Eating disorders

SUMMARY

Bulimia nervosa (BN) is a detrimental persistent eating disorder that impacts millions of women, and imposes serious costs on the economy in terms of physical health, treatment costs, absence from work and reduced human capital accumulation. One important issue in treating BN is that it is often undiagnosed, especially among disadvantaged girls. The failures to diagnose BN occur, in part, because many cases of BN are unobservable to others, and asking girls about their bingeing and purging behaviour can be considered invasive. Using data on eating disorder behaviours from the National Heart, Lung, and Blood Institute Growth and Health Study, we show that information on a girl's personality traits, along with information on her family's socioeconomic status (SES), can be used to impute the unobservable BN behaviour. In particular, we find that personality traits are significant determinants of bulimic behaviour, even after controlling for SES. These results suggest a way to target those who are likely to suffer from BN based on identifiable personality traits. Given the costs involved in BN, and the number of individuals affected, our research suggests a practical direction for public health policy to reduce the number of undiagnosed cases.

Keywords: bulimia nervosa, personality traits, social class, economic costs
JEL codes: C23, J58, I1

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Health outcomes, personality traits and eating disorders

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1. INTRODUCTION

Health disparities by education, race and income are widespread. There has been an outpouring of research in health economics focusing on disparities by socioeconomic status (SES) in a number of behaviours and measures, such as the adoption of contraceptive methods, smoking, drinking, body size, eating habits, use of illicit drugs, compliance in following treatments and medication adherence. There are also important differences across SES in terms of who receives treatment for a disease, in part because diagnosing a disease is difficult if the patient does not report his/her condition to a doctor.

This is certainly true for the eating disorder bulimia nervosa (BN), which is defined by recurrent episodes of binge-eating followed by compensatory

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behaviour.[1] The binge–purge cycle usually occurs several times a week, and as a result, BN can cause serious health problems. The negative impact is even more detrimental for the young due to the irreversible effects on development.[2] The costs of BN to society are magnified by the fact that eating disorders affect a significant number of individuals. More than 20 million women will suffer from a clinically significant eating disorder at some point. Over the past decades 6–8.4% of female adolescents reported trying to lose weight by purging, which is one of the characteristics of BN (National Youth Risk Behavior Survey, 2005). Moreover, the seriousness of the disease is accentuated by the fact that only about half of those diagnosed manage to recover (Keel et al., 2005).

Of course, the situation is even more serious for undiagnosed individuals, who by definition receive no treatment. Further, certain socioeconomic groups are more likely to be underdiagnosed. For example, Ham et al. (2015) show that black girls, low-income girls and especially low-income-black girls who suffer from BN were much less likely to be diagnosed. Further, it is difficult to simply observe which girls have BN, as they are characterized by average weight, and hide their behaviours. Moreover, Ham et al. (2013) find that bulimia is a progressive disease in that the intensity of BN behaviour in next period will be 50% higher than the intensity in the current period. Hence, it is important to determine who is suffering from BN and to identify them. However, identifying who has BN is difficult, and asking young girls about their BN behaviour is regarded to be too intrusive.[3] Furthermore, given the stigma associated with an eating disorder, girls may be unlikely to directly reveal their behaviour.

Our goal in this paper is to show how to use a set of (relatively easy to observe) variables to predict bulimic behaviour. Specifically, we show how personality traits of the girls, in addition to SES can provide valuable information regarding current bulimic

1 Binge-eating is the consumption of an unusually large amount of food (by social comparison) in a 2-h period accompanied by a loss of control over the eating process. Compensatory behaviour includes self-induced vomiting, misuse of laxatives, diuretics, or other medications, fasting or excessive exercise.

2 For example, the cycle of bingeing and purging can lead to electrolyte and chemical imbalances that affect the heart (i.e., irregular heartbeats and possibly heart failure). Other health concerns include the inflammation of the esophagus, gastric rupture, tooth decay, muscle weakness and anemia (American Psychiatric Association, 1993). The harmful side effects consist of pubertal delay or arrest and impaired acquisition of peak bone mass resulting in growth retardation and increased risk of osteoporosis (Society for Adolescent Medicine, 2003).

3 For example, the study would need to ask young girls sensitive questions on whether they eat excessively, if they make themselves vomit after eating, or whether they engage in other purging behaviour such as excessive use of laxatives. It would be worthwhile to conduct a survey of randomly chosen schools to see if it would be hard to get proper responses if one could obtain the schools' consent, but this is beyond the scope of this paper.

behaviour.[4,5] Our results are supported by a growing number of papers in psychology, sociology and economics that have found that personality traits are associated with health behaviours, or the lack of thereof.[6] Similar conclusions have been reached by a large set of small-scale studies underlining the link between bulimic behaviour and perfectionism, sense of ineffectiveness, obsessive compulsive disorder, neuroticism, low self-directedness and low cooperativeness.[7] We cannot investigate the possibility of using the personality traits to choose a treatment strategy conditional on a diagnosis of clinical BN, but we believe that such an investigation in the future would be quite interesting.

We use a unique longitudinal dataset from the National Heart, Lung, and Blood Institute Growth and Health Study (NHLBIS) to examine the association between personality traits, SES (such as race, parental education and family income) and bulimic behaviours. Information on personality traits are based on indices that measure a respondent's potential for personality traits/disorders, such as tendencies towards perfectionism, feelings of ineffectiveness, body dissatisfaction and interpersonal distrust (Garner et al., 1983). Information on bulimic behaviours are based on an eating disorders inventory index that was developed by a panel of medical experts to assess the psychological characteristics that may be relevant to eating disorders (Garner et al., 1983). We focus on the level of the eating disorders inventory index, which allows us to obtain more efficient estimates of our parameters, as opposed to using a binary variable determined by higher levels of this index (that are consistent with fully developed BN).[8]

The NHLBIS surveyed a relatively large number of female adolescents who were first interviewed when they were between the ages of 11 and 12 years—ages that typically signify the onset of eating disorders. They used a stratified sampling scheme to survey an

4 A number of papers have investigated the relationship between SES and eating disorders. Hudson et al. (2007) document various types of eating disorder behaviours among women and men (in a univariate framework) using data from the National Comorbidity Replication Survey. Reagan and Hersch (2005) investigate the frequency of bingeing behaviour (but not purging) using cross-sectional data from the Detroit metropolitan area. They find that there are no race effects on bingeing behaviour and that marital status, neighbourhood and income play a role among women. A related epidemiological study using the NHLBIS is Strigel-Moore et al. (2000), who examine correlations between BN and race and between BN and parental education. Their univariate results show that BN is more prevalent among African-American girls. Ham et al. (2015) use the same data, NHLBIS, together with the AddHealth dataset, to show that the distribution of bulimic behaviour across socioeconomic groups may crucially differ depending on if the focus group is all individuals potentially at risk or only on diagnosed individuals.

5 Roberts (2009) define personality traits as 'the relatively enduring patterns of thoughts, feelings, and behaviors that reflect the tendency to respond in certain ways under certain circumstances.'

6 Regarding the education-health gradient, see Rosenzweig and Schultz (1989); Goldman and Smith (2002); Lillard et al. (2007) and Cutler and Lleras-Muney (2010). Regarding the association between personality traits and health behaviours and outcomes, Pulkki et al. (2003); Smith (2007); Turian et al. (2012) and Turian et al. (2015).

