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Abstract

In this paper we explore a serious eating disorder, bulimia nervosa (BN), which afflicts a surprising number of girls in the US. We challenge the long-held belief that BN primarily affects high income White teenagers, using a unique data set on adolescent females evaluated regarding their tendencies towards bulimic behaviors independent of any diagnoses or treatment they have received. Our results reveal that African Americans are more likely to exhibit bulimic behavior than Whites; as are girls from low income families compared to middle and high income families. We use another data set to show that who is diagnosed with an eating disorder is in accord with popular beliefs, suggesting that African American and low-income girls are being under-diagnosed for BN. Our findings have important implications for public policy since they provide direction to policy makers regarding which adolescent females are most at risk for BN. Our results are robust to different model specifications and identifying assumptions.

Keywords: Bulimia Nervosa, Race, Income, Education
JEL Codes: I1

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1 Introduction

Eating disorders are an important and growing health concern in the United States. According to the National Eating Disorders Association (NEDA, 2008), approximately 9 million women in the US struggle with an eating disorder (ED). To put this in perspective, in 2005, approximately 4.5 million people had Alzheimer's disease and about 2.2 million had Schizophrenia. Bulimia nervosa (BN) accounts for the highest number of ED incidents and disproportionately affects women.[1] Over the last decade 6 to 8.4% of female adolescents reported purging to lose weight (National Youth Risk Behavior Survey, 2005). In addition, children report suffering from BN at ever younger ages. The age of onset is between 14 and 25, but the behavior is increasingly seen in children as young as 10 (Cavanaugh and Ray, 1999). Furthermore, only about half of the patients diagnosed with BN fully recover, many experiencing bulimic occurrences for decades (Keel et al., 2005).

The primary characteristic of BN is the recurrent episodes of binge-eating followed by compensatory behavior, which includes self-induced vomiting, misuse of laxatives, diuretics, or other medications, fasting, or excessive exercise. As a result, BN can be extremely harmful to the body and thus causes serious health problems. For example, the cycle of bingeing and purging can impact the digestive system leading 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 negative impact of BN is even more serious for the very young since BN has irreversible effects on physical development and emotional growth.[2] Moreover, bulimics persist in their behaviors (Keel, et al., 2005; Goeree, Ham, Iorio, 2011), hence, as with any serious persistent disease, BN is likely to negatively affect human capital accumulation as it will cause students to miss class and to be less attentive in class. It may also reduce on-the-job training if it prevents individuals from holding stable employment for demanding jobs. In addition, there are other costs of BN including days lost from work. Thus BN can impose serious costs to the economy in terms of physical health, treatment costs, increased absence from work, and reduced human capital accumulation.

Given the number of people affected and the seriousness of the effects, BN should be thought of as a primary health issue. However, public campaigns targeting BN remain scarce, as recently noted by the Senate Committee of Appropriations, who expressed concern about the "growing

[1] Lifetime prevalence of anorexia nervosa is 0.9% in women and 0.3% in men (Hudson, et al, 2007). Furthermore, approximately 80% of BN patients are female (Gidwani, 1997).

[2] 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).

incidence and health consequences of eating disorders among the population" (Department of Health and Human Services, 2006).[3] In contrast, there is a major push to reduce obesity, and this comes at a cost that receives little or no attention: campaigns fighting obesity could move individuals who are currently bingeing on food to engage in both bingeing and purging behaviors leading to all the negative consequences that arise from BN.[4] Thus policy aimed at BN has an important role to play. However, implementation is difficult given how little is known about the disorder, as realized by the Senate Committee that emphasized the need for research on the incidence of EDs across demographic groups. For example, popular culture portrays EDs as affecting relatively affluent White women who are highly educated, or come from high income families but, to our knowledge, there is no multivariate analysis to confirm or deny this assertion.[5] Thus it is not clear whom should be targeted by health campaigns.

In this paper we aim to begin addressing the Senate Committee's challenge. To do so, we analyze data from the National Heart, Lung, and Blood Institute (NHLBI, henceforth) Growth and Health Study, which is a panel data set on female adolescents' behaviors. A notable aspect of the NHLBI Growth and Health survey is that *all* respondents were asked a large number of questions related to bulimic behavior, *independent* of any diagnoses or treatment they had received. The survey questions were designed by a panel of medical experts to assess the psychological characteristics and symptoms that are relevant to detect bulimic behavior (Garner et al., 1983). Based on the answers to these questions, they constructed an Eating Disorders Inventory-BN scale, which is widely used in ED research. This stands in contrast to many data sets, where often a measure of ED or BN behavior is available only if the respondent had been diagnosed with, or was being treated for, an eating disorder. However, if individuals from certain income or racial groups are more likely to seek treatment for an ED, results based on data from diagnosed individuals can present a very misleading picture of the incidence of EDs across socioeconomic (SES) groups.

Our results reveal that African-American girls report a stronger tendency towards bulimic

[3] According to the 2004 School Health Profiles study, only 25 states had a least one school that taught students about EDs. The percent of schools providing ED education in these states ranged from 78 to 99, where the majority of ED programs were in high schools.

[4] For example, in preliminary regressions using data from the National Longitudinal Study of Adolescent Health we found that women who have been exposed to preventative educational programs on the dangers of being overweight report more severe bulimic behaviors. These concerns have also been raised in a number of publications in the ED literature and more recently the Academy for Eating Disorders commented on the risk of unintended negative consequences from obesity education (see Danielsdottir et al., 2009).

[5] The epidemiological literature that estimated the incidence of BN across racial or income groups often suffers from at least one of the following: i) focuses on univariate correlations, ii) creates a selection problem by only considering those diagnosed with an eating disorder, or iii) does not distinguish between correlations and causal factors. See the related literature section for a further discussion.

behavior than White girls do. For example, being White lowers the Eating Disorders Inventory-BN scale by 20% relative to its mean value. Further, our results reveal interesting BN patterns across family income groups. For example, the poorest girls exhibit a 32% increase of symptoms of bulimia (relative to the mean of the Eating Disorders Inventory-BN scale) when compared to middle class girls, and a 40% increase when compared to wealthier peers. Regarding the race-income interactions, low and middle income African American girls, and low income White girls, are at substantially higher risk of BN behavior than girls from other race-income groups.

These findings stand in stark contrast to the popular conceptions about EDs. Using supplementary data from the National Longitudinal Study of Adolescent Health, which contains information on ED diagnosis, we find that White girls in a high income household with highly educated parents are almost twice as likely to be diagnosed with an ED (5.9%) relative to an average girl. In contrast, only 0.7% of African American girls in low-income households have been diagnosed with an ED. Our results show that the popular conception is consistent only with who is diagnosed with an ED, suggesting dramatic differences in diagnosis across race and income classes. Our results have the implications that greater outreach for BN should be made to African Americans and to individuals from low income families.

In order to investigate the relationship between the incidence of BN and socioeconomic status, we consider linear, Tobit, Ordered Probit and Probit models that address the limited dependent nature of our measures of bulimic behavior. Our estimates are robust to different estimation methods and identifying assumptions. Furthermore, there is ample evidence in the non-economics literature that personality traits (such as perfectionism tendencies, feelings of ineffectiveness and distrust) are associated with BN. When we add personality traits, we find that our results for race and income class disparities continue to hold. Thus our results for SES variables are not simply a result of omitted confounding factors, e.g., as captured by the personality traits. Interestingly the personality traits are statistically significant when we combine them with the SES variables. Further, when we allow for correlation between an unobserved individual effect and the personality traits, both the personality and the SES variables remain significantly important; in fact the results for the SES variables become somewhat stronger, suggesting that outreach be based on both the SES characteristics and the personality traits.

The outline of the paper is as follows. In section 2 we present a brief review of the literature. In section 3 we describe the data and present basic statistics on the incidence of BN. We outline our methodology for studying BN incidence in section 4. In section 5 we present the results regarding the predictive role of socioeconomic status in the incidence and intensity of bulimic behaviors. These results are policy relevant as they provide insight into which girls are at the greatest risk for BN and thus guide the direction of future outreach. We conclude in section 6.

