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David W. Johnston & Grace Lordan

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My body is fat and my wallet is thin: The link between weight perceptions, weight control and income

David W Johnston, Centre of Health Economics, Monash

Grace Lordan* , Department of Social Policy, LSE

*** corresponding author, please email feedback to g.lordan@lse.ac.uk**

Abstract:

This paper explores why the poor are more likely to be overweight and obese than the rich. The main aim is to better understand the mechanisms underlying the income-obesity relationship so that effective policy interventions can be developed. Our approach involves analysing data on approximately 9,000 overweight British adults from between 1997 and 2002. We estimate the effect of income on the probability that an overweight individual correctly recognises their overweight status and the effect of income on the probability that an overweight individual attempts to lose weight. Our work finds that low-income individuals are more likely to both misperceive that they are a healthy weight and fail to address their unhealthy weight. Both of these effects are higher for males than females. For example, it is estimated that overweight low-income males are 15%-points less likely to recognize their overweight status than overweight high-income males, and that after controlling for weight perceptions, overweight low-income males are 10%-points less likely to be trying to lose weight. An implication of these results is that more public education on what constitutes overweight and the dangers associated with being overweight is needed, especially in low income neighbourhoods.

Keywords: Obesity, Overweight, Weight Control, Weight Misperceptions

Introduction and Background

Being overweight or obese is known to be bad for your health, yet the prevalence of obesity is increasing worldwide (Lobstein et al., 2007). Coined as the “most prevalent nutritional problem in the world” (Lau et al., 2007), the epidemic is most prevalent in developed countries. For example, in Canada, U.S, France and Australia, 23% (Linder et al., 2010), 33% (Dorsey et al., 2009), 17% (International Obesity Taskforce, 2011) and 25% (International Obesity Taskforce, 2011) of the population are classified as obese (body mass index (BMI) of more than 30), respectively. While obesity rates are similar for males and females, there is a divergence between genders with respect to being overweight. For example, in Canada 42.8% of males and 23.7% of females are overweight (a BMI of more than 25) or obese. The equivalent figures for the U.S., France and Australia are 40.1% and 28.6%, 41.0% and 23.8%, and 42.1% and 30.9%, respectively (International Obesity Taskforce, 2011).

In England, over 40% of men and 30% of women are overweight or obese (International Obesity Taskforce, 2011), with predictions that *without action*, 60% of men, 50% of women and 25% of children will be obese or obese by 2050 (Butland et al., 2007). Action is being taken, however, with £75 million of public health funds and £200 million of external funds earmarked for a public health campaign called ‘Change4Life’ in 2009 (The Lancet, 2009). This campaign was launched in response to the extraordinary costs associated with the overweight population – approximately £7 billion per year in England (NICE, 2006) – as well as the human costs (being overweight is associated with an increased risk of type 2 diabetes, heart disease, stroke, high blood pressure, certain cancers (colon, breast, endometrial and gallbladder) and high cholesterol) and almost 25% of deaths in England have an underlying cause related to an above normal BMI (Duncan et al., 2010). However, the campaign as yet has not produced any visible signals that it is defeating the obesity epidemic. Therefore, given that the obesity epidemic is not waning either in England or in other developed countries, there is scope to investigate further its underlying cause.

In this paper, we investigate the obesity-income gradient by estimating the impact of income on weight perception and weight control in a sample of overweight British adults. While those of high income may have a lower weight because they can afford a healthier lifestyle, it is also plausible that they have a more narrowly defined standard for acceptable body size and adjust their behavior accordingly. This would suggest an income gradient with respect to weight perceptions and a subsequent role for weight perceptions in determining a person’s propensity to pursue weight control. An independent income gradient-weight control relationship is also likely to exist owing to the higher opportunity costs associated with weight control for poorer people.

