriction (actively reducing nutritional intake to influence shape/weight)	4935	44.62
Excessive exercise (driven use of exercise to influence body weight/shape)	6687	60.36
Underweight cutoff for child's age and sex-significant underweight[a]	169	1.56
Overweight cutoff for child's age and sex-significant overweight[a]	3751	34.52
Puberty (female)	6362	67.01
Puberty (male)	4686	49.15
Female sex	5671	50.17
Below poverty line	2711	23.98
Ethnicity		
White	9250	81.92
Mixed	323	2.86
Indian	308	2.73
Pakistani or Bangladeshi	867	7.68
Black or Black British	363	3.21
Other ethnic group	180	1.59

[a]Based on the UK90 (Cole, Freeman, & Preece, 1995). CGT, Cambridge Gambling Task; M, mean.

on risk adjustment were associated with significant underweight (Table 3).

Excessive Exercise (the Use of Driven Exercise to Influence Body Weight or Shape)

Higher scores on risk-taking were significantly associated with the use of exercise to influence body weight even after adjusting for covariates (Table 2). Similar results were found in Model 1 and Model 2 (Table S5, Supplemental Digital Content, http://links.lww.com/JDBP/A353).

DISCUSSION

This longitudinal, prospective, general-population study investigated the degree to which differences in decision-making, measured experimentally with the Cambridge Gambling Task (CGT) in childhood at age 11 years, would contribute to prodromal eating pathology measured in adolescence at age 14 years. Data show that those with better quality of decision-making were 34% less likely to report an intention to lose weight (b = −0.40, odds ratio [OR] = 0.66, $p < 0.05$) and 34% less likely to be overweight (b = −0.41, relative risk ratio [RRR] = 0.66, $p < 0.05$). This suggests that young people with the ability to make advantageous decisions under conditions of risk are more protected against overweight compared with those who find it harder to select the most advantageous option under conditions of risk. They were also less likely to report a desire to lose weight. Given that dietary restriction generally results in long-term weight gain (as opposed to the desired weight loss),[27] these data have implications for those working to reduce possible negative health outcomes associated with overweight and obesity because they indicate that those with more effective decision-making skills may be less likely to engage in attitudes conducive to dieting, which could reduce future difficulties with weight gain. Furthermore, these findings fit with data from clinical samples that have shown that individuals with diagnosed eating disorders (EDs) such as bulimia nervosa also show less advantageous responding on a gambling that which involves a learning context.[28] In line with this, those exhibiting higher risk-taking were 58% more likely to show dietary restriction (b = 0.45, OR = 1.58, $p < 0.05$) and 46% more likely to report excessive exercise (b = 0.38, OR = 1.46, $p < 0.05$). This suggests that young people who take greater risks than their peers may represent a group who may have started to engage in prodromal eating behaviors, such as restricting dietary intake and using driven exercise to influence their shape/weight. This may represent an emerging group in the cohort who will warrant further investigation because they may be those at heightened risk of prodromal eating pathology developing into a clinical disorder.

In the complete-cases sample, higher risk-adjustment scores were associated with a 47% increased risk of underweight (b = 0.39, RRR = 1.47, $p < 0.05$). This suggests that the more participants adjusted their risk, the more likely they were to be underweight. Furthermore, better quality of decision-making was associated with a 46% lower risk of overweight (b = −0.60, RRR = 0.54, $p < 0.05$), which is consistent with what we found in the imputed sample. As we did not find that body dissatisfaction, operationalized here as the perception of being too overweight, was prevalent in our cohort, and this factor was not associated with any decision-making variables, it is possible that significant body dissatisfaction manifests *after* an individual develops the intention to lose weight and/or engages in dietary restriction (which were present in around half of the cohort by age 14 yrs), suggesting that a diet-focused mindset (the intention to lose weight), plus dieting behaviors (active dietary restriction), might precipitate more entrenched dissatisfaction with one's body, weight, and shape. This idea is also suggested by the cognitive behavioral model[20] and integrated modalities therapy[29] for EDs in planned future work for which we will extend our longitudinal model to explore the impact of decision-making measured in childhood and adolescence on the presence of prodromal eating pathology in later adolescence, at age 17 years.