2 Literature Review and Background

In 2006 the Agency for Healthcare Research and Quality (Department of Health and Human Services, 2006) published a comprehensive review of papers on ED published in epidemiology since 1980. As the report notes, these studies are mainly focused on the effectiveness of different treatment programs. Within this literature, to our knowledge, there are only two papers that relate SES to bingeing or purging behaviors. Hudson et al. (2007) document the prevalence of various types of ED behaviors among women and men (in a univariate framework) using data from the National Comorbidity Survey Replication. Reagan and Hersch (2005) investigate the frequency of bingeing behavior (but not purging) using cross-sectional data from the Detroit metropolitan area. They find that there are no race or age effects on bingeing behavior (holding constant gender and obesity status), and that marital status, neighborhood, and income play a role among women. Unlike Reagan and Hersch (2005) we focus on BN (both binge eating and purging) and we have additional cross-section variables such as parent's education, as well as somewhat wider geographic variation. A related epidemiological study using the NHLBI Growth and Health survey is Striegel-Moore et al. (2000), who examine univariate correlations between BN and race and between BN and parental education. Their univariate results show that BN is higher among African Americans girls. Below we show that these racial differences remain when we also control for the education of the parent, family income and personality characteristics. However, we find a more subtle pattern when we interact income class and race: low and middle income African American girls, and low income White girls, are at substantially higher risk of BN behavior than girls from other race-income groups. Furthermore, we investigate whether the race-social class disparities in bulimic behavior are consistent across samples (girls who could be potentially at risk for EDs versus girls that have been diagnosed with EDs) to highlight how sample selection can lead to misleading picture about the SES groups that are more at risk. Finally, in other work on this topic (Goeree, Ham, and Iorio, 2011), we use the NHLBI data to examine whether bulimic behavior exhibits true state dependence and hence is consistent with addictive behaviors. In Goeree, Ham, and Iorio (2011), we find that unobserved heterogeneity plays a role in the persistence of BN, but strikingly up to two thirds of BN persistence is due to true state dependence. This suggests the timing of policy is crucial: preventative education should be coupled with (rehabilitation) treatment at the early stages of bingeing and purging behaviors. Given this need for early intervention, it is particularly important to know how the incidence varies across ethnic groups and income classes.

This paper is related to the growing literature of using economic identification strategies and appropriate econometric methods to investigate public health issues, (see, e.g., Adams, et al., 2003; Heckman, et al., 2007; and Currie and MacLeod, 2008) and the literature examining

disparities in health outcomes by income, race, and education (see e.g., Currie and Hyson, 1999; Khanam et al., 2009, Smith, 2007; Tenn et al., 2010, Thompson, 2011). A number of empirical papers also document differences in education and socioeconomic status for the prevalence of obesity (Cutler et al., 2003; Philipson and Posner, 2008; Kemptner et al., 2011). Our paper is related to this literature in the broad sense that it pertains to food consumption, but is otherwise unrelated given that women suffering from BN are characterized by average body weight (Department of Health and Human Services, 2006). Finally, recent studies demonstrate that poor child health and nutrition reduce both the time in school and the learning process during that time (Glewwe and Miguel 2008 and references therein).

3 Data

We use data from the NHLBI Growth and Health Study, which includes girls from schools in Richmond, California and in Cincinnati, Ohio, as well as from families enrolled in a health maintenance organization in the Washington, DC area.[6] The survey was conducted annually for ten years, and starting in 1990, when the girls were aged 11-12, the survey contains questions on BN behavior that were asked approximately every other year.[7] It also contains substantial demographic and socioeconomic information such as 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).

The NHLBI Growth and Health survey was constructed to have equal numbers of African Americans and Whites, and to have approximately equal representation across different income groups for African Americans and Whites (Kimm et al., 2002). Thus it is an exogenously stratified sample, which is particularly useful for examining the role that race and income play in the incidence and persistence of BN. For example, a nationally representative sample would have to be much larger than NHLBI Growth and Health survey to obtain equivalent numbers of high and middle income African Americans, or one the same size as NHLBI Growth and Health survey would have little power to examine the differences between races, let alone differences across income groups among African Americans.[8] Furthermore, if the equations we estimate

[6] Due to confidentiality concerns, the data do not indicate where an individual lives. Selection of potential schools was based on census tract data that showed approximately equal fractions of African American and White children, and the least disparity in income and education between the respondents of the two ethnic groups. The majority of the cohort, selected via the Health Maintenance Organization (HMO), was randomly drawn from a membership list of potentially eligible families with nine (or ten) year-old girls. A small percentage was recruited from a Girl Scout troop located in the same geographical area as the HMO population.

[7] The attrition rate after ten years was 11%.

[8] These sort of issues motivate the National Longitudinal Survey oversampling of African Americans (and

are constant across individuals, we will obtain consistent estimates of the national parameters (except for the constant).[9]

To the best of our knowledge the NHLBI Growth and Health survey has not been used previously in economics by other authors, so we now describe the data and variable construction in some detail. The data consist of ten waves of 2379 girls, where questions on BN behavior were asked in waves 3, 5, 7, 9, and 10. The questions were formulated to be consistent with diagnostic criteria for BN and were adjusted to be easy to understand for young respondents.[10]

The survey contains an Eating Disorders Inventory-BN scale for each respondent (hereafter the ED-BN index), which measures degrees of the symptoms associated with BN. The ED-BN index is constructed based on the subjects responses ("always"=1, "usually"=2, "often"=3, "sometimes"=4, "rarely"=5, and "never"=6) to seven items: 1) I eat when I am upset; 2) I stuff myself with food; 3) I have gone on eating binges where I felt that I could not stop; 4) I think about bingeing (overeating); 5) I eat moderately in front of others and stuff myself when they are gone; 6) I have the thought of trying to vomit in order to lose weight, and 7) I eat or drink in secrecy. A response of 4-6 on a given question contributes zero points to the ED-BN index; a response of 3 contributes 1 point; a response of 2 contributes 2 points; and a response of 1 contributes 3 points. The ED-BN index is the sum of the contributing points and ranges from 0 to 21 in our data. For instance, if a respondent answers "sometimes" to all questions, her ED-BN index will be zero.[11] Therefore, a higher ED-BN score is indicative of more intense BN behavior. The ED-BN scale is widely used in ED research (Rush et al., 2008). According to the panel of medical experts that 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. 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 NHLBI Growth and Health questionnaire: the average ED-BN index among this sample was 10.8.[12] Approximately 2.2% of the respondents scored higher than 10 in the NHLBI Growth and Health

Hispanics) and the Panel Study of Income Dynamics oversampling of low income families. See Chapter 7 of the BLS Handbook of Methods on the National Longitudinal Survey and Chapter 5 of the PSID User Guide.

[9] If coefficients differ across the nation in other ways, one could obtain nationally representative estimates by reweighting. Given our emphasis on the role of race and income, we have not used reweighted data.

[10] Clinical criteria for BN, according to the Diagnostic and Statistical Manual of Mental Disorders fourth edition (American Psychiatric Assocation, 2000), require the cycle of binge-eating and compensatory behaviors occur at least two times a week for three months or more and that the individual feel a lack of control during the eating episodes. Due to data restrictions, we cannot examine the prevalence of anorexia nervosa.

[11] Note that the answers to the individual questions are not available in the data.

[12] See Garner et al. (1983) for more details of the development and validation of the ED-BN index.

sample, which is close to the national average of clinical BN reported from other sources.[13] Based on these considerations, we will consider a respondent with a score of the ED-BN index greater than 10 as clinical bulimia for the remainder of the paper.

Table 1: Descriptive Statistics

	Mean	Standard Deviation	Clustered Standard Error of Mean	Number of Waves
ED-BN Index	1.279	2.682	0.039	3,5,7,9,10
Clinical Bulimia	0.0215	0.1452	0.002	3,5,7,9,10
Age	1.436	2.990.952	0.014	All 10
White	0.48	0.499	0.01	1
Parents High School or Less	0.255	0.436	0.009	1
Parents Some College	0.393	0.488	0.01	1
Parents Bachelor Degree or More	0.352	0.477	0.01	1
Income less than $20,000	0.318	0.466	0.01	1
Income in [$20000, $40000]	0.315	0.465	0.01	1
Income more than $40,000	0.367	0.482	0.01	1
Body Dissatisfaction Index*	8.039	7.554	0.131	3,5,7,9,10
Distrust Index**	3.589	3.492	0.056	3,5,9,10
Ineffectiveness Index***	2.752	3.915	0.063	3,5,9,10
Perfectionism Index****	6.468	3.290	0.052	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 for more detailed description of the variables.

Based on psychological criteria, a team of medical experts designed additional questions to construct four indices that measure a respondent's potential for personality traits/disorders (henceforth, "personality indices"), which are likely to be associated with BN.[14] The first index assesses how much the respondent is dissatisfied with the size and shape of specific parts of her body. Overall, it is a measure of body dissatisfaction. The remaining three personality indices assess tendencies toward: perfectionism (hereafter the perfectionism index), feelings of ineffectiveness (hereafter the ineffectiveness index), and interpersonal distrust (hereafter the distrust index). For all the personality indices, a higher score indicates a higher tendency of

[13] See for instance, Hudson et al. (2007) and National Eating Disorders Association (2008).

[14] See Garner et al., 1983 for a discussion of the association of these personality characteristics with EDs.

the personality trait that the index quantifies. For ease of exposition, we provide details on the questions used to form the personality indices in Appendix A.

We report variable means, standard deviations, and the standard errors for the mean values of the NHLBI Growth and Health sample in Table 1. For all demographic variables except age we have one observation per person, while for the other variables we have multiple observations per person; we adjust the standard errors of the mean to take this into account.[15] The mean of the ED-BN index is 1.2. The average age of the girls over the sample is approximately 14 years, and, as expected given the sample design, it is approximately equally distributed across race, income, and parent's education level.