Our work is related to two main strands of the obesity literature. The first of these is the literature that attempts to estimate the impact of income on the propensity to be overweight or obese. So far, many studies have found that higher socioeconomic status is related to a lower risk of obesity (Costa-Font and Gil, 2008; Nayga, 1999; Wamala et al., 1997; Zhang and Wang, 2007). However, the endogeneity of income in a weight regression complicates these studies interpretation. That is, income may cause a person to be overweight, being overweight may cause lower income or common factors may affect both income and overweight status. These factors include, individual heterogeneity such as self-discipline and impulsivity (Cutler et al., 2003) along with weight misperceptions, which we explore in this work. Attempts have been made to establish a casual relationship between BMI and income with mixed results. For example, Quintana-Domeque (2005) utilize the European Community Household Panel (ECHP), and exploit exogenous variation in household income owing to inheritance, gifts, or lottery winnings of €2000 or more to instrument income in an obesity regression. They explore this relationship for nine countries and find a relationship between income and obesity only for women in both Denmark and Italy, and men in Finland. Notably, this work suffers from a weak instrument problem. In the U.S. context, Cawley et al. (2008) exploit exogenous variation in the social security policy but are unable to identify any statistically significant relationship between additional social security income and BMI in the elderly. Schmeiser et al. (2008) examine the effect of family income changes on BMI and obesity using data from the National Longitudinal Survey of Youth 1979 cohort. They find that income significantly raises the BMI and probability of being obese for women only. Finally, using a longitudinal Swedish panel Ljungvall and Gerdtham (2010) estimate the impact of mean income, positive deviation from mean income and negative deviation from mean income on weight status using questionable instruments**.** They find income to be negatively related to obesity in general.

The second strand of literature that our work relates to concerns itself with the relationship between actual body size and body size perception. Self-perception of body size is a factor that influences whether weight loss is a concern (Liburd et al., 1999 and Anderson et al., 2002). Clearly, if a person is unaware they are overweight they cannot fully internalize the costs associated with the health risks of their weight status. This is in line with research suggesting accurately perceiving oneself as overweight or obese results in a greater motivation to engage in healthy lifestyle behaviors (Baranowski et al., 2003 and Rhee et al., 2005). Given that misperceptions of a normal weight among the overweight and obese have been highlighted in the general literature (Collins et al., 1987; Maximova et al., 2008; Kuchler and Variyam, 2003; Peratakul et al., 2002; Truesdale et al., 2006; Viner at al., 2006) as well as in the literature specific to the UK (Wardle et al., 2002; Johnson et al.,

2008) the problem of a failure to internalize is one that may contribute to the obesity epidemic. This work aims to explore the role of an income gradient on weight perceptions. Specifically we focus on individuals who are the targets of obesity campaigns in England (that is, those overweight or obese).

Thus far the role of the income gradient on misperceptions has yet to be explored. Accepting that income is correlated with being overweight or obese, and acknowledging the lack of consistency in establishing a casual relationship, it would seem that there are pathways yet to be identified through which income is correlated with an unhealthy weight. We argue that weight misperception is one such pathway. The potential for an income gradient to be associated with diverse weight perceptions is linked to it being usual for poor individuals to have poor friends (Tigges et al., 1998; Wacquant and Wilson, 1989) and the likelihood that poorer people are more likely to be overweight or obese. Therefore, peer effects may imply an increased propensity for poorer people to perceive being overweight as a 'healthy' weight, which may reflect ideals of body weight among that group (Kemper et al., 1994). This arises because people's behaviour is likely to be influenced by the norms in their social environment. Thus, when overweight becomes the norm within a peer group, it is likely that the negative social stigma associated with being overweight is reduced. The idea that your social circle can affect your weight is mostly supported by recent research. Christakis and Fowler (2007) find that weight gain spreads through a population like a contagious disease owed to individuals being influenced by their friends and relatives. However, Cohen-Cole and Fletcher (2008) re-estimate these effects and find them greatly reduced and not significant once econometric techniques are utilized. Elsewhere, Maximova et al. (2008) have shown that young people's perceptions of weight is dependent on the weight of their parents and friends. Similarly, Blanchflower et al. (2008) describe a 'keeping up with the Jones weight effect' where weight perceptions and dieting are influenced by the individuals that surround us. Overall they suggest that individuals have different comparison groups, with the highly educated holding themselves to a 'thinner' standard. Oswald and Powdthavee (2007) argue that people have a utility function defined on relative weight and hence choose their weight with reference to the weight of their peers. Given the higher rates of obesity amongst the poor, this peer effect is likely to create an income gradient in weight perception and weight control, which further reinforces the obesity-income gradient.