These findings have important implications for public health and obesity (beyond the ED field). This is because

Table 2. Fully Adjusted Models[a] in Imputed Cases (N = 11,303)

	b	SE	95% CI	OR
Body dissatisfaction (the perception of being too overweight)				
Risk-taking	0.32	0.43	−0.52 to 1.17	1.37
Quality of decision-making	−0.27	0.46	−1.19 to 0.64	0.75
Deliberation time	0.00	0.00	−0.00 to 0.00	1.00
Risk adjustment	0.03	0.10	−0.16 to 0.24	1.03
Delay aversion	0.23	0.30	−0.37 to 0.84	1.26
Intention to lose weight (a strong desire to lose weight)				
Risk-taking	0.21	0.20	−0.18 to 0.60	1.23
Quality of decision-making	−0.40*	0.16	−0.72 to −0.08	0.66
Deliberation time	−0.00	0.00	−0.00 to 0.00	0.99
Risk adjustment	0.00	0.03	−0.07 to 0.08	1.00
Delay aversion	0.26	0.15	−0.03 to 0.56	1.30
Dietary restriction (actively reducing nutritional intake to influence shape/weight)				
Risk-taking	0.45*	0.20	0.05 to 0.85	1.58
Quality of decision-making	−0.22	0.16	−0.56 to 0.10	0.79
Deliberation time	0.00	0.00	−0.00 to 0.00	1.00
Risk adjustment	0.00	0.03	−0.06 to 0.08	1.00
Delay aversion	0.14	0.14	−0.14 to 0.44	1.16
	b	**SE**	**95% CI**	**RRR**
Significantly underweight[b]				
Risk-taking	0.44	0.90	−1.33 to 2.22	1.55
Quality of decision-making	−0.00	0.79	−1.57 to 1.56	0.99
Deliberation time	−0.00	0.00	−0.00 to 0.00	0.99
Risk adjustment	0.22	0.17	−0.11 to 0.57	1.25
Delay aversion	−0.17	0.63	−1.42 to 1.07	0.84
Significantly overweight[b]				
Risk-taking	−0.07	0.20	−0.48 to 0.32	0.92
Quality of decision-making	−0.41*	0.18	−0.76 to −0.05	0.66
Deliberation time	0.00	0.00	−0.00 to 0.00	1.00
Risk adjustment	−0.05	0.04	−0.13 to 0.03	0.94
Delay aversion	0.26	0.16	−0.05 to 0.58	1.30
	b	**SE**	**95% CI**	**OR**
Excessive exercise (driven use of exercise to influence weight/shape)				
Risk-taking	0.38*	0.17	0.04 to 0.72	1.46
Quality of decision-making	−0.26	0.16	−0.58 to 0.05	0.77
Deliberation time	0.00	0.00	−0.00 to 0.00	1.00
Risk adjustment	−0.03	0.03	−0.11 to 0.03	0.96
Delay aversion	0.14	0.15	−0.15 to 0.45	1.15

All predictor variables are Cambridge Gambling Task–derived variables. [a]Adjusted for sex, ethnicity, socioeconomic status, IQ, pubertal status, exact age, and internalizing and externalizing symptoms. [b]Based on the UK90 (Cole, Freeman, & Preece, 1995). *$p <$ 0.05. b, unstandardized regression coefficient; CI, confidence interval; OR, odds ratio; RRR, relative risk ratio; SE, standard error.

although decision-making on the CGT did not predict some forms of prodromal eating pathology such as body dissatisfaction, it did predict the presence of overweight. The findings also have important implications for ED prevention. Supporting decision-making skills, moderating risk-taking, and helping adolescents to select more favorable responses under conditions of risk may be ways of helping adolescents to make more advantageous decisions under the conditions of our risky, obesogenic environment, in which thinness is valued alongside rapid access to highly calorific and palatable food. This fits with recent evidence from clinical samples that shows how disorder-specific cues such as dietary restriction and exercise may underpin the differences in decision-