7 See Cassin and von Ranson (2005) for a comprehensive review of the literature.

8 Garner et al. (1983) combine a sample of girls suffering from anorexia with a control sample of girls and look at the univariate correlations between anorexic behaviour and several variables including the personality traits. However, their sampling scheme induces choice-based sampling, which they do not correct for.

equal number of blacks and whites, which enables us to estimate precise relationships for both groups.[9]

Our goal is to impute current bulimic behaviour using personality traits and SES variables rather than to establish causal relationships between BN and these variables. To see the difference, assume that there is a single genetic factor that determines BN and the personality traits. To address this issue when undertaking causal analysis, we would use a fixed effects model. However, this approach is not useful for imputing current BN behaviour since the fixed effects are unknown variables to those implementing our results for other children. Of course, another option is to rely only on the SES variables to impute BN because collecting data on personality traits, while not considered invasive, will still be time-consuming. The problem with this strategy is that the SES variables explain only 3% of the variance in our measure of bulimic behaviour.

Given the number of people suffering from BN, BN imposes significant costs on individuals and the economy. First, engaging in BN behaviour reduces the health of the individual. Addressing these health issues will require considerable resources. Second, BN is likely to negatively affect human capital accumulation as BN has negative effects on cognitive development, and adolescents suffering from BN are more likely to miss class and to be less attentive in class. Third, BN has a negative impact on work productivity. BN may reduce the return to on-the-job training, which is often aimed at single mothers. Individuals suffering from BN may be more likely to miss work, which affects their likelihood of having a stable job. Thus, BN can impose serious costs to the economy in terms of physical health, treatment costs, reduced human capital accumulation, increased absence from work and decreased productivity.

As a result of the costs to society, BN is considered a primary health concern. However, it has received relatively little attention from the government (as opposed to, say, obesity). Public campaigns targeting BN remain scarce, as noted by the US Senate Committee of Appropriations, who expressed concern about the 'growing incidence and health consequences of eating disorders among the population' (Department of Health and Human Services, 2006).[10] This lack of targeting is especially unfortunate because of the number of BN cases that go undiagnosed.

This study on BN yields the following: First, we find that including current personality traits (conditional on the SES variables) substantially and significantly increases our ability to explain BN. Second, this relationship holds for every wave of our cohort, that is, at each age level of the cohort, including the wave when the girls are only 11–12 years old. Third, race and family income continues to be significant when we control for the

9 Since ethnicity is treated as exogenous, this stratifying will not create any bias.

10 According to the 2004 School Health Profiles study, only 25 states had at least one school that taught students about eating disorders. In these states, between 78% and 99% of schools provided education on eating disorders. The majority of these programs were in high schools.

personality traits. Hence, our results strongly suggest that outreach should be based on both SES characteristics and personality traits.

The outline of the paper is as follows. In Section 2, we describe the data and present basic statistics on BN. In Section 3, we discuss the econometric methodology. In Section 4, we present the results regarding the predictive role of the SES and personality traits in the incidence and intensity of bulimic behaviours. We discuss the policy implications of our results in Section 5 and conclude in Section 6.

2. DATA

We use data from the NHLBIS. The data include a cohort of black and white girls from schools in Richmond, California and Cincinnati, OH, as well as from families enrolled in a health maintenance organization in Washington, DC.[11] The sampling scheme used exogenous stratification on race and initial family income. Specifically, it was constructed to have equal numbers of African Americans and Whites, and to have approximately equal representation across three income groups (defined below) by race (Kimm et al., 2002). The survey collected data on the (same) girls in this cohort for 10 years, starting in the academic year 1989/1990, when the girls were between the ages of 11 and 12 years.[12] The survey contains questions on BN behaviour; these questions were asked approximately every other year. Demographic and socioeconomic information include age, race, parental education and initial family income (in categories). The data also contain a number of time-varying psychological or personality indices (reflecting the potential for personality disorders) that were sampled every year except 1993.

Our outcome variable is an index of bulimic behaviour (d_{it}), which is constructed based on questions on BN behaviour asked in every other year of the survey (i.e., in five waves starting when the girls were between the ages of 11 and 12 years). The questions were formulated to be consistent with diagnostic criteria for BN and were adjusted to be easy to understand for young respondents. For each girl in every other year, the survey contains an Eating Disorders Inventory-BN scale, which measures degrees of BN symptoms. The ED-BN index is constructed from ordered responses [(1) always; (2) usually; (3) often; (4) sometimes; (5) rarely and (6) never] to seven items: (i) I eat when I am upset; (ii) I stuff myself with food; (iii) I have gone on eating binges where I felt that I could not stop; (iv) I think about bingeing (overeating); (v) I eat moderately in front of others and stuff myself when they are gone; (vi) I have the thought of trying to vomit in order to lose weight and (vii) I eat or drink in secrecy. A response of 4–6 on a question contributes zero points to the ED-BN index; a response of 3 contributes one point; a response of 2 contributes two points and a response of 1 contributes three points. The ED-BN index is the sum of the points and ranges from 0 to 21 in our data. For instance, if a

11 Due to confidentiality concerns, the data do not indicate where an individual lives.

12 The dataset is unbalanced. The attrition rate after 10 years was 11%.

respondent answers 'sometimes' to all questions, her ED-BN index will be zero; if she answers 'always' to each question, her index will be 21. Therefore, a higher ED-BN score is indicative of more intense BN behaviour. The survey does not provide the researcher with the answers to individual questions, only the overall index.

According to the panel of medical experts who designed the index (Garner et al., 1983), a score higher than 10 indicates that the girl is very likely to have a clinical case of BN.[13] Approximately 2.2% of the NHLBIS respondents scored higher than 10, which is close to the national average of clinical BN reported from other sources.[14] We refer to a respondent with an ED-BN index greater than 10 as one exhibiting clinical BN. However, we focus our attention on the index rather than the discrete variable (which is equal to one when the index is greater than 10) to exploit the intensity of bulimic tendencies available in the data.

Table 1 shows the descriptive statistics of the variables. For all demographic variables except age we have one observation per person. The mean of the ED-BN index is 1.4 and has substantial variation among the girls. The average age of the girls is approximately 15 years. Recall that the sample was chosen to have (approximately) an equal number of girls for whites and blacks in the three income groups, so by design there will be a lot of variation in the demographic variables. Recall that this design is one of exogenous sampling and hence does not create a sample selection problem. Moreover, following the literature in economics we do not reweight the data to mimic a nationally representative sample. Given that parent's education and race are very unlikely to change (except perhaps by remarriage) the only SES variable for which it would be useful to have multiple observations is family income. The data also contain indices that measure a potential for personality characteristics (henceforth, 'personality indices'), and are available in all years of the survey except for 1993. The first index assesses the degree to which the respondent is dissatisfied with the size and shape of specific parts of her body (henceforth 'the body dissatisfaction index'). The remaining personality indices assess tendencies toward: perfectionism (henceforth 'the perfectionism index'), feelings of ineffectiveness (henceforth 'the ineffectiveness index') and interpersonal distrust (henceforth 'the distrust index'). For all the personality indices, a higher score indicates a higher intensity of the personality trait. For ease of exposition, we provide details on the questions used to form the personality indices in Appendix A.

The top panel of Table 2 illustrates the distribution of the ED-BN index by year. Specifically, in panel A, each row shows the percentage of young women with an ED-BN index of zero, between 1 and 5, between 6 and 10, and greater than 10 in each

13 In order to externally validate the ED-BN index, a sample of women diagnosed with BN [according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) criteria] was interviewed using the NHLBIS questionnaire: the average ED-BN index among this sample was 10.8. See Garner et al. (1983) for more details of the development and validation of the ED-BN index.

14 See for instance, Hudson et al. (2007) and National Eating Disorders Association (2012), which notes between 1.1% and 4.6% of females will develop bulimia.