In addition, weight misperceptions among people of lower income may be explained by lower levels of health knowledge. That is, those with higher levels of education are more capable of processing information about the type of behaviours that yield them good health (Gottfredson and Deary, 2004).

Understanding weight misperceptions is important given that those who are satisfied with being overweight are less likely to do anything about. That is, if I don't see the problem than I am less likely to address it! Conversely, those who are aware that they have an elevated BMI are more likely to take action. It is noteworthy that feeling overweight does not in itself motivate attempts at weight loss, however the majority of those who feel this way do try to lose weight (approximately 60%) according to some received studies (Wardle and Johnson, 2002; Horm and Anderson, 1993) and the literature generally points to a positive correlation between self perceived weight status and weight control (Crawford and Campbell, 1999, Forman et al., 1986 and Riley et al., 1998). Even once weight misperceptions are accounted for, given the higher opportunity cost of weight control for those of lower income it is likely that an independent income-weight control relationship will exist. For example this greater opportunity cost arises because the neighbourhoods in which poorer people live have characteristics that are positively correlated with obesity such as poor walkability (Sallis et al., 2009), a lack of healthy food options (Zick and Smith, 2009), a higher presence of unhealthy food outlets (Harrison et al., 2011) and greater disorder (Burdette and Hill, 2008). Additionally, the literature has identified a relationship between income and healthy lifestyle choices including the propensity to exercise and eat well (Pampel et al., 2010) and higher rates of dieting (French et al., 1994; Jeffrey and French, 1996). However, it is likely that these studies do not establish causality. That is, unobserved heterogeneity attributed to poor health knowledge results in overweight individuals being less likely to try and lose weight. In order to control for this unobserved heterogeneity we utilize our data on weight misperceptions. We argue that individuals who have an unhealthy BMI and believe their weight to be healthy are likely to have a lesser health knowledge than those who recognize the problem. Therefore, separating these groups allows us to more accurately estimate the income gradient on the propensity for an overweight person to pursue weight control. That is, we attempt to disentangle the effects of the poor being more likely to have weight misperceptions and the poor simply being less likely to address a known weight problem. Separating, these effects is important as very different policy options are necessary to address a lack of weight control owed to an income gradient versus weight misperceptions.

Data and Methodology

Our data source is the annual Health Survey for England (HSE), which is a household level survey that collects information through an interview, self-completion questionnaire and medical examination. We pool data from the 1997, 1998 and 2002 surveys and consider prime working age (25-60) respondents who, according to BMI measurements collected by a nurse, are of an unhealthy weight: defined either by BMI ≥ 25 or BMI ≥ 30. The individuals are unaware that they have been classified as 'overweight'. The survey year, age and BMI ≥ 25 restrictions, as well as a restriction of non-missing income information, leaves us with an estimation sample of 9,089.

Data from 1997, 1998 and 2002 are used because in these years adult respondents were asked questions regarding their weight perceptions and weight goals. Specifically, individuals were asked:

(i) Given your age and height, would you say that you are: about the right weight, too heavy or too light?

(ii) At the present time are you trying to lose weight, tying to gain weight or are you not trying to change your weight?

The responses are used to define two binary variables. The first represents weight perception and equals one if the individual believes they are too heavy. Given that only those who are classified as overweight (or obese) are included, this variable also measures weight misperceptions. The second key variable represents weight control, and equals one if the overweight (or obese) individual is trying to lose weight.