Table 2: Mean of ED-BN Index and Incidence of Clinical Bulimia by Characteristics

Variable	ED-BN Index			Clinical Bulimia (BN)		
	Mean	Standard Deviation	Clustered Std. Error	Mean	Standard Deviation	Clustered Std. Error
1989	1.814	3.287	0.07	0.038	0.191	0.004
1991	1.61	3.021	0.067	0.033	0.178	0.004
1993	1.098	2.342	0.054	0.014	0.117	0.003
1995	0.86	2.054	0.046	0.008	0.092	0.002
1996	0.955	2.279	0.05	0.013	0.113	0.002
White	1.042	2.437	0.051	0.017	0.13	0.002
African American	1.498	2.873	0.058	0.026	0.158	0.003
Parents High School or Less	1.648	3.136	0.096	0.033	0.178	0.005
Parents Some College	1.325	2.682	0.06	0.02	0.141	0.003
Parents Bachelor Degree or More	0.973	2.278	0.055	0.015	0.122	0.002
Household Income (in 1988$):						
Income less than $20,000	1.721	3.146	0.086	0.033	0.179	0.004
Income in [$20000, $40000]	1.198	2.633	0.072	0.021	0.144	0.003
Income more than $40,000	0.982	2.245	0.053	0.013	0.112	0.002

Note: We cluster by individual and allow for heteroskedasticity in calculating the standard errors.

Table 2 illustrates the univariate relationship between the demographic variables, the ED-BN index, and BN incidence. For a given demographic group, we present the mean, standard deviation, and the standard error of the mean for the ED-BN index in columns (1)-(3), respectively. Columns (4)-(6) present the same statistics for the incidence of clinical BN. Again, in

[15] 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 interesting to have multiple observations is family income.

each case we cluster the standard errors (by individual) for the means. Simply aggregating the ED-BN index into an incidence of clinical BN would discard valuable information. Indeed our results presented in the next section show that coefficients are of the same sign when we analyze the ED-BN index and the incidence of clinical BN, but the former are much more precisely estimated. Note first that as the girls age, both the ED-BN index and BN incidence fall. Interestingly, African American girls have a statistically significant higher ED-BN index and incidence of clinical BN than White girls.

We emphasize that our univariate results are not due to an incorrect interpretation of what the ED-BN index measures, i.e., the possibility that it might capture obesity instead of bulimic behaviors. If the index was actually measuring obesity, we would expect that higher ED-BN scores would be associated with a higher body mass index (BMI). However, we find a low correlation between BMI and the ED-BN index of 0.05. Further, BMI is decreasing in ED-BN for African Americans. Moreover, among African Americans 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 (22.48 versus 24.72, respectively). Similarly for Whites, average BMI associated with an ED-BN index above 5 is lower than that associated with an index of 5 or lower (20.55 versus 22.14, respectively). These statistics strongly suggest that the ED-BN index is not an obesity index.

Both the ED-BN index and the incidence of clinical BN decrease as parental education and family income increase, and again these differences are statistically significant at standard confidence levels. These results suggest that BN is more problematic among African American girls, girls from low income families, and girls from families with low parental education. Thus they stand in sharp contrast to popular conceptions about the incidence of BN.

Table 3: Correlations of ED-BN Index and Clinical Bulimia with Personality Traits

Personality Trait Index	ED-BN Index	Clinical Bulimia (BN)
Body Dissatisfaction Index	0.221	0.114
Distrust Index	0.213	0.107
Ineffectiveness Index	0.439	0.274
Perfectionism Index	0.229	0.145

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

One possibility is that these univariate results will disappear once we condition on the other demographic variables, and that some will disappear once we condition on the personality indices. However, the results in the next section indicate that the differences for race and family income persist in a multivariate setting even after conditioning on the other demographic

variables and personality traits. In Table 3 we present the univariate correlations between each of the personality indices with both the ED-BN index and the incidence of clinical BN. In all cases these correlations are positive and statistically significant at the 1% level.

4 The SES-BN Gradient

We consider results from five model specifications: i) a linear regression structure that treats a zero value of the ED-BN index as lying on the regression line; ii) a Tobit structure for the ED-BN index; iii) a linear probability model (LPM) for the incidence of clinical BN (i.e., a value for the ED-BN index greater than 10); iv) a Probit model for the incidence of clinical BN; and v) an Ordered Probit model. It is important to note that the ED-BN index function is based solely on behavior and is not in any way based on diagnosis. This is an advantage if, as we argue below, certain groups are much more likely to seek medical attention for BN.[16]

We first use these models to examine the relationship between the ED-BN index and the SES. For example, in the linear regression model we regress the ED-BN index, y_{it}, on the time-constant SES variables, X_i (and interactions between them).[17] The medical literature indicates that personality traits may affect bulimic behavior, so to obtain consistent estimates of the SES effects we augment these models by including the personality indices, p_{it}, as explanatory variables. Specifically, we have

$$y_{it} = \beta_0 + \beta_1 X_i + \beta_2 p_{it} + \gamma_i + a_t + v_{it}, \tag{1}$$

where γ_i is an individual specific effect, a_t is a time dummy, and v_{it} is a contemporaneous shock for person i at time t. When γ_i is uncorrelated with the SES variables and personality indices, we can obtain consistent estimates of the SES effects. We cluster the standard errors by individual to control for correlation across time due to individual components, as well as the induced heteroskedasticity in the linear models. We do not treat the coefficients on the personality indices as causal; rather we investigate whether adding them affects the size and significance of the SES coefficients.

Note, however, that the personality traits may be correlated with γ_i if they are driven by time constant genetic factors, which may also affect BN, leading to bias in the coefficients for p_{it} and for X_i.[18] If we address this endogeneity using fixed effects regressions or first-differencing,

[16] We do not know whether the respondent has been diagnosed with, or is being treated for, clinical BN. See Section 5 for further discussion.

[17] For simplicity assume that we are using time dummies so that age is not a regressor.

[18] If the personality indices are independent of X_i there will not be any bias in the coefficients of the SES

the time-constant SES variables will be eliminated.[19] To allow for correlation of the personality traits with the unobserved effect while retaining the (exogenous) SES variables, we implement the approach of Hausman-Taylor (1981), within the context of the linear models. The Hausman-Taylor (1981) approach provides consistent and fully efficient estimates of all parameters under the random effects framework when the personality indices, but not the SES variables, are correlated with the individual specific effect.[20] Specifically, the Hausman-Taylor estimates are obtained by using the time-demeaned personality traits $(p_{it} - \bar{p}_i)$ and X_i as instruments in a 2SLS estimation of equation (1) where $\overline{p}_i$ is the mean of p_{it} for individual i. The 2SLS residuals are then used to obtain the variances of γ_i and v_{it}, which are used to compute the quasi-demeaned variables.[21] Finally, the parameters of the quasi-demeaned equation are estimated by 2SLS using the quasi-demeaned instruments.

Regarding the Tobit, we assume that the latent variable underlying the ED-BN index is

$$y_{it}^* = \varphi_0 + \varphi_1 X_i + \varphi_2 p_{it} + \omega_i + b_t + e_{it}, \tag{2}$$

where the change in notation is obvious. The observed value, y_{it}, of the ED-BN index is

$$y_{it} = \begin{cases} 0 \text{ if } y_{it}^* \leq 0 \\ \\ y_{it}^* \text{ otherwise.} \end{cases} \tag{3}$$

We assume that ω_i and e_{it} are i.i.d. (over time and individuals) as $N(0, \sigma_\omega^2)$ and $N(0, \sigma_e^2)$ and that they are (initially) independent of p_{it}. We estimate the model by forming a quasi-likelihood of the period by period observations and cluster the standard errors by individual.[22]

We compare the regression coefficients to the Tobit partial effects, and find (as expected) that they are very similar. Next we allow p_{it} and ω_i to be correlated using the correlated random effects approach of Chamberlain (1984)/Wooldridge (2005). We obtain very similar results, which we present in Appendix B for expositional ease.

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variables, but in this case there is no need to control for the personality characteristics.

[19] We present estimates of the parameters of first-differenced equation (1) in Appendix B. The results we obtained are similar to those from the level estimates (in terms of the magnitude and significance of the coefficients on the personality indices).

[20] See Wooldridge (2002, pp 325-328). We assume v_{is} (for all time periods s) is independent of p_{it} and X_i.

[21] For example, y_{it} becomes $y_{it} - \lambda \bar{y}_i$ where the expression for λ depends on these variances and is given in equation (10.77) in Wooldridge (2002, p. 287).

[22] We cannot allow for heteroskedasticity when clustering, since Tobit estimates are inconsistent unless errors are homoskedastic. We also estimated random effects Tobit models, which offer efficiency gains at the cost of assuming that the error structure is covariance stationary and that the correlation coefficient is the same across individuals. The results were very similar to the ones reported in the paper.