Table 1. Descriptive statistics

	Mean	Clustered standard error of mean	Standard deviation			Number of waves
			Overall	Between	Within	
Age	14,992	0.014	2.755	1.240	2.542	All
White	0.480	0.010	0.499			1
Parents high school or less	0.255	0.009	0.436			1
Parents some college	0.393	0.010	0.488			1
Parents bachelor degree or more	0.352	0.010	0.477			1
Family income less than $20,000	0.318	0.010	0.466			1
Family income in [$20,000, $40,000]	0.315	0.010	0.465			1
Family income more than $40,000	0.367	0.010	0.482			1
ED-BN index	1.4	0.039	2.852	2.287	1.869	3,5,7,9,10
Clinical bulimia (ED-BN > 10)	0.022	0.002	0.159	0.118	0.116	3,5,7,9,10
Body dissatisfaction index*	8.039	0.131	7.432	6.384	4.075	3,5,7,9,10
Distrust index**	3.589	0.056	3.466	2.768	2.218	3,5,9,10
Ineffectiveness index***	2.752	0.063	3.903	3.144	2.479	3,5,9,10
Perfectionism index****	6.468	0.052	3.290	2.541	2.168	3,5,9,10

Notes: Income is in 1988$; * ranges from 0 to 27 (maximal dissatisfaction); ** ranges from 0 to 21 (maximal distrust). *** ranges from 0 to 29 (maximal ineffectiveness); **** ranges from 0 to 18 (maximal perfectionism). See Appendix A for more detailed description of the variables. Clustering is at the individual level.

Table 2. Distributions of the ED-BN index and sample sizes

	Waves	1989	1991	1993	1995	1996
ED-BN index range % = 0	All years	60.4	62.2	67.9	71.8	71.2
ED-BN index range % = [1,5]	All years	27.8	27.8	27	24.1	24.2
ED-BN index range % = [6,10]	All years	8.01	6.76	3.78	3.21	3.24
ED-BN index range % > 10	All years	3.78	3.28	1.38	0.85	1.3
Sample size						
ED-BN index	All years	2,198	2,011	1,879	1,995	2,071
Perfection	All except 1993	2,194	2,012	0	1,995	555
Ineffectiveness	All except 1993	2,185	1,993	0	1,990	555
Distrust	All except 1993	2,193	2,005	0	1,995	555
Body dissatisfaction	All years	2,198	2,005	1,874	1,992	2,071
Parental education	Baseline only	2,196	2,010	1,878	1,993	2,066
Family income	Baseline only	2,077	1,899	1,778	1,887	1,957
White	Baseline only	2,198	2,011	18,789	1,995	2,071
Age	All years	2,198	2,011	1,879	1,995	2,071

interview year. We see that in 1989, the first wave of the sample when the subjects were between the ages of 11 and 12 years has the lowest fraction of the sample with ED-BN of zero, and the highest fraction with ED-BN greater than 10. In fact, it appears that the proportion of girls with high BN scores shrinks as the waves proceed and they get older. This may be due to the fact that some children are getting treatment in the later waves (at older ages), but unfortunately we cannot observe whether a girl received treatment. The bottom panel presents the sample size for all relevant variables in each wave.

Consider the distribution of ED-BN scores by the demographic variables. The common perception that BN is a disorder that only affects upper-income girls, or White

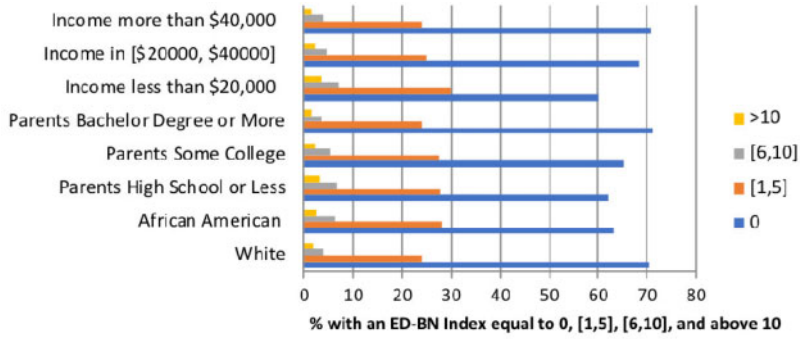

Figure 1. The relationship between SES and ED-BN index

girls, is discredited by Figure 1. For example, an ED-BN index equal to zero is more prevalent among Whites than African-Americans, an ED-BN index that is greater than zero is more prevalent among African-Americans than Whites.[15] Further, as parental education increases, and as initial family income increases, the seriousness of ED-BN is decreasing. Combined with the results for African-Americans, Figure 1 suggests that untreated BN is more problematic among African-American girls, girls from low-income families and girls from families with low parental education, motivating our goal of identifying girls at risk of BN in our sample, and subsequently in the population. One possibility is that the results for race or class will disappear once we also condition on the personality traits. But our multivariate analysis below shows that the race and class factors continue to be significant when we do this.

To get a first look at the relationship between the personality traits and ED-BN, in Table 3, Columns (1) and (2), each row shows the correlation between ED-BN and each personality trait for the full sample and the first wave data when the girls are 11–12 years old. In Columns (3) and (4), each row shows the correlation between clinical bulimia (ED-BN index >10) and each personality trait, again for the full sample and the first wave data when the girls are 11–12 years old. These correlations are sizeable and statistically significant at the 1% level. For our purposes, it is helpful to note that these correlations are always stronger in the first wave than in all of the data. Below we see that our regression results are stronger in the first wave, suggesting that personality traits are a good signal of BN even for the youngest girls.

15 One could be concerned that the ED-BN index might capture obesity instead of bulimic behaviour. However, if the index was actually measuring obesity, we would expect a strong positive correlation between ED-BN scores and body mass index (BMI), while the correlation in the data for all girls is only 0.05, and is actually negative for African-Americans. In addition, one might be concerned that correlation is driven by the highest ED-BN scores, and that the index represents obesity among those scoring 0–10. However, average BMI for girls with an ED-BN index above 5 (i.e., the midpoint of the 0–10 interval) is lower than average BMI for girls with an index of 5 or lower for both African-Americans (22.48 versus 24.72) and Whites (20.55 versus 22.14). These statistics strongly suggest that the ED-BN index is not an obesity index.

Table 3. Correlations of ED-BN index and clinical bulimia with personality traits

	ED-BN index		Clinical bulimia (BN)	
	Full sample	Aged 11 or 12	Full sample	Aged 11 or 12
Personality trait index				
Body dissatisfaction index	0.221	0.252	0.114	0.157
Distrust index	0.213	0.238	0.107	0.122
Ineffectiveness index	0.439	0.462	0.274	0.298
Perfectionism index	0.229	0.322	0.145	0.206

Note: Correlations are significant at the 1% level using clustered standard errors.

Finally, the purpose of Figures 2–5 is to show that girls with higher tendencies towards a given personality trait (e.g., perfectionism) are also more inclined towards bulimic behaviour. This pattern is present for each trait we consider in this paper. Specifically, the two graphs in Figure 2 depict the cumulative density of the ED-BN for two sub-samples: (i) girls with relatively low tendency towards perfectionism, that is the bottom 75% of the distribution of the perfectionism index and (ii) girls with relatively high tendency towards perfectionism, that is the top 25% of the distribution of the perfectionism index. By comparing the cumulative density of the ED-BN index in these two groups, we see that girls scoring low in perfectionism are also more likely to display lower scores of the ED-BN index. On the contrary, girls scoring high in perfectionism also have higher values of the ED-BN index. We then repeat the exercise for the sub-samples of girls showing relatively low and high tendency towards distrust, ineffectiveness and body dissatisfaction separately in Figures 3–5, respectively. We reach similar conclusions: The ED-BN index of girls scoring high in a certain personality trait stochastically dominates the ED-BN index of girls scoring low in that trait.