Table 3. Fully Adjusted Models[a] in Complete Cases

	b	SE	95% CI	OR
Body dissatisfaction (the perception of being too overweight) (n = 5917)				
Risk-taking	0.52	0.51	−0.49 to 1.54	1.69
Quality of decision-making	−0.22	0.51	−1.23 to 0.79	0.80
Deliberation time	0.00	0.00	−0.00 to 0.00	1.00
Risk adjustment	0.12	0.10	−0.08 to 0.33	1.13
Delay aversion	0.17	0.40	−0.61 to 0.97	1.19
Intention to lose weight (a strong desire to lose weight) (n = 5928)				
Risk-taking	0.25	0.25	−0.24 to 0.75	1.29
Quality of decision-making	−0.42	0.22	−0.86 to −0.00	0.65
Deliberation time	−0.00	0.00	−0.00 to 0.00	0.99
Risk adjustment	0.05	0.04	−0.03 to 0.14	1.05
Delay aversion	0.12	0.19	−0.26 to 0.52	1.13
Dietary restriction (actively reducing nutritional intake to influence shape/weight) (n = 5918)				
Risk-taking	0.33	0.27	−0.19 to 0.87	1.40
Quality of decision-making	0.10	0.23	−0.34 to 0.55	1.11
Deliberation time	0.00	0.00	−0.00 to 0.00	1.00
Risk adjustment	0.01	0.04	−0.07 to 0.10	1.01
Delay aversion	0.11	0.19	−0.27 to 0.50	1.12
	b	**SE**	**95% CI**	**RRR**
Significantly underweight (n = 5801)[b]				
Risk-taking	1.30	1.01	−0.69 to 3.30	3.68
Quality of decision-making	−0.38	0.96	−2.29 to 1.51	0.67
Deliberation time	−0.00	0.00	−0.00 to 0.00	0.99
Risk adjustment	**0.39***	0.16	0.05 to 0.72	1.47
Delay aversion	−0.79	0.77	−2.32 to 0.72	0.45
Significantly overweight (n = 5801)[b]				
Risk-taking	−0.24	0.27	−0.78 to 0.29	0.78
Quality of decision-making	**−0.60***	0.25	−1.11 to −0.09	0.54
Deliberation time	0.00	0.00	−0.00 to 0.00	1.00
Risk adjustment	−0.06	0.04	−0.16 to −0.02	0.93
Delay aversion	0.03	0.20	−0.37 to 0.44	1.03
	b	**SE**	**95% CI**	**OR**
Excessive exercise (driven use of exercise to influence weight/shape) (n = 5928)				
Risk-taking	0.44	0.24	−0.03 to 0.93	1.56
Quality of decision-making	−0.25	0.24	−0.73 to 0.22	0.77
Deliberation time	0.00	0.00	−0.00 to 0.00	1.00
Risk adjustment	−0.02	0.04	−0.10 to 0.06	0.97
Delay aversion	0.23	0.20	−0.15 to 0.62	1.26

All predictor variables are Cambridge Gambling Task–derived variables. [a]Adjusted for sex, ethnicity, socioeconomic status, IQ, pubertal status, exact age, and internalizing and externalizing symptoms. [b]Based on the UK90 (Cole, Freeman, & Preece, 1995). *$p <$ 0.05. b, unstandardized regression coefficient; CI, confidence interval; OR, odds ratio; RRR, relative risk ratio; SE, standard error.

making shown by people with anorexia nervosa relative to asymptomatic peers.[30] Supporting adaptive decision-making may therefore help to reduce the number of young people who are intending to lose weight, actively restricting their diet, or who are driven to exercise excessively to change their weight and shape who may then go on to develop lifelong patterns of disordered eating and EDs. This could perhaps be offered to young people through training provided using gamification as a means of teaching strategies for optimal responding when making decisions under conditions of risk.

The data are limited by the multidisciplinary nature of the Millennium Cohort Study (MCS), which meant that we were not involved in the generation of items

included in the MCS, and the data set did not have a clinical interview for EDs available to us. However, it is important to note that clinical diagnosis was not the focus of this study and that this study aimed to explore prodromal eating pathology in a large community cohort sample to improve the inclusion of a broader range of individuals in ED research. Although we used the recommended cutoffs for underweight and overweight from the UK90, the second centile likely underestimates underweight and is not directly equivalent to the 85th centile for overweight. Furthermore, these cutoffs are based on historical data sets from 1 geographical location (the United Kingdom), and therefore, caution should be taken when considering the generalizability of the weight data to other contexts. In future work, we could calculate weight for height percentages based on the World Health Organization growth charts. Although we controlled for nonverbal IQ measured at age 5 years in the models, it is possible that mathematical reasoning skills might be a possible confounder regarding the quality of decision-making variable. A caveat to consider when interpreting the significance of the findings is that we ran 6 different sets of analysis to test our hypotheses. If we correct for the possibility of type 1 error using the Bonferroni correction ($0.05/6 = 0.008$) as $p < 0.05$ for the significant relationships we identified in our modeling, we lose significance. However, it is important to note that this correction is highly conservative. It is likely that some individuals were intending to lose weight, restricting their diet, and engaging in exercise to manage overweight/obesity and that this is unrelated to prodromal eating pathology. It would have been helpful to have items on ED cognitions within the survey. We will endeavor to influence future sweeps of the MCS to include this information.

In future work, we aim to build on the self-reported data collected in the MCS on exercise by exploring data collected on the cohort using accelerometers at age 14 years to investigate exercise using a more objective measure.

In conclusion, work focused on preventing EDs and disordered eating in children and adolescents should incorporate awareness of decision-making skills and preferences and help young people to develop skills to make advantageous decisions that will positively (rather than negatively) affect their health and well-being.

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