We also consider an Ordered Probit model based on ED-BN index categories equal to 0; $1-5$; $6-10$ and greater than 10, which is more flexible than the Tobit (due to estimated limit points). However, the coefficients are not directly comparable as we must normalize the variance, but the coefficients should be of the same sign and approximate significance. This is indeed what we find; the results are in Appendix B. Finally, we estimate Probit and LPM specifications as robustness checks on the regression and Tobit results. The signs should be similar to the models discussed above, but we expect the parameters to be less precisely estimated since these models use much less information.[23]

5 Estimation Results

In Table 4 we present the estimates from a number of estimators where we include socioeconomic variables; in the lower panel we also include year dummies. For the Tobit and Probit models we report partial effects. The vector X_i contains the respondent's age, a dummy variable for White, two dummy variables for parent's education (some college and four year college degree or more) and two dummy variables for initial family income (between \$20,000 and \$40,000 and over \$40,000 in \$1988). Thus the base case is an African American girl whose parents' have a high school education or less, with a family income under \$20,000. The coefficients for the linear model and the partial effects for the Tobit model are very similar in terms of size and significance, so we discuss only the former. They show that the effect of being White, holding the other variables constant, is significantly negative. In terms of magnitude, being White lowers the ED-BN index by 0.24, which is about a 20% reduction relative to the mean value (of 1.2), holding all else equal (in what follows we do not repeat the latter qualification). Further, the ED-BN index is significantly decreasing in age; each additional year of aging decreases the ED-BN index by about 11% of its mean value.[24] Perhaps equally surprising as the results for African Americans, the index is also significantly decreasing in family income; being middle income lowers the index by about 0.38 (a 32% reduction relative to the mean) as compared to the lowest income group, while being in the highest income group lowers the index by about 0.49 (more than a 40% reduction relative to the mean) as compared to the lowest family income. Having the highest parental education significantly lowers the index by 0.31 (a 26% reduction of the mean value) as compared to those with the lowest parental education, while having parents with some college education lowers the ED-BN index by a (significant) 0.20. When we include

[23] We also allow for correlated random-effects; see Appendix B for further details regarding the specification.

[24] We also estimated a specification that included quadratic effects in age. The estimates imply that going from age 12 to 14 (14 to 16) decreases the ED-BN index by 0.20 (0.15).

year dummies (the lower panel of Table 4), only the coefficients for age are affected, and these coefficients are now estimated imprecisely. This latter result is not surprising since there is not much age variation at the start of the sample, so the girls tend to act like a single cohort.

Table 4: The (Partial) Effects of Demographic Variables on BN

	ED-BN Index		Clinical Bulimia	
	Linear Model	Tobit	Probit	Linear Probability
White	-0.243***	-0.220***	-0.003	-0.004
	(0.088)	(0.078)	(0.004)	(0.004)
Age	-0.132***	-0.104***	-0.004***	-0.004***
	(0.011)	(0.009)	(0.001)	(0.001)
Parents Some College	-0.198*	-0.104	-0.006*	-0.010*
	(0.113)	(0.090)	(0.003)	(0.005)
Parents Bachelor Degree	-0.313***	-0.225**	-0.005	-0.008
or More	(0.116)	(0.100)	(0.004)	(0.005)
Income in [$20000, $40000]	-0.377***	-0.324***	-0.005	-0.009*
	(0.112)	(0.087)	(0.003)	(0.005)
Income more than $40,000	-0.488***	-0.405***	-0.013***	-0.016***
	(0.107)	(0.091)	(0.004)	(0.005)
Year Dummies Included				
White	-0.227***	-0.205***	-0.003	-0.004
	(0.088)	(0.078)	(0.003)	(0.004)
Age	0.010	0.040	-0.004	-0.005*
	(0.060)	(0.057)	(0.002)	(0.003)
Parents Some College	-0.193*	-0.101	-0.006*	-0.009*
	(0.113)	(0.090)	(0.003)	(0.005)
Parents Bachelor Degree	-0.299***	-0.211**	-0.005	-0.008
or More	(0.116)	(0.100)	(0.004)	(0.005)
Income in [$20000, $40000]	-0.384***	-0.330***	-0.005	-0.009
	(0.112)	(0.086)	0.003	(0.005)
Income more than $40,000	-0.500***	-0.416***	-0.013***	-0.016***
	(0.106)	(0.090)	(0.004)	(0.005)
Sample Size	9591	9591	9591	9591

Notes: Standard errors robust to both heteroskedasticity and intra-individual correlation are in parenthesis in columns (1) and (4). Standard errors robust to intra-individual correlation are in parenthesis in (2) and (3). * indicates significant at the 10% level; ** at the 5% level; *** at the 1% level.

Finally, the Probit partial effects and LPM coefficients in columns (3) and (4) respectively, have similar signs as the linear model and Tobit coefficients, but as expected, are much less

likely to be statistically significant. The linear and Tobit results for race, income and education are substantial, statistically significant, and present a challenge to the widespread perception that BN primarily affects privileged, White teenagers. Further, these findings remain even after we condition on personality traits, as we will show below. For completeness, we report the estimated coefficients from the Ordered Probit in Appendix B. Table B1 shows the results are very similar to those from the linear and Tobit models. Thus our results consistently suggest that there should be great outreach to low income and African American girls.

In a nutshell, our findings challenge the belief that BN primarily affects affluent White teenagers, and an interesting question is why does this divergence between our results and popular conceptions occur? We believe one potential explanation is that popular opinion appears to be based on who has been diagnosed with an eating disorder, and not the potentially different group of those who exhibit bulimic behaviors. To investigate this explanation we use data from the National Longitudinal Study of Adolescent Health (ADD Health) survey, which contains information on who is diagnosed with an ED, whereas the NHLBI Growth and Health study does not contain information on ED diagnosis.[25]

Table 5: Probit Partial Effects

	NHLBI	ADD Health
	Clinical Bulimia (ED-BN Index>10)	Diagnosed with ED
White	-0.003	0.025***
	(0.004)	(0.004)
Age	-0.004***	-0.0004
	(0.001)	(0.001)
Parents Some College	-0.006*	0.003
	(0.003)	(0.008)
Parents Bachelor Degree or More	-0.005	0.013***
	(0.004)	(0.005)
Income in [$20000, $40000]	-0.005	0.011
	(0.003)	(0.021)
Income more than $40,000	-0.013***	0.022***
	(0.004)	(0.007)

Notes: Standard errors robust to intra-individual correlation are in parenthesis. * indicates significant at the 10% level;** at the 5% level; *** at the 1% level. The ADD Health does not contain an ED-BN Index. It asks if the individual has been diagnosed with an ED. For this reason we can only make a comparision with the Probit results presented in Table 4. We present results using regressors constructed to be consistent across both data sets.

[25] See Appendix A for details on the ADD Health dataset and variables used in this study.

Probit partial effects using ADD Health are presented in the second column of Table 5. To ease comparison, the first column repeats Probit partial effects for clinical BN (i.e., ED-BN Index > 10) using the NHLBI Growth and Health, which are reported in column (3) of Table 4.[26] Strikingly, the estimated SES gradients are of opposite signs in Columns (1) and (2). Our estimates reveal that high-income, White teenagers are more likely to be diagnosed with an ED. Approximately 3.3% of the girls in the ADD health data have been diagnosed with an ED. However, White girls are 2.5% more likely to be diagnosed with an ED than African Americans (that is, they have on average a 75% higher chance of being diagnosed). Girls living in households where at least one parent had a college degree (or higher) increases on average the probability of being diagnosed with an ED by 40% (as compared to households where parents are at most High School graduates); and girls from families in the highest income bracket are on average 66% more likely to be diagnosed with an ED. In other words, a White girl of average age from a high income household where at least one parent has a college degree is almost twice as likely to be diagnosed with an ED (5.9%) relative to a girl with the mean values of the explanatory variables. In contrast, only 0.7% of African American girls of average age from low-income households whose parents have no college education have been diagnosed with an ED. Hence, a girl in the former SES group is 8 times more likely to be diagnosed with BN than a girl in the latter group, and these findings for ED diagnosis seem to be consistent with popular opinion. Thus, the difference in results for bulimic behaviors relative to diagnosis appears to arise, at least in part, because girls who are African American and/or come from low income families are much less likely to be diagnosed with an ED conditional on having an ED. These results illustrate the importance of having objective information on behavior rather than only data on diagnoses.[27] They also have the strong policy implication that outreach should be made to low income and African American girls.

Note that the estimated coefficients for racial/income differences in bulimic behavior may reflect both different propensity to engage in bulimic behavior across socioeconomic groups, as well as racial/income differences in treatment; one might expect that girls from White and/or high income families are more likely to receive treatment that mitigates bulimic behavior over time. Our data allow us to shed some light on this issue. Recall that the survey starts when girls are younger than the average onset age for BN (e.g., 11-12 years old in wave 3), hence, it

[26] Given that the ADD Health survey does not contain an ED-BN Index we can only make a comparision with the Probit results presented in the main paper. We present results using regressors constructed to be consistent across both data sets.

[27] We believe self-reported information can be considered objective in the sense that girls are not asked if they have an ED but rather are asked a series of questions about their behavior. Any diagnosis of BN, or any disease with a behavioral component, is based on more detailed versions of these questions. In other words, we are using a limited version of the information a physician would use to determine whether to make a diagnosis.

is likely that those exhibiting bulimic behavior just started and have not yet been diagnosed or treated. Thus if we use only data from wave 3, the ED-BN index should mainly reflect only differences in the propensity of engaging in BN, and not the potential racial/income differences in treatment. When we estimate the static model in column (1) of Table 4 using data from wave 3, we find that the difference in incidence between Whites and African Americans is even higher (and still statistically significant) than what we obtained by pooling all waves. Being White now lowers the ED-BN index by 0.65. Similarly, as compared to the lowest income group, being middle (high) income lowers the index by about 0.42 (0.48), and these differences also are statistically significant.[28] Overall, these findings suggest that there are remarkable racial/income differences in the propensity towards engaging in bulimic behavior. However, it is important to note that irrespective of how one interprets our results, the implication is that there is a large untreated group (e.g., African Americans and girls from low-income families) at whom outreach should be aimed.