3. EMPIRICAL STRATEGY

We begin our analysis by including SES and personality traits measures in separate regressions. We estimate the following regressions:

$$d_{it} = \beta_0 + \mathbf{X}_{it}\beta_1 + v_{it}, \tag{1}$$

$$d_{it} = \beta_2 + \mathbf{p}_{it}\beta_3 + e_{it}, \tag{2}$$

where d_{it} is the ED-BN index for child i in year t, $\mathbf{X}_{it}$ is her set of SES variables, $\mathbf{p}_{it}$ denotes the vector of personality indices and v_{it} and e_{it} represent contemporaneous shocks for person i at time t. In some specifications, we add wave dummies and drop age from $\mathbf{X}_{it}$ since we cannot distinguish time effects from age effects within a single cohort.

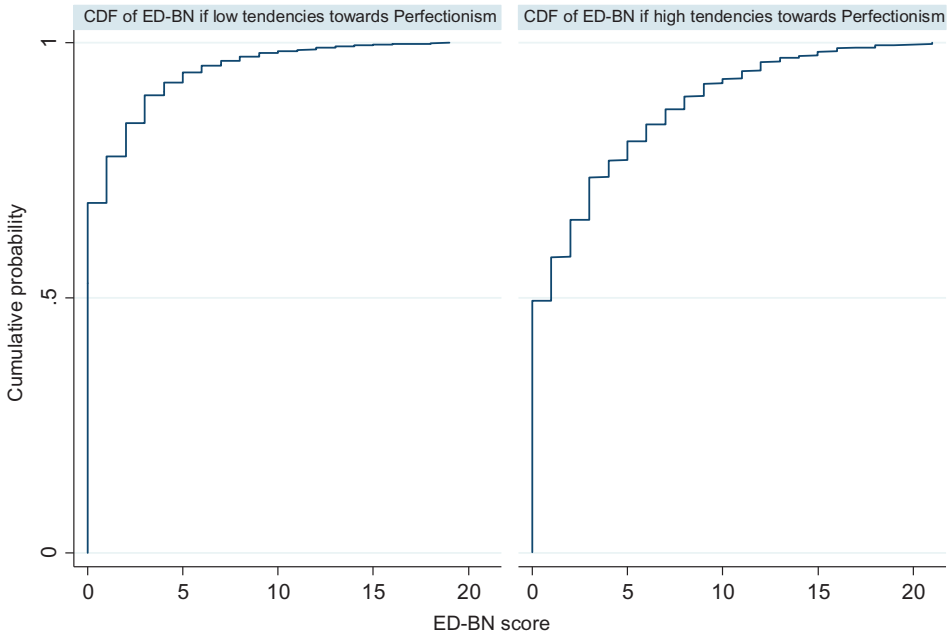

Figure 2. CDF of ED-BN index by low and high levels of perfectionism

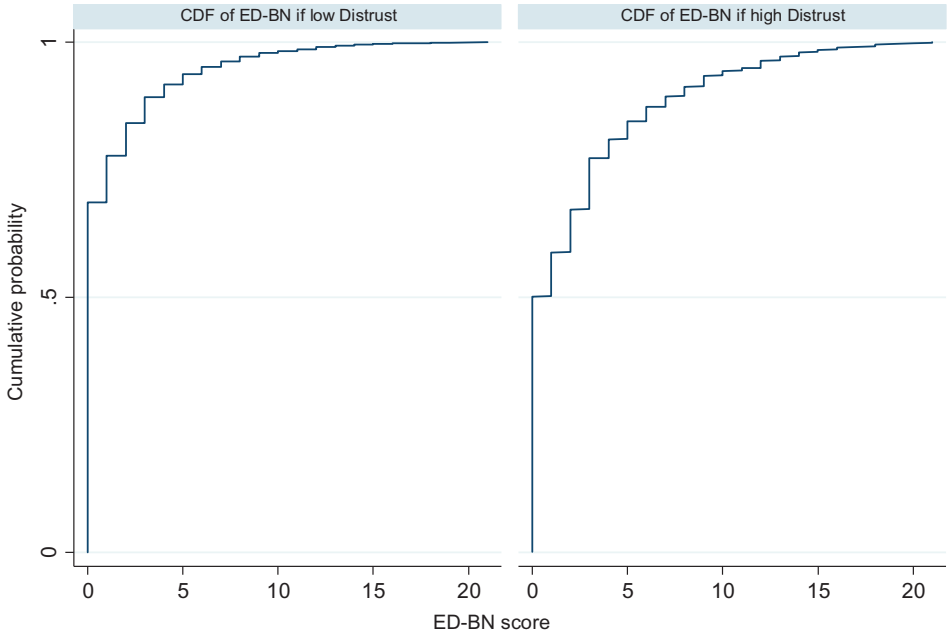

Figure 3. CDF of ED-BN index by low and high level of distrust

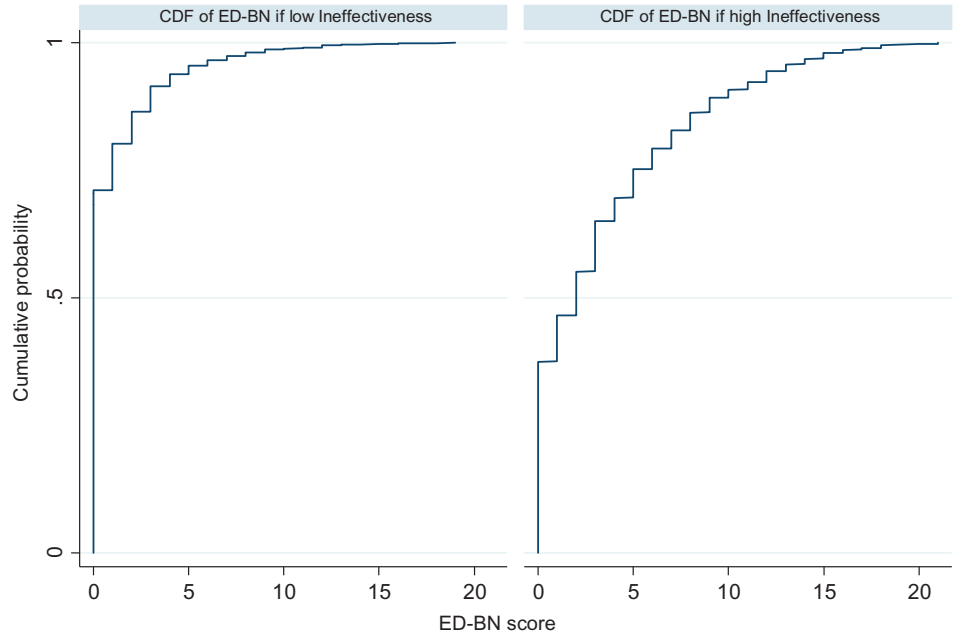

Figure 4. CDF of ED-BN index by low and high levels of ineffectiveness

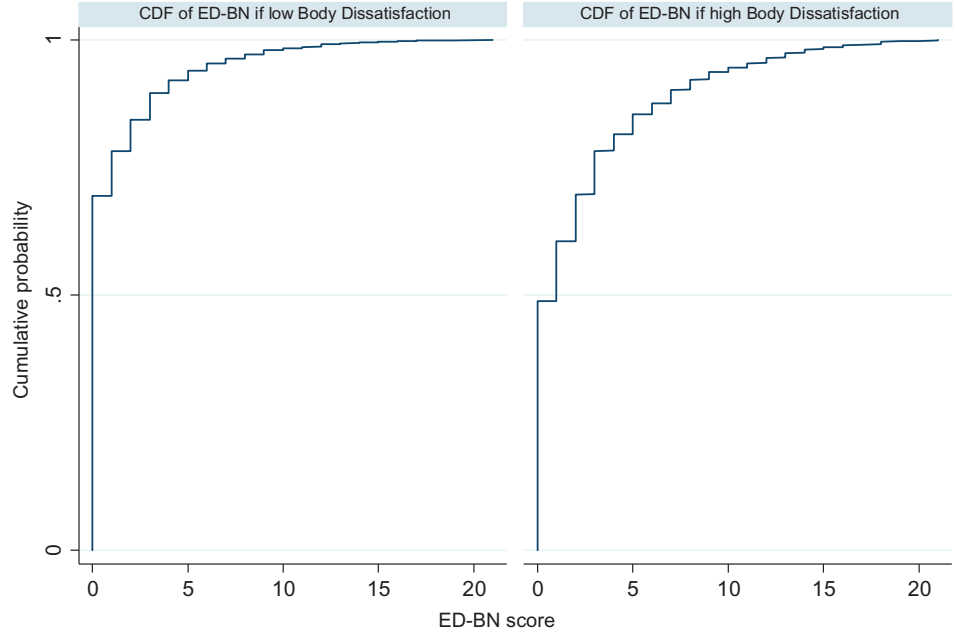

Figure 5. CDF of ED-BN index by low and high levels of body dissatisfaction

We then control both for socioeconomic characteristic and personality traits as follows:

$$d_{it} = \alpha_0 + \mathbf{X}_{it}\alpha_1 + \mathbf{p}_{it}\alpha_2 + u_{it}. \tag{3}$$

We do not interpret the coefficients in Equations (1)–(3) as causal, since individuals may have unobservables that affect both d_{it} and p_{it}. The inability to determine causality is not a concern as our goal is to ascertain whether these variables allow us to impute who has BN, or is likely to experience BN in the future. We cluster the standard errors by individuals to control for correlation across time as well as any heteroskedasticity in u_{it} (following Abadie et al., 2017).

One drawback of the regression model is that it ignores the large number of observations with an ED-BN index of zero. To address this drawback, we consider a Tobit model where the latent variable underlying the ED-BN index is

$$d_{it}^{\text{Tobit}*} = \mu_0 + \mathbf{X}_{it}\mu_1 + \mathbf{p}_{it}\mu_2 + \theta_i + \varepsilon_{it}, \tag{4}$$

where θ_i is an individual specific random effect that is assumed to be independent of $\mathbf{X}_{it}$ and $\mathbf{p}_{it}$ and ε_{it} are i.i.d. idiosyncratic shocks. The observed value, d_{it}^{Tobit}, is

$$d_{it}^{\text{Tobit}} = \begin{cases} 0 \text{ if } d_{\text{it}}^{\text{Tobit}*} \leq 0 \\ d_{it}^{Tobit*} \text{ otherwise.} \end{cases}$$

Note that the Tobit parameter estimates will be inconsistent if we have heteroskedasticity so we do not allow for heteroskedasticity. However, we can allow for correlation over time in an individual's error terms by including the random effect θ_i and assuming that θ_i and ε_{it} are independent of each other and distributed as i.i.d. normal random variables.[16] Following the custom in applied economics, we report the partial effects, for example,

$$\frac{\partial d_t^{\text{Tobit}}}{\partial X_k} = \mu_{1k}\overline{\Pr}(d_t^* > 0),$$

where $\overline{\Pr}(d_t^* > 0)$ is the average of $\Pr(d_{it}^* > 0)$ over individuals and time periods. Note that these partial effects are analogous to estimated coefficients in the regression approach.

We also estimate a Probit model for clinical bulimia. The latent index function is

$$d_{it}^{\text{Probit}*} = \delta_0 + \mathbf{X}_{it}\delta_1 + \mathbf{p}_{it}\delta_2 + \eta_i + w_{it}, \tag{5}$$

16 We do not need the random effect in the regression equations since we allow for unrestricted correlations across the errors for the same girl.

where the observed value of clinical bulimia is

$$d_{it}^{\text{Probit}} = \begin{cases} 1 \text{ if } d_{\text{it}}^{\text{Probit}*} > 10 \\ d_{it}^{\text{Probit}*} \text{ otherwise.} \end{cases}$$

We also report the partial effects which are formed analogously. Again, we do not allow for heteroskedasticity. We do allow for correlation over time in an individual's error terms by including the random effect η_i, and assuming that η_i and w_{it} are independent of each other and distributed as i.i.d. normal random variables.[17] A discussant noted that we may have nonclassical measurement error in the ED-BN index, or in the personality traits indices, which is correlated with one or more of the independent variables. However, if measurement error falls as the girl ages, the first-order bias term will occur in the age coefficient and not the personality traits coefficients.

4. EMPIRICAL RESULTS

Table 4 contains the results for the OLS model. We include only the SES characteristics in Column (1). The benchmark group is African-American families, from the lowest income bracket and comprising parents who are (at most) high school graduates. In column (1), all of the SES coefficients are jointly significant. Column (2) presents the regression results with the personality characteristics as explanatory variables; all of the personality traits coefficients are jointly significant. Column (3) includes both sets of explanatory variables.

Column (3) includes both the SES and personality traits as explanatory variables.[18] Now the coefficients for race, age and income remain jointly statistically significant, even when we condition on personality traits, but fall in size compared with those in Column (1). Specifically, the coefficient for White is about 25% smaller while the coefficient for income falls by about 47% for the middle group, and by 50% for the high-income group.

In Column (3), we also see that all but one of the personality indices (interpersonal distrust) continue to be individually and jointly significantly associated with the ED-BN index in the direction expected from Column (2). Note that each of these estimated coefficients is substantial when compared with the mean ED-BN index of 1.4. The estimates of ineffectiveness, perfectionism and body dissatisfaction are individually and jointly significant, and quite stable when we control for SES. Some may be concerned about the fit of our model given R^2 values around 0.23, which suggest that we can

17 We use the common normalization that the variance of $(\eta_i + w_{it})$ equals 1.

18 Some readers may be more familiar with results when the BN-ED and the personality traits are measured as Z-scores, that is with mean 0 and standard deviation 1. To get the Z-score (aside from the intercept) multiply the respective coefficient by the ratio of (i) the BN-ED standard deviation and (ii) the respective personality trait standard deviation. The values of the standard deviations are in Table 1.

Table 4. SES, personality indices and the ED-BN index (OLS)

	(1)	(2)	(3)
White	−0.318***		−0.238***
	(0.099)		(0.088)
Age	−0.130***	−0.087***	−0.087***
	(0.013)	(0.012)	(0.013)
Parents some college	−0.160		−0.083
	(0.129)		(0.110)
Parents bachelor degree or more	−0.327**		−0.143
	(0.135)		(0.119)
Income in [$20,000, $40,000]	−0.440***		−0.232**
	(0.130)		(0.112)
Income more than $40,000	−0.504***		−0.253**
	(0.127)		(0.109)
Distrust index		0.026**	0.008
		(0.012)	(0.013)
Ineffectiveness index		0.261***	0.260***
		(0.017)	(0.018)
Perfectionism index		0.142***	0.134***
		(0.013)	(0.014)
Body dissatisfaction index		0.037***	0.040***
		(0.006)	(0.006)
Constant	4.033***	0.699***	1.179***
	(0.246)	(0.201)	(0.241)
Sample size	6,308	6,291	6,291
F-statistics	30.84	112.45	56.84
R^2	0.034	0.236	0.239

Notes: Standard errors are robust to intra-individual correlation and robust to heteroskedasticity are in parentheses. * indicates significant at the 10% level; ** at 5% and *** at 1%.