Table 6 contains the results for the linear and Tobit models where personality indices are included as explanatory variables and the year dummies are dropped.[29] Recall that we do this to examine the sensitivity of our SES results to their inclusion as opposed to trying to estimate causal effects of the indices. We discuss the results when personality traits are allowed to be correlated with the individual effect in Table 7. We begin by estimating the linear model in levels and column (1) presents results with the distrust, ineffectiveness and perfectionism indices (but not the body dissatisfaction index) used as explanatory variables, while in column (2) we also include the body dissatisfaction index.[30] Note first that race, age and family income, but not parental education, are still statistically significant when we condition on personality indices (independent of which ones we condition on), although the size of the income differentials, but not the race differential, is reduced. Second, the ineffectiveness, perfectionism and body dissatisfaction indices, but not the distrust index, are significantly associated with the ED-BN index in the direction expected. Since the personality indices and the ED-BN are (almost) continuous variables, it is perhaps most illuminating to consider elasticities measured at mean values from Table 1. Using the estimates in column (2), we find large elasticities of the ED-BN index with respect to the ineffectiveness, perfectionism, and body dissatisfaction indices, which are 0.56, 0.68, and 0.25, respectively. Alternatively, a (separate) five point increase in the ineffectiveness index and perfectionism index each increase the ED-BN index by about 1.3 and

[28] For ease of exposition we do not report these additional estimates in Table 4.

[29] Adding time dummies again only affects the age coefficient.

[30] We present results with and without the body dissatisfaction index as a regressor, since body dissatisfaction is more likely to be affected by BN behavior.

0.7 respectively, while a (separate) five point increase in the body dissatisfaction index increases the ED-BN index by about 0.2. Note that each of these estimated coefficients is substantial when compared to the mean ED-BN index of 1.2.

Table 6: Demographic Variables, Personality Indices and the ED-BN Index

	Linear Model				Tobit Partial Effect		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
White	-0.178**	-0.238***			-0.248***		
	(0.090)	(0.088)			(0.073)		
Age	-0.068***	-0.087***	-0.088***	-0.088***	-0.075***	-0.075***	-0.062***
	(0.012)	(0.013)	(0.013)	(0.012)	(0.010)	(0.010)	(0.008)
Parents Some College	-0.086	-0.083	-0.081		-0.019	-0.019	
	(0.110)	(0.110)	(0.110)		(0.085)	(0.085)	
Parents Bachelor Degree	-0.162	-0.143	-0.158		-0.105	-0.117	
or More	(0.119)	(0.119)	(0.119)		(0.098)	(0.099)	
Income in [$20000, $40000]	-0.219*	-0.232**		-0.226**	-0.242***		-0.159**
	(0.112)	(0.112)		(0.112)	(0.083)		(0.072)
Income more than $40,000	-0.233**	-0.253**		-0.252**	-0.235***		-0.164**
	(0.109)	(0.109)		(0.109)	(0.089)		(0.073)
White & Income less than $20000			-0.335*			-0.276*	
			(0.196)			(0.117)	
White & Income in [$20000, $40000]			-0.584***			-0.514***	
			(0.133)			(0.087)	
White & Income more than $40000			-0.433***			-0.406***	
			(0.134)			(0.095)	
Black & Income in [$20000, $40000]			-0.163			-0.182*	
			(0.147)			(0.100)	
Black & Income more than $40000			-0.414***			-0.324***	
			(0.136)			(0.097)	
White & High School Graduate				-0.308			-0.221**
				(0.194)			(0.116)
White & Some College				-0.366**			-0.260***
				(0.150)			(0.094)
White & Bachelor Degree or More				-0.383***			-0.279***
				(0.146)			(0.093)
Black & Some College				-0.098			-0.069
				(0.144)			(0.094)
Black & Bachelor Degree or More				-0.221			-0.159
				(0.172)			(0.110)
Distrust Index	0.010	0.008	0.007	0.008	0.020**	0.020**	0.005
	(0.013)	(0.013)	(0.013)	(0.013)	(0.009)	(0.009)	(0.008)
Ineffectiveness Index	0.287***	0.260***	0.260***	0.260***	0.150***	0.150***	0.169***
	(0.018)	(0.018)	(0.018)	(0.018)	(0.009)	(0.009)	(0.011)
Perfectionism Index	0.136***	0.134***	0.134***	0.134***	0.093***	0.093***	0.088***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.009)	(0.009)	(0.008)
Body Dissatisfaction Index		0.040***	0.040***	0.040***	0.044***	0.044***	0.027***
		(0.006)	(0.006)	(0.006)	(0.004)	(0.004)	(0.004)
Constant	1.063***	1.179***	1.215***	1.202***			
	(0.243)	(0.241)	(0.248)	(0.251)			
Sample Size	6308	6291	6291	6291	6308	6291	6291

Notes: Standard errors robust intra-individual correlation (and robust to heteroskedasticity for linear regressions) are in parentheis. * indicates significant at the 10% level; ** at 5%; *** at 1%. The variation in the sample size comes primarily from the fact that all personality indices but the body dissatisfaction index are not available in wave 7.

Column (5) contains the Tobit partial effects we include the personality traits as explanatory variables. The results are close to those from the linear model. Each of the SES variables continue to be strongly related to BN behavior when we condition on personality indices.[31]

In column (3) we use race-income interactions while controlling for all personality indices and education in the linear model; the corresponding estimates for the Tobit model is in column (6). Here the base case is African Americans from the lowest income households. The coefficients indicate low and middle income African Americans have the strongest tendency towards bulimic behavior. Specifically, among African Americans, girls from high income households score an average of 34 percentage points lower on the ED-BN index than girls from low income families. (All percentages are relative to the ED-BN mean.) However, among Whites, low income girls have a substantially higher propensity toward BN than both middle and high income girls. Further, middle (high) income Whites present an ED-BN index that is 49% (36%) lower than low income African Americans. Finally, among the lowest income White households, the ED-BN index drops by about 25% if one moves from the lowest income family to a middle income family (that is, a 25% decrease relative to the mean ED-BN index).

In columns (4) and (7) we report the linear and Tobit estimates with race-education interactions conditional on family income and all personality indices. The base case is African Americans from the lowest educated families. While all whites have significantly lower ED-BN indices than all African Americans, and the disparity slightly increases with parental education, within the Whites parental education does not play a remarkable role. Finally, family income still plays a significant role.

Table 7 presents the Hausman-Taylor estimates, which allows for the possibility that the personality indices are not independent of the individual effect. We estimate three specifications and report estimates and standard errors in Table 7. Specification 1 concerns the case when there are no interactions between the SES variables. Note that the coefficients on the race and income variables become larger and more significant, relative to those in Table 6, and continue to indicate that ED-BN behavior is significantly higher for African American and low income girls. In terms of magnitude, being White lowers the ED-BN index by 0.30, which is about a 25% reduction relative to the mean value (of 1.2). The index is also significantly decreasing in family income; being middle income lowers the index on average by about 25% as compared to the lowest income group, while being in the highest income group results on average in a reduction of 28% as compared to the lowest family income. Further, the personality indices continue to be statistically significant, indicating that the coefficients reported in Table 6 do

[31] For a discussion of why personality traits can be considered exogenous with respect to unobserved individual-specific heterogeneity see the discussion in Appendix B.

not simply arise from a correlation between them and the individual effect.

Table 7: Hausman-Taylor Estimates of ED-BN Index

	Specification 1		Specification 2		Specification 3	
	Estimate	Std. Err.	Estimate	Std. Err.	Estimate	Std. Err.
White	-0.304 ***	(0.093)				
Age	-0.114 ***	(0.011)	-0.115 ***	(0.011)	-0.114 ***	(0.011)
Parent's Education and Interactions						
Some College	-0.121	(0.109)	-0.120	(0.109)		
Bachelor Degree or More	-0.198	(0.126)	-0.214 *	(0.126)		
White & High School Graduate					-0.358 **	(0.177)
White & Some College					-0.462 ***	(0.162)
White & Bachelor Degree or More					-0.502 ***	(0.158)
Black & Some College					-0.134	(0.137)
Black & Bachelor Degree or More					-0.264	(0.173)
Income and Interactions						
Income in [$20000, $40000]	-0.295 ***	(0.111)			-0.290 ***	(0.111)
Income more than $40,000	-0.340 ***	(0.121)			-0.339 ***	(0.121)
White & Income less than $20000			-0.405 **	(0.175)		
White & Income in [$20000, $40000]			-0.712 ***	(0.143)		
White & Income more than $40000			-0.579 ***	(0.140)		
Black & Income in [$20000, $40000]			-0.224	(0.137)		
Black & Income more than $40000			-0.512 ***	(0.152)		
Time Varying Endogenous Variables						
Distrust Index	-0.036 ***	(0.013)	-0.036 ***	(0.013)	-0.036 ***	(0.013)
Ineffectiveness Index	0.212 ***	(0.012)	0.212 ***	(0.012)	0.212 ***	(0.012)
Perfectionism Index	0.133 ***	(0.012)	0.133 ***	(0.012)	0.133 ***	(0.012)
Body Dissatisfaction Index	0.044 ***	(0.007)	0.044 ***	(0.007)	0.044 ***	(0.007)
Constant	1.976 ***	(0.221)	2.002 ***	(0.224)	1.995 ***	(0.220)
Sample Size	6291		6291		6291	