0.08		0.208	0.251	
−0.251572327		−0.47273	−0.49802	
z scores inef	0.26	3.903	2.852	0.35581
z score perfct	0.134	3	3	0.15458
z score body dis	0.04	7	3	0.10424

explain 23% of the variance in the ED-BN variable. But we feel it is informative to put our findings within the context of the larger literature, where equations with R^2 values of 0.23 are considered to perform very well in prediction.[19] We examine to what extent we are able to predict bulimic behaviour. To do this, we omit 1 year of data, which gives us 4 years of data to use to estimate the parameters. We consider a model that (i) contains only age and personality traits, (ii) contains age and the socioeconomic variables and (iii) contains year dummies, the socioeconomic variables and their interactions. In each case, we compute the mean-squared error using the omitted period. As Table 4 reports, we find that the adjusted R^2 values for (i) and (ii) are 0.189 and 0.001, respectively. Table A2 in the Appendix gives the parameter estimates and statistics for (iii), and

19 The commonly used regression of log-wages on schooling and IQ has an R^2 around 0.18.

Table 5. SES, personality indices and the ED-BN index (OLS)—first wave

	(1)	(2)	(3)
White	−0.647***		−0.267**
	(0.159)		(0.141)
Age	−0.012	0.109	0.073
	(0.119)	(0.107)	(0.109)
Parents some college	−0.256		−0.199
	(0.207)		(0.181)
Parents bachelor degree or more	−0.716***		−0.352*
	(0.216)		(0.194)
Income in [$20,000, $40,000]	−0.406**		0.057
	(0.202)		(0.181)
Income more than $40,000	−0.439**		0.022
	(0.204)		(0.181)
Distrust index		0.041*	0.028
		(0.021)	(0.028)
Ineffectiveness index		0.289***	0.285***
		(0.028)	(0.028)
Perfectionism index		0.202***	0.194***
		(0.024)	(0.024)
Body dissatisfaction index		0.037***	0.038***
		(0.011)	(0.011)
Constant	2.905**	−0.927***	−1.392
	(1.461)	(0.166)	(1.342)
Sample size	2,029	2,022	2,022
F-statistics	12.11	142.35	72.35
R^2	0.035	0.261	0.265

Notes: Standard errors robust to heteroskedasticity are in parenthesis. * indicates significant at the 10% level; ** at 5% and *** at 1%.

the adjusted R^2 is 0.001. We believe this is strong evidence that the personality variables provide much more information for prediction than socioeconomic variables alone, even when they are interacted with period dummies.[20]

We argued that early identification of BN behaviour will enable early intervention. Hence, the ability to impute BN behaviour at young ages could have substantial benefits. In Table 5, we have replicated Table 4 using only the first wave of data, when the girls are between the ages of 11 and 12 years. Importantly, the results in Table 5 are similar to those in Table 4. Both SES and personality traits are predictive of BN behaviour.

Table 6 shows the estimated partial effects from the Tobit model in columns (1)–(3). These partial effects are quite similar to the regression results in Table 4. In Columns (4)–(6), we show the partial effect from the Probit model. These estimates use only the information provided by the dummy variable for clinical bulimia and are considerably

20 We note that we would expect the approaches (ii) and (iii) to do better if the data contained updated income measures in each survey and information on the status of the parents' marriage over the sample.

Table 6. SES, personality indices and the ED-BN index Tobit and Probit partial effects

	ED-BN index—Tobits			Clinical bulimia—Probits		
	(1)	(2)	(3)	(4)	(5)	(6)
White	−0.288***		−0.248***	−0.008		−0.011***
	(0.090)		(0.073)	(0.005)		(0.004)
Age	−0.106***	−0.076***	−0.075***	−0.005***	−0.003***	−0.003***
	(0.012)	(0.010)	(0.010)	(0.001)	(0.001)	(0.001)
Parents some college	−0.076		−0.019	−0.005		−0.005
	(0.104)		(0.085)	(0.005)		(0.005)
Parents bachelor degree or more	−0.249**		−0.105	−0.005		−0.002
	(0.116)		(0.098)	(0.006)		(0.006)
Income in [$20,000, $40,000]	−0.399***		−0.242***	−0.006		−0.001
	(0.099)		(0.083)	(0.005)		(0.005)
Income more than $40,000	−0.441***		−0.235***	−0.015***		−0.008
	(0.106)		(0.089)	(0.005)		(0.005)
Distrust index		0.037***	0.020**		0.000	0.000
		(0.009)	(0.009)		(0.000)	(0.000)
Ineffectiveness index		0.150***	0.150***		0.004***	0.004***
		(0.010)	(0.009)		(0.000)	(0.000)
Perfectionism index		0.101***	0.093***		0.003***	0.003***
		(0.010)	(0.009)		(0.000)	(0.000)
Body dissatisfaction index		0.041***	0.044***		0.001***	0.001***
		(0.004)	(0.004)		(0.000)	(0.000)
Sample size	6,308	6,291	6,291	6,308	6,291	6,291

Notes: Standard errors robust intra-individual correlation are in parenthesis. * indicates significant at the 10% level; ** at 5% and *** at 1%.

weaker in terms of significance than the estimates for the Tobit model. The loss of significance when we move from the Tobit to the Probit models is to be expected, since the Tobit and Probit model uses the same index function structure, but the Tobit model uses much more data by considering the actual values of the BN-ED index.

In Table 7, we replace the current values of the personality variables with those in the previous wave, and find similar results to Table 4. For ease of comparison, Column (1) in Table 8 is a replicate of Column (1) in Table 4. Note that as soon as the personality traits are collected, they can be used to impute BN next year.

We also considered robustness checks where we replaced our age variable with wave/year-fixed effects but this had no effect on the other coefficients. Perhaps not surprisingly, we cannot separately estimate with any precision age effects and wave effects. We present these results in Appendix B.

5. POLICY PRESCRIPTIONS

Our results strongly indicate that we can impute who is demonstrating symptoms of BN using relatively noninvasive questions on personality traits, as opposed to using invasive

Table 7. SES, lagged personality indices and the ED-BN index (OLS)

	(1)	(2)	(3)
White	−0.318***		−0.038
	(0.099)		(0.089)
Age	−0.130***	−0.090***	−0.092***
	(0.013)	(0.015)	(0.015)
Parents some college	−0.160		−0.132
	(0.129)		(0.110)
Parents bachelor degree or more	−0.327**		−0.053
	(0.135)		(0.117)
Income in [$20,000, $40,000]	−0.440***		−0.294***
	(0.130)		(0.109)
Income more than $40,000	−0.504***		−0.382***
	(0.127)		(0.105)
Lagged distrust index		0.057***	0.046***
		(0.013)	(0.014)
Lagged ineffectiveness index		0.131***	0.128***
		(0.015)	(0.015)
Lagged perfectionism index		0.078***	0.075***
		(0.013)	(0.013)
Lagged body dissatisfaction index		0.034***	0.035***
		(0.006)	(0.006)
Constant	4.033***	1.353***	1.179***
	(0.246)	(0.262)	(0.296)
R^2	0.034	0.11	0.12
Sample size	6,308	5,520	5,520

questions on BN behaviour. This finding is crucial since diagnosis of BN is very different across racial groups and income groups; specifically, minorities and low-income groups are especially likely to experience untreated bulimia. Moreover, our results suggest that we can successfully impute BN behaviour for girls as young as 11–12 years. Since we know that untreated BN is a progressive disease and hence should be treated as early as possible, these latter results are important.

But our results are based on a relatively small data set that covers only three cities, so we would recommend that much larger data sets be collected for at least the four general regions of the country. With such a larger data set we could allow for region-specific coefficients, as well as interactions among the SES variables, interactions among the personality traits and interactions between the SES variables and the personality traits. Here, it will be crucial to also collect data on who is receiving treatment for BN.