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

Notice that our results also show that the personality traits have a significant effect on BN after controlling for SES variables. Hence, if one takes the results for the personality indices as causal, then they shed light on the potential effectiveness of preventive programs that improve self-esteem, body satisfaction, or other related personality traits, in combating BN. In specification 2 we present the coefficients for interactions between family income and race, conditional on the level of education. Once again we see that lower and middle income African American girls, and lower income White girls continue to experience higher ED-BN behavior. Furthermore, the ED-BN index drops on average by about 18% when girls are from households with college-educated parents relative to households with education less or equal

to high school degree (although this is significant only at the 10% level). Finally, specification 3 presents coefficients for the interactions between education and race, conditional on income. These results indicate that the ED-BN index is significantly decreasing for White girls as the education level of the parents increases, and is significantly lower than African-American girls.

In sum, our empirical findings reveal strong disparities in the bulimic patterns across SES groups. Our results are robust to different identifying assumptions and estimation methods (including both linear and non linear models).

6 Conclusions

Surprisingly little is known about the (multivariate) factors determining the incidence of BN, and we fill this gap in the literature. We find that race, income, and parental education attainment play crucial roles: African Americans are more likely to exhibit bulimic behavior. In addition, the incidence of BN is decreasing in income and in parental education. These results stand in stark contrast to the popular conceptions about who suffers from BN. We present evidence showing that popular conception is based on who is diagnosed with an ED rather than who exhibits bulimic behavior. Thus a primary reason for the disparity between diagnosis and behavior occurs because high-income White teenage girls with highly educated parents are more likely to be diagnosed with an ED conditional on having it.

Our paper suggests that when a diagnosis is based on an underlying index, using all the information contained in the index, in addition to the zero-one diagnosis, can be very helpful to obtain precise parameter estimates. Using information on the index itself, rather than only information on the incidence of BN, dramatically increases the precision of our results but does not change the coefficients qualitatively. However, given that the index is based on questions concerning both bingeing and purging behaviors, there is the danger that the index mainly captures overeating behavior. This concern is eliminated by noting that there is essentially no correlation between the ED-BN index and BMI, where the latter is commonly used to measure the degree of obesity.

Our findings show the usefulness of using appropriate econometric techniques for investigating public health issues from survey data and are robust to different estimation methods and identifying assumptions. Our results have important policy implications; specifically, they indicate substantial outreach should be directed to low income girls, girls from low-education households, and especially to African Americans.

Appendix

A Data Variable Definitions

A.1 The NHLBI Growth and Health Dataset

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: 1) I think that my stomach is too big, 2) I think that my thighs are too large, 3) I think that my stomach is just the right size, 4) I feel satisfied with the shape of my body, 5) I like the shape of my buttocks, 6) I think my hips are too big, 7) I think that my thighs are just the right size, 8) I think that my buttocks are too large, 9) 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.[32]

The perfectionism index is based on subject responses to six items: 1) In my family everyone has to do things like a superstar; 2) I try very hard to do what my parents and teachers want; 3) I hate being less than best at things; 4) My parents expect me to be the best; 5) I have to do things perfectly or not to do them at all; 6) I want to do very well. The subjects are offered the same responses, and the responses are scored in the same way as the ED-BN index.

The distrust index is based on subject responses to seven items: 1) I tell people about my feelings; 2) I trust people; 3) I can talk to other people easily; 4) I have close friends; 5) I have trouble telling other people how I feel; 6) I don't want people to get to know me very well; and 7) 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, 2, 3, 4, and 7. A response of 4-6 on a given question contributes zero points to the distrust index; a response of 3 contributes 1 point; a response of 2 contributes 2 points; and a response of 1 contributes 3 points. The distrust index is a sum of all contributing points.

The ineffectiveness index is based on subject responses to ten items: 1) I feel I can't do things very well; 2) I feel very alone; 3) I feel I can't handle things in my life; 4) I wish I were someone else; 5) I don't think I am as good as other kids; 6) I feel good about myself; 7) I don't like myself very much; 8) I feel I can do whatever I try to do; 9) I feel I am a good person; 10) I feel empty inside. The scoring rule is as follows: "always"=1, "usually"=2, "often"=3,

[32] The scoring rule is as follows: "always"=6, "usually"=5, "often"=4, "sometimes"=3, "rarely"=2, and "never"=1 in questions 3, 4, 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 1 point; a response of 2 contributes 2 points; and a response of 1 contributes 3 points. The body image index is the sum of the contributing points.

"sometimes"=4, "rarely"=5, and "never"=6 in questions 1,2,3,4,5,7, 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 1 point; a response of 2 contributes 2 points; and a response of 1 contributes 3 points. The ineffectiveness index is a sum of all contributing points.

Table A1 provides more details on the variables used in the paper.

Table A.1: Variable Definitions

Variable	Description	Coding	Waves
ED-BN Index	Eating Disorders Bulimia Subscale	Categorical Variable; Range 0-21	3,5,7,9,10
Clinical Bulimia	Case of Clinical Bulimia	=1 if ED-BN Index >10; =0 Otherwise	3,5,7,9,10
Body Dissatisfaction Index	Measures Poor Body Image Concerns	Categorical Variable; Range 0-27	3,5,7,9,10
Perfectionism Index	Measures Driveness for Perfection	Categorical Variable; Range 0-18	3,5,9,10
Ineffectiveness Index	Measures Feelings of Ineffectiveness	Categorical Variable; Range 0-29	3,5,9,10
Distrust Index	Measures Interpersonal Distrust	Categorical Variable; Range 0-21	3,5,9,10
Age	Respondent Age		All 10
White	Respondent Race is White	=1 if Race is White; =0 if African American	1
Parents High School or Less	Highest Education of Parents	Dummy Variable Highest Education High School or Less	1
Parents Some College	Highest Education of Parents	Dummy Variable Highest Education Some College	1
Parents Bachelor Degree or More	Highest Education of Parents	Dummy Variable Highest Education College Degree or More	1
Income less than $20,000	Household income (in 1988$)	Dummy Variable Household Income is Less than $20,000	1
Income in [$20000, $40000]	Household income (in 1988$)	Dummy Variable Household Income is in Range [$20,000,$40,000]	1
Income more than $40,000	Household income (in 1988$)	Dummy Variable Household Income is Higher than $40,000	1

A.2 The ADD Health Dataset

The ADD Health data is a longitudinal data set that examines health-related behaviors of adolescents who were in grades 7 through 12 in 1995. It is a school-based, stratified, random sample of all high schools in the U.S. in 1995.[33] It consists of three waves (1995, 1996, and 2002) with sample sizes of about 90,000, 15,000 and 15,000 respectively. The data were collected from students, parents, siblings, fellow student peers, and school administrators. The data include social and demographic characteristics of respondents, education and occupation of parents, household income, household structure, indicators of self-esteem, health status, nutrition, and self-reported bingeing and purging behaviors. In 2002 they ask whether the respondent has been diagnosed with an ED. Information about parental income and education were collected in 1995, and variables on family income and parental education have been constructed to match the ones in the NHLBI Growth and Health Dataset.

[33] A school was eligible if it included an 11th grade and had a minimum enrollment of 30 students. Feeder schools, those that sent graduates to the high school and that included a 7th grade, were also included.

B Additional Specifications

B.1 Ordered Probit

In estimating the Tobit and linear regression models in section 4, we treat the sum of the answers to the ED-BN index questions as a quantitative variable for which the difference between the values of 2 and 3, say, is the same as the difference between the values of 7 and 8, say. Alternatively, we could consider a model where the ED-BN index takes on 21 ordinal values determined by

$$y_{it} = \begin{cases} 0 \text{ if } y_{it}^* \leq 0 \\ 1 \text{ if } 0 < y_{it}^* \leq \alpha_1 \\ k \text{ if } \alpha_{k-1} < y_{it}^* \leq \alpha_k \qquad k = 2, ., 20 \\ 21 \text{ if } \alpha_{20} < y_{it}^*. \end{cases} \tag{B1}$$

While (B1) is very flexible, it also involves estimating 20 α parameters, in addition to the parameters in equation (1) in the main text, which we think would be too many to identify using our data. Instead we estimate an Ordered Probit model (with estimated limit points) as an informal specification test of the Tobit model. In the Ordered Probit model the dependent variable takes the form: $z_{it} = 0$ if the ED-BN index equals 0, $z_{it} = 1$ if the index is in $[1, 5]$, $z_{it} = 2$ if the index is in $[6, 10]$, and $z_{it} = 3$ if the index is greater than 10. Our statistical model is

$$z_{it}^* = \delta_0 + \delta_1 X_i + \widetilde{b}_t + e_{it}, \tag{B2}$$

where

$$z_{it} = \begin{cases} 0 \text{ if } z_{it}^* \leq 0 \\ 1 \text{ if } 0 < z_{it}^* \leq \theta_{L2} \\ 2 \text{ if } \theta_{L2} < z_{it}^* \leq \theta_{U2} \\ 3 \text{ if } z_{it}^* > \theta_{U2}. \end{cases} \tag{B3}$$

In this approach we estimate the parameters in (B2) and the two θ cutoff terms by maximizing the quasi-likelihood based on the period-by-period likelihood function and cluster the standard errors by individual. In Table B1 we compare the sign and significance of the Tobit and Ordered Probit estimates; the coefficients are not directly comparable because the variance must be normalized to 1 for the Ordered Probit model with estimated limit points. The

Ordered Probit estimated coefficients are very similar in significance and sign to those from the Tobit coefficients, but as one would expect the Tobit coefficients are significant at higher confidence levels (since they are based on less-aggregated data).

Table B1: Comparison of Coefficients from Linear, Tobit and Ordered Probit Models

	ED-BN Index		
	Linear Model	Tobit	Ordered Probit
White	-0.243***	-0.676***	-0.108***
	(0.088)	(0.240)	(0.041)
Age	-0.132***	-0.318***	-0.051***
	(0.011)	(0.029)	(0.005)
Parents Some College	-0.198*	-0.321	-0.042
	(0.113)	(0.280)	(0.047)
Parents Bachelor Degree	-0.313***	-0.703**	-0.100*
or More	(0.116)	(0.316)	(0.053)
Income in [$20000, $40000]	-0.377***	-1.029***	-0.174***
	(0.112)	(0.287)	(0.048)
Income more than $40,000	-0.488***	-1.278***	-0.209***
	(0.107)	(0.295)	(0.050)
Constant	3.975***	3.871***	
	(0.227)	(0.518)	
Year Dummies Included			
White	-0.227***	-0.629***	-0.100**
	(0.088)	(0.240)	(0.041)
Age	0.010	0.122	0.024
	(0.060)	(0.174)	(0.030)
Parents Some College	-0.193*	-0.311	-0.040
	(0.113)	(0.279)	(0.047)
Parents Bachelor Degree	-0.299***	-0.657**	-0.093*
or More	(0.116)	(0.316)	(0.053)
Income in [$20000, $40000]	-0.384***	-1.050***	-0.178***
	(0.112)	(0.286)	(0.048)
Income more than $40,000	-0.500***	-1.314***	-0.216***
	(0.106)	(0.294)	(0.050)
Constant	1.362	-4.348	
	(1.169)	(3.355)	
Sample Size	9591	9591	9591

Notes: Standard errors robust to heteroskedasticity and intra-individual correlation are in parenthesis in column (1). Standard errors robust to intra-individual correlation are in parenthesis in (2) and (3). * indicates significant at the 10% level; ** at 5%; *** at 1%.

B.2 Clinical Bulimia LPM and Pobit Estimates

For the LPM the dependent variable is $w_{it} = 0$ if the ED-BN index is less than or equal to 10 and $w_{it} = 1$ otherwise; we cluster the standard errors to allow for heteroskedasticity and correlation across time for a given individual. We estimate a Probit model by maximizing the quasi-likelihood and clustering the standard errors by individuals. The Probit partial effects and LPM results are given in Table B2 and are relatively similar to each other. They also have the same signs as the Tobit results. However fewer estimated coefficients are statistically significant in the Probit and LPM, and those that are significant occur at lower confidence levels. The fact that we have substantially fewer significant coefficients in the Probit and LPM estimates is again expected, since they use much less information per person than the other methods. Indeed, our estimates illustrate the importance of not simply focusing on whether an individual has a clinical case of BN for understanding the determinants of this disorder.

Table B2 reports the estimate of the SES-Clinical BN gradient when we also control for personality traits in the LPM and Probit models. To allow for fixed effects in the LPM we report the result of first differencing in column (3), while in column (6) we use the Chamberlain (1984)/Wooldridge (2005) (hereafter C/W) correlated random effects model to control for individual effects that are correlated with the personality indices in the Probit model.[34]

[34] To control for the fixed effect, Chamberlain (1984) suggests making it a linear function of all values of the explanatory variables, while Wooldridge (2005) suggests making it the mean of the independent variables. We follow Wooldridge since it makes our estimates more comparable to the Hausman-Taylor regression estimates.

Table B.2: Partial Effects of Demographic Variables and Personality Indices on Clinical Bulimia

	Linear Probability Estimates				Probit Estimates		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
White	-0.004	-0.005			-0.0054*	-0.0065**	
	(0.005)	(0.005)			(0.0030)	(0.0027)	
Age	-0.002***	-0.003***			-0.0016***	-0.0019***	
	(0.001)	(0.001)			(0.0005)	(0.0004)	
Parents Some College	-0.005	-0.005			-0.0030	-0.0029	
	(0.006)	(0.006)			(0.0028)	(0.0026)	
Parents Bachelor Degree	-0.001	-0.000			-0.0010	-0.0009	
or More	(0.007)	(0.007)			(0.0035)	(0.0033)	
Income in [$20000, $40000]	-0.001	-0.001			-0.0001	-0.0004	
	(0.006)	(0.006)			(0.0031)	(0.0029)	
Income more than $40,000	-0.008	-0.008			-0.0046	-0.0047	
	(0.006)	(0.006)			(0.0032)	(0.0030)	
Distrust Index	-0.001	-0.001	-0.002*	-0.002**	-0.0000	-0.0000	-0.0003
	(0.001)	(0.001)	(0.001)	(0.001)	(0.0003)	(0.0003)	(0.0002)
Ineffectiveness Index	0.010***	0.010***	0.009***	0.008***	0.0028***	0.0023***	0.0008***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.0003)	(0.0003)	(0.0002)
Perfectionism Index	0.005***	0.005***	0.005***	0.004***	0.002***	0.0018***	0.0007***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.0003)	(0.0003)	(0.0002)
Body Dissatisfaction Index		0.001**	0.002*	0.001***		0.0006***	0.0003***
		(0.000)	(0.001)	(0.000)		(0.0001)	(0.0001)
Constant	0.008	0.011	-0.002	0.006			
	(0.014)	(0.014)	(0.004)	(0.014)			
First Difference	No	No	Yes	No	NA	NA	NA
Chamberlain/Wooldridge Fixed Effects	No	No	No	Yes	No	No	Yes
Sample size	6308	6291	2624	6291	6308	6291	6291

See notes in Table 6.

B.3 Correlated Random Effects Tobit Estimates

We allow for the fact that in the Tobit model that the personality traits may be driven by time constant genetic factors, which may also affect BN, and use the C/W correlated random effects model. Specifically, for the Tobit model of equation (2) we assume that $\mu_i = \pi_1 \overline{p}_i + u_i$ where $\overline{p}_i$ is the vector of means of the explanatory variables across time, $u_i \sim iid\ N(0, \sigma_u^2)$. This yields

$$y_{it}^{*} = \varphi_0 + \varphi_1 X_i + \varphi_2 p_{it} + b_t + \pi_1 \overline{p}_i + u_i \ + e_{it}. \tag{4}$$

We again maximize the quasi-likelihood and cluster the observations across individuals when calculating standard errors.

Table B.3: Effect of Demographic Variables and Personality Indices on the ED-BN Index

	Linear Estimates				Tobit Partial Effects	
	(1)	(2)	(3)	(4)	(5)	(6)
White	-0.178**	-0.238***			-0.248***	
	(0.090)	(0.088)			(0.073)	
Age	-0.068***	-0.087***			-0.075***	
	(0.012)	(0.013)			(0.010)	
Parents Some College	-0.086	-0.083			-0.019	
	(0.110)	(0.110)			(0.085)	
Parents Bachelor Degree	-0.162	-0.143			-0.105	
or More	(0.119)	(0.119)			(0.098)	
Income in [$20000, $40000]	-0.219*	-0.232**			-0.242***	
	(0.112)	(0.112)			(0.083)	
Income more than $40,000	-0.233**	-0.253**			-0.235***	
	(0.109)	(0.109)			(0.089)	
Distrust Index	0.010	0.008	-0.060***	-0.035***	0.020**	-0.011
	(0.013)	(0.013)	(0.016)	(0.013)	(0.009)	(0.011)
Ineffectiveness Index	0.287***	0.260***	0.194***	0.214***	0.150***	0.117***
	(0.018)	(0.018)	(0.015)	(0.012)	(0.009)	(0.010)
Perfectionism Index	0.136***	0.134***	0.130***	0.133***	0.093***	0.096***
	(0.014)	(0.014)	(0.016)	(0.012)	(0.009)	(0.011)
Body Dissatisfaction Index		0.040***	0.047***	0.045***	0.044***	0.045***
		(0.006)	(0.009)	(0.007)	(0.004)	(0.006)
Constant	1.063***	1.179***	-0.106*	1.224***		
	(0.243)	(0.241)	(0.057)	(0.237)		
First Difference	No	No	Yes	No	NA	NA
Chamberlain/Wooldridge	No	No	No	Yes	No	Yes
Fixed Effects						
Sample Size	6308	6291	2624	6291	6308	6291

Notes: Standard errors robust intra-individual correlation (and robust to heteroskedasticity for linear regressions) are in parentheis. * indicates significant at the 10% level; ** at 5%; *** at 1%. The variation in the sample size comes primarily from the fact that all personality indices but the body dissatisfaction index are not available in wave 7.