6. CONCLUSION

We examine the role of personality traits in eating disorder behaviour and find that personality traits explain a significant amount of the variation in ED-BN behaviour, while SES variables explain much less of this variation. Further, we present results showing that personality traits continue to be significant determinants of BN behaviour, even

after controlling for the SES. With a much bigger data set, along the lines of that suggested in Section 5, we would be able to substantially improve imputations for BN. A better data set would also avoid a possible disadvantage of our data: since we cannot observe who has been treated for BN in the NHLBIS, we do not know which girls have already received treatment.[21]

Finally, we recommend that programs or publicity campaigns aimed at overeating be sensitive to possible unintended consequences, for example, inducing eating disorders. In preliminary regressions using data from the National Longitudinal Study of Adolescent Health, we find that women who have been exposed to preventative educational programs on the dangers of being overweight report more severe bulimic behaviour.[22]

Discussion

Sebastian Axbard

Queen Mary University of London

This paper studies predictors of the eating disorder BN using rich data from a panel of young girls in the United States collected by the *National Heart, Lung, and Blood Institute*. The authors move beyond standard socio-economic variables used in previous work to also consider how BN correlates with four self-reported personality traits: perfectionism, sense of ineffectiveness, body dissatisfaction and interpersonal distrust. The paper documents that BN behaviour is more common among individuals that have a higher score on the four personality traits also when controlling for a set of socio-economic variables. These associations are present already for girls as young as 11 years old.

As discussed in the paper, the correlates of BN cannot be interpreted as causal effects, since estimates could be affected by both omitted variable bias and reversed causality. Hence, the analysis is not informative about what causally determines BN. Instead, the goal of the analysis is to learn if BN behaviour can be predicted by using information on personality traits. The benefit of such an approach is to enable the identification of individuals at risk of BN without having to ask intrusive questions about bingeing and purging behaviour.

The results presented in the paper lend some credence to such an approach since personality traits are predictive of BN behaviour both within and out of sample. However,

21 Furthermore, certain individual characteristics might identify those at a high risk of bulimia, but not necessarily those who are more likely to respond to treatment. Also, treatment itself might affect an individual's personality traits over time. We thank an anonymous referee for this point.

22 These concerns have also been raised in a number of publications in the eating disorders literature. More recently, the Academy for Eating Disorders commented on the risk of unintended negative consequences from obesity education (see Danielsdottir et al., 2009).

when using such an approach to identify BN behaviour there are a couple of additional trade-offs that policymakers might wish to consider. First, it would be important to have a good understanding of the type I and type II errors for such predictions. In other words, how reliably can we identify individuals at risk of BN based on their personality traits and how often would individuals be incorrectly classified? The ability to correctly identify potential cases with this approach could then be evaluated against the intrusiveness and difficulty of conducting surveys about bingeing and purging behaviour in different contexts. Analysing these type of questions might be an interesting avenue for future work in order to further assess the desirability of the prediction approach suggested by the authors.

The difficulty of conducting surveys of bingeing and purging behaviour has some potential additional implications related to the reliability of the self-reported data used in this study. The interpretation of the findings relies on this measure being an accurate reflection of true behaviour. However, if questions about BN are found to be intrusive, there could be misreporting. If reporting behaviour is in turn related to personality traits this could lead to non-classical measurement error biasing the estimates in an unknown direction. Understanding to what extent personality traits also predict clinical diagnosis of BN could be an interesting avenue for future work to shed light on this issue.

A final issue to keep in mind when interpreting the findings in this study is the limitation of the socio-economic data used, which is: broadly defined (three parental income and education categories), only available in the first wave of the survey (i.e., there is no temporal variation) and does not include geographical information (despite survey participants from two different states in the United StatesCalifornia and Ohio). If a wider range of time-varying socio-economic data was available, the predictive power of these characteristics might improve. Understanding if this is the case or not would be important for policy since socio-economic data are likely easier and less costly to acquire than information on personality traits.

Overall, this is an interesting paper that studies an important and underexplored topic. It shows how detailed information on personality traits can help detect a severe disease that often goes undiagnosed.

Martin Halla

Johannes Kepler University of Linz

Ham, Iorio and Sovinsky (hereafter "the authors") combine standard econometric techniques with information on young girls' personality traits collected in a longitudinal survey study to predict (or impute) *Bulimia Nervosa*, an eating disorder characterized by binge eating followed by purging. The authors' motivation for developing a new diagnostic tool is two-fold. First, *Bulimia Nervosa* (hereafter bulimia) is a common, but often undiagnosed disorder, with a comparably high prevalence among girls from lower socio-economic backgrounds. Second, the authors consider existing diagnostic tools as

unsatisfactory. The first alternative approach, explicitly mentioned by the authors, is to ask at-risk patients direct questions on bulimia behaviour. Given that this requires asking questions about binge eating and vomiting, the authors consider this "*just ask approach*" to be too intrusive, and they worry about non- and/or false response. A second alternative diagnostic approach, similar to the authors suggested diagnostic tool, are existing self-report questionnaires. One example is the *Eating Disorders Inventory* (hereafter EDI) index developed by Garner et al. (1983). In my understanding, the authors use a sub-component of the EDI as an actual measure for bulimia, and as their main dependent variable in their analysis. A third diagnostic approach is medical screenings, in which health professionals look for physical or psychological symptoms of bulimia.

The authors' data comprise information on the girls' EDI-BN index, personality traits (i.e., body dissatisfaction, distrust, ineffectiveness and perfectionism) and socio-economic background. Their OLS estimations show that these four personality traits explain 23.6% of the variation in the EDI-bulimia index. In contrast, socio-economic variables explain less than 4%. The combination of both sets of explanatory variables gives an R-squared of about 0.24. Based on these results, the authors suggest to use these four personality traits to impute for bulimia in the population of girls of 11–12 years of age. Put differently, they suggest a personality traits-based diagnostic approach. I agree with the authors that it is remarkable to explain with only four covariates, and without individual fixed effects, almost a quarter of the variation of a variable measuring a health condition. I also appreciate their idea that it is comparably cheap and easy to collect information on these four personality traits.

However, more discussion of the advantages and potential disadvantages of the authors' new diagnostic tool, of their '*personality traits-based approach*', relative to existing diagnostic tools, is needed. I fully understand the authors' objections to the '*just ask approach*'. But it remains unclear why the '*personality traits-based approach*' is superior to existing diagnostic tools which also rely on self-report questionnaires. For instance, the aforementioned EDI '*consists of eight sub-scales measuring*'[23] includes all four personality traits used by the authors. Is the authors' '*personality traits-based approach*' nested in the EDI approach? If yes, what are the costs and benefits of excluding the four remaining sub-scales from the EDI?

In other words, how does the '*personality traits-based approach*' compare to existing 'medical screenings approaches'. For instance, bulimia has clear effects on teeth. The frequent exposure of enamel to stomach acids (included in vomit) erodes tooth enamel and can lead to cavities, tooth discoloration and tooth loss. Hague (2010) presents a diagnostic tool that oral health care professionals can use to screen at-risk patients for eating disorders during routine preventive care appointments.

It seems plausible, that the '*personality traits-based approach*' is one of the simpler and cheaper among the available diagnostic tools for bulimia. However, the associated

23 According to Garner et al. (1983) "*[. . .] the EDI consists of eight sub]scales measuring: 1) Drive for Thinness, 2) Bulimia, 3) Body Dissatisfaction, 4) Ineffectiveness, 5) Perfectionism, 6) Interpersonal Distrust, 7) Interoceptive Awareness and 8) Maturity Fears.*"

benefits are unknown. For instance, it is unclear how the '*personality traits-based approach*' performs in terms of test sensitivity and specificity. Given an R-squared of about 0.24, one has to expect a rather high rate of false positive and false negative cases. The administrative implementation is also yet to be resolved. How are girls at-risk sampled and how do diagnosed girls transition to treatment?