We present the estimates in Table B3. To ease the comparison with the linear model, in Columns (1) and (2) we repeat the results reported in Columns (1) and (2) of Table 6. Column (3) reports the first difference estimates of the linear model, which will eliminate an unobserved genetic fixed effect that could potentially drive both the personality indices and the ED-BN index. These results are quite similar to those from the level estimates in terms of the magnitude

and significance of the coefficients on the personality indices.[35] In this case, the elasticities of the ED-BN index with respect to ineffectiveness, perfectionism, and body dissatisfaction indices are 0.42, 0.66, and 0.30 respectively. Note that these are very similar to what we found for the Hausman-Taylor model, and also to those obtained when we do not allow for a fixed unobserved effect that could be causing a spurious correlation between the personality indices and ED-BN index.[36] Since we need to use the more restrictive C/W correlated random effects approach in the Tobit model, as a robustness check, column (4) presents the results of using this approach within the linear model. Note that the signs and significance of these estimates are reassuringly similar to the first difference estimates, suggesting that the Tobit estimates based on the C/W approach are likely to be consistent.

Column (5) reports again the Tobit partial effect estimates of Column (4) in Table 6. Finally, we present the results of using the C/W approach with the Tobit model in Column (6). Note that the Tobit partial effect estimates of perfectionism, body dissatisfaction and ineffectiveness are virtually identical in Columns (5) and (6). Each of the personality indices (except the one for distrust) continue to be strongly related to ED-BN behavior when we use the C/W approach.

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[35] The only difference being that the coefficient on distrust is statistically significant and has an (unexpected) negative sign. Note that the distrust coefficient is significant and has the expected sign in the Tobit regression. Demographic variables are measured at the start of the survey and so drop out of the first differences.

[36] We cannot test the hypothesis difference in the estimates for the personality indices in columns (2) and (3) are different using the standard formula, since the estimates in column (2) are not fully efficient due to heteroskedasticity and intra-individual correlation. Rather, we would use a bootstrap approach to obtain a standard error for this difference. However, given how close the estimates for the personality indices are in (2) and (3), this step did not seem necessary.

References

Adams, P., M. Hurd, D.McFadden, A. Merrill, and T. Ribeiro (2003) "Healthy, Wealthy and Wise? Tests for Direct Causal Paths Between Health and Socioeconomic Status," *Journal of Econometrics* 112: 3-56.

American Psychiatric Association (APA) (1993) "Practice Guideline for Eating Disorders" *American Journal of Psychiatry* 150: 212-228.

American Psychiatric Association (APA) (2000) Diagnostic and Statistical Manual of Mental Disorders American Psychiatric Press: Washington DC. 4th Edition.

Bulik, C., B. Devlin, and S. Bacanu (2003) "Significant Linkage on Chromosome 10p in Families with Bulimia Nervosa," *American Journal of Human Genetics* 72: 200-207.

Cavanaugh, C. and L. Ray (1999) "What we Know about Eating Disorders: Facts and Statistics" In Lemberg, Raymond and Cohn, Leigh (Eds) Eating Disorders: A Reference Sourcebook. Oryx. Press. Phoenix, AZ.

Chamberlain, G. (1984) "Panel Data," in Z. Griliches and M.D. Intriligator (eds.), Handbook of Econometrics, Volume 2. Amsterdam: North Holland, 1247-1318.

Currie, J. and R. Hyson (1999) "Is the Impact of Health Shocks Cushioned by Socioeconomic Status? The Case of Low Birth Weight," *American Economic Review* 19-22.

Currie, J. and B. MacLeod (2008) "First Do No Harm? Tort Reform and Birth Outcomes," *Quarterly Journal of Economics* 123: 795-830.

Cutler, D., E. Glaeser, and J. Shapiro (2003) "Why have Americans Become More Obese?" *Journal of Economic Perspectives* 17: 93-118.

Danielsdottir, S., D. Burgard, and W. Oliver-Pyatt (2009) "AED Guidelines for Childhood Obesity Prevention Programs," AED Position Statements URL: http: // www.aedweb.org /media/ Guidelines.cfm.

Department of Health and Human Services (2006) Agency for Healthcare Research and Quality, Management of Eating Disorders, Evidence Report/Technology Assessment, Number 135, 2006. AHRQ publication 06-E010. Senate Report accompanying the 2006 budget as reported by the Eating Disorders Coalition. URL: www.eatingdisorderscoalition.org.

Garner, D., P. Marion, M. Olmstead, and J. Polivy (1983) "Development and Validation of a Multidimensional Eating Disorder Inventory for Anorexia Nervosa and Bulimia," *International Journal of Eating Disorders* 2: 15-34.

Gidwani, G.P. and Rome, E.S. (1997). Eating Disorders. Clinical Obstetrics and Gynecology, 40(3), 601-615.

Glewwe, P. and E. Miguel (2008) "The Impact of Child Health and Nutrition on Education in Less Developed Countries," *Handbook of Development Economics* Volume 4, (eds.) T. Paul Schultz and John Strauss, Elsevier.

Goeree, M., J. Ham, and D. Iorio (2011) "Caught in the Bulimic Trap? Persistence and State Dependence of Bulimia Among Young Women," mimeo, University of Zurich.

Hausman, J.A. and W. Tayler (1981) "Panel Data and Unobservable Individual Effects," *Econometrica* 49(6), 1377-1398.

Heckman, J., A. Basu, S. Navarro, and S. Urzua (2007) "Use of Instrumental Variables in the Presence of Heterogeneity and Self-Selection: An Application to Treatments of Breast Cancer Patients," *Health Economics* 16(11):1133-1157.

Hudson, J., E. Hiripi, H. Pope Jr, and R. Kesslre (2007) "The Prevalence and Correlates of Eating Disroders in the National Comorbidity Survey Replication," *Biological Psychiatry* 61: 348-358.

Keel, P., D. Dorer, D. Franko, S. Jackson, S., and D. Herzog (2005) "Postremission Predictors of Relapse in Women with Eating Disorders" *American Journal of Psychiatry* 162: 2263-2268.

Kemptner, D., H. Jürges, S. Reinhold (2011) "Changes in Compulsory Schooling and the Causal Effect of Education on Health: Evidence from Germany," *Journal of Health Economics*, forthcoming.

Khanam, R., H. S. Nghiem, L. B. Connelly (2009) "Child health and the income gradient: Evidence from Australia," *Journal of Health Economics*, 28: 805–817

Kimm, S., B. Barton, E. Obarzanek, et al. (2002) "Obesity Development During Adolescence in a Biracial Cohort: The NHLBI Growth and Health Study," *Pediatrics* 110: e54**.**

National Eating Disorders Association (2008) URL: www.nationaleatingdisorders.org. Accessed Dec 29, 2008.

National Youth Risk Behavior Survey (2005) URL: http:// www.cdc.gov /HealthyYouth /yrbs/index.htm.

Philipson, T. and R. Posner (2008) "Is The Obesity Epidemic a Public Health. Problem? A Decade of Research on The Economics of Obesity," NBER Working Paper #14010.

Reagan, P. and J. Hersch (2005) "Influence of Race, Gender, and Socioeconomic Status on Binge Eating Frequency in a Population-Based Sample," *International Journal of Eating Disorders* 38: 252–256.

Rush, J., M. First, and D. Blacker (2008) *Handbook of Psychiatric Measures* American Psychiatric Publishing: Arlington, VA, 2nd Edition.

Society for Adolescent Medicine (2003) "Eating Disorders in Adolescents: Position Paper of the Society for Adolescent Medicine," *Journal of Adolescent Health* 33: 496-503.

Smith, J. (2007) "The Impact of Social Economic Status on Health over the Life Course," *Journal of Human Resources* 42(4): 739-764.

Striegel-Moore, R., G. Schreiber, A. Lo, P. Crawford, E. Obarzanek, and J. Rodin (2000) "Eating Disorder Symptoms in a Cohort of 11 to 16-Year-Old Black and White Girls: The NHLBI Growth and Health Study," *International Journal of Eating Disorders* 27:49-66.

Tenn, S., D. A. Herman, B. Wendling (2010) "The Role of Education in the Production of Health: An Empirical Analysis of Smoking Behavior," *Journal of Health Economics* 29: 404–417.

Thompson, O. (2011) "Racial Disparities in the Cognition-Health Relationship" *Journal of Health Economics,* forthcoming.

Wooldridge, J. (2002) *Econometric Analysis of Cross Section and Panel Data* MIT Press.

Wooldridge, J. (2005), "Simple Solutions to the Initial Conditions Problem in Dynamic, Nonlinear Panel Data Models with Unobserved Effects," *Journal of Applied Econometrics* 20: 39-54.