To conclude, this is a very nice paper, in which economists venture into a topic previously hardly studied within (health) economics. I applaud the authors' pioneer spirit, but also the editors for bringing this topic to the economic audience. I hope that the public health care community will pay attention to the '*personality traits-based approach*', despite being published in an economics journal. In a next step, it would be very nice to bring this new approach to the field, and to see practitioners evaluating the pros and cons of this new approach relative to their established diagnostic tools.

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APPENDIX A: DATA VARIABLE DEFINITIONS

We describe the construction of the ED-BN index in the main text of the paper. The body dissatisfaction index is based on subject responses to nine items: (i) I think that my stomach is too big; (ii) I think that my thighs are too large; (iii) I think that my stomach is just the right size; (iv) I feel satisfied with the shape of my body; (v) I like the shape of my buttocks; (vi) I think my hips are too big; (vii) I think that my thighs are just the right size; (viii) I think that my buttocks are too large and (ix) I think my hips are just the right size. This index ranges from 0 to 27 and responses are scored such that a higher score indicates more dissatisfaction.[24]

The perfectionism index is based on subject responses to six items: (i) In my family everyone has to do things like a superstar; (ii) I try very hard to do what my parents and teachers want; (iii) I hate being less than best at things; (iv) My parents expect me to be the best; (v) I have to do things perfectly or not to do them at all and (vi) I want to do very well. The responses are scored in the same way as the ED-BN index.

24 The scoring rule is as follows: 'Always' = 6; 'Usually' = 5; 'Often' = 4; 'Sometimes' = 3; 'Rarely' = 2; and 'Never' = 1 in questions 3–5, 7 and 9; and 'Always' = 1; 'Usually' = 2; 'Often' = 3; 'Sometimes' = 4; 'Rarely' = 5 and 'Never' = 6 in questions 1, 2, 6 and 8. Again a response of 4–6 on a given question contributes zero points to the body image index; a response of 3 contributes one point; a response of 2 contributes two points; and a response of 1 contributes three points. The body image index is the sum of the contributing points.

The distrust index is based on subject responses to seven items: (i) I tell people about my feelings; (ii) I trust people; (iii) I can talk to other people easily; (iv) I have close friends; (v) I have trouble telling other people how I feel; (vi) I don't want people to get to know me very well and (vii) I can talk about my private thoughts or feelings. The scoring rule is as follows: 'Always' = 1; 'Usually' = 2; 'Often' = 3; 'Sometimes' = 4; 'Rarely' = 5 and 'Never' = 6 in questions 5 and 6 and 'Always' = 6, 'Usually' = 5; 'Often' = 4; 'Sometimes' = 3; 'Rarely' = 2 and 'Never' = 1 in questions 1–4 and 7. A response of 4–6 on a given question contributes zero points to the distrust index; a response of 3 contributes one point; a response of 2 contributes two points and a response of 1 contributes three points. The distrust index is the sum of all contributing points.

The ineffectiveness index is based on subject responses to ten items: (i) I feel I can't do things very well; (ii) I feel very alone; (iii) I feel I can't handle things in my life; (iv) I wish I were someone else; (v) I don't think I am as good as other kids; (vi) I feel good about myself; (vii) I don't like myself very much; (viii) I feel I can do whatever I try to do; (xi) I feel I am a good person and (x) I feel empty inside. The scoring rule is as follows: 'Always' = 1; 'Usually' = 2; 'Often' = 3; 'Sometimes' = 4; 'Rarely' = 5 and 'Never' = 6 in questions 1–5, 7 and 10 and 'Always' = 6; 'Usually' = 5; 'Often' = 4; 'Sometimes' = 3; 'Rarely' = 2 and 'Never' = 1 in questions 6, 8 and 9. A response of 4–6 on a given question contributes zero points to the ineffectiveness index; a response of 3 contributes one point; a response of 2 contributes two points and a response of 1 contributes three points. The ineffectiveness index is the sum of all contributing points.

APPENDIX B: ADDITIONAL SPECIFICATIONS

Table A1. Regressions with fixed effects

SES, personality indices and the ED-BN index (OLS)—year FE						
	(1)	(2)	(3)	(4)	(5)	(6)
White	−0.287***		−0.238***	−0.287***		−0.213***
	(0.1000)		(0.088)	(0.1000)		(0.087)
Age				−0.010	−0.020	0.002
				(0.073)	(0.064)	(0.063)
Parents some college	−0.162		−0.083	−0.162		−0.084
	(0.129)		(0.110)	(0.129)		(0.110)
Parents bachelor degree or more	−0.331**		−0.143	−0.331**		−0.146
	(0.136)		(0.119)	(0.136)		(0.119)
Income in [$20,000, $40,000]	−0.470***		−0.232**	−0.470***		−0.255***
	(0.130)		(0.112)	(0.130)		(0.112)
Income more than $40,000	−0.555***		−0.253**	−0.554***		−0.292***
	(0.128)		(0.109)	(0.127)		(0.109)
Distrust index		0.0267**	0.00880		0.0268**	0.009
		(0.0122)	(0.0130)		(0.0122)	(0.013)
Ineffectiveness index		0.259***	0.258***		0.259***	0.258***
		(0.0178)	(0.0178)		(0.0178)	(0.018)
Perfectionism index		0.143***	0.135***		0.143***	0.135***
		(0.0133)	(0.0136)		(0.0133)	(0.0136)
Body dissatisfaction index		0.0378***	0.0403***		0.0378***	0.040***
		(0.00589)	(0.00584)		(0.006)	(0.006)

(*continued*)

Table A1. Continued

SES, personality indices and the ED-BN index (OLS)—year FE						
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	1.891***	−0.428***	0.0455	2.589***	−0.622	0.080
	(0.167)	(0.103)	(0.156)	(0.902)	(0.763)	(0.776)
Sample size	6,308	6,291	6,291	6,308	6,291	6,291
R^2	0.039	0.235	0.241	0.039	0.235	0.241

Notes: Standard errors robust intra-individual correlation and robust to heteroskedasticity are in parenthesis. * indicates significant at the 10% level; ** at 5% and *** at 1%.

Table A2. Regressions with SES interactions

SES interactions and the ED-BN index (OLS)		
Variables		ED-BN index
White		−1.303**
		(0.511)
Age		−0.279***
		(0.0341)
Parents some college		−1.038*
		(0.628)
Parents bachelor degree or more		−1.578**
		(0.671)
Income in [$20,000, $40,000]		−1.575**
		(0.649)
Income more than $40,000		−1.540**
		(0.630)
Age*	White	0.0872***
		(0.0268)
Age*	Parents some college	0.0531
		(0.0366)
Age*	Parents bachelor degree or more	0.0985**
		(0.0389)
Age*	Income in [$20,000, $40,000]	0.0690*
		(0.0384)
Age*	Income more than $40,000	0.0570
		(0.0375)
White*	Parents some college	−0.274
		(0.275)
White*	Parents bachelor degree or more	−0.303
		(0.275)
White*	Income in [$20,000, $40,000]	−0.265
		(0.206)
Parents some college*	Income in [$20,000, $40,000]	0.450*
		(0.262)
Parents some college*	Income more than $40,000	0.278
		(0.257)
Constant		6.211***
		(0.573)
Sample size		6,308
Adjusted R^2 (within-sample)		0.041
Adjusted R^2 (out-of-sample)		0.001

Notes: Standard errors are robust to intra-individual correlation and robust to heteroskedasticity are in parentheses. * indicates significant at the 10% level; ** at 5% and *** at 1%. To compute the out-of-sample statistics, we omit the last year of data from the analysis.