Approximately 75% of overweight (BMI ≥ 25) respondents feel too heavy and approximately 60% are trying to lose weight (equivalent percentages for the obese sample are 95% and 73%). In other words, 25% of respondents incorrectly perceive themselves as the right weight, and 40% are not trying to change their weight (very few overweight respondents feel they are "too light" or are "trying to gain weight"). However, these sample averages mask heterogeneity. For example, mean values of weight perception and control are 64% and 47% for men, and 87% and 75% for women. This suggests that women are more likely to recognise their overweight status and more concerned with their weight. Similarly, the raw propensities depend upon income. This is highlight in Figure 1 which illustrates the obesity-income gradient across gender. For example, amongst overweight male respondents, 59% of low-income respondents (bottom income decile) feel too heavy compared with 70% of high-income respondents (top income quintile).

Given our binary dependent variable, we use probit regression models to estimate the impact of log household annual income on weight perception and weight control (probit regressions give similar results). The model for individual *i*'s weight perception is:

(1) $$Pr(heavy_i = 1) = \Phi(\alpha_0 + \alpha_1 \log inc_i + X_i'\alpha_2) + \varepsilon_i$$

where $Heavy$ equals one if an individual has the correct perception that they are overweight and zero otherwise, $\Phi(\cdot)$ represents the logistic function, inc denotes real household income, X is a vector of control variables and ε is a random disturbance term. The probit regression model of weight control, conditional on the individual correctly perceiving themselves as overweight, can be similarly represented:

(2) $$Pr(losewgt_i = 1|heavy_i = 1) = \Phi(\beta_0 + \beta_1 \log inc_i + X_i'\beta_2) + \upsilon_i$$

where $losewgt$ equals one if an individual is trying to lose weight and zero otherwise, υ is a random disturbance term, and inc, $\Phi(\cdot)$, $heavy$ and X are defined as above. Model (2) conditions on $heavy_i = 1$ because without this restriction the income effect in the weight control models would represent an amalgamation of the income effect on weight perception and the income effect on weight control – few people who perceive themselves as the right weight or too light try to lose weight, especially amongst the obese population.

Our empirical strategy is to sequentially estimate richer variants of equations (1) and (2) in order to test whether the income effect can be 'explained' by mediating variables. The purpose of this exercise is to gauge which covariates are the potential pathways between income and our outcome (weight misperception/weight control). First we add a set of baseline controls, which represent demographic information that is personal to the individual. Therefore, Model (1) includes gender, age, age-squared, married, divorced, number of children, black Caribbean or African, Asian, year 1997 and year 1998. Second, given the link between obesity and environment our second set of variables (Model (2)) pertains to area of residence information: rural versus metropolitan and North-East, North-West, Yorkshire, West-Midlands, East-Midlands, South-East, and South-West. Next, Model (3) adds general health indicators: long-standing illness and limiting long-standing illness. Given that income is essentially one dimension of socio-economic status that is correlated with other dimensions, our next step is to add some of these dimensions. Therefore, Model (4) adds highest educational attainment and employment status: degree, vocational qualification, A levels, O levels, and employed. In the context of this data, those who have O and A levels stay in secondary education until the ages of 16 and 18 respectively. Finally, model (5) adds occupation categories: professional, associate professional and technical, administrative and secretarial, skilled trades, personal service, sales and customer service, plant and machine operatives, and elementary. Importantly, all sets of control variables (1 through 5) include BMI since it is a significant predictor of weight perceptions and weight control even amongst samples of overweight and obese respondents. Note that if we didn't control for BMI the estimated income coefficient would be downward biased – BMI is negatively correlated with income and positively correlated with our dependent variables.[1] Table 1 includes descriptive statistics for some of the included covariates.

Given equations (1) and (2) are estimated using a non-random subset of the population, the income coefficients may suffer from sample selection bias. The direction of any bias is likely to be negative because the negative income-obesity relationship implies that high-income individuals in the sample (i.e. overweight) care relatively little about their weight. Therefore, the true income effects are likely to be larger. To test this proposition we estimated probit sample selection models (Van de Ven and Van Pragg, 1981) and found that the estimated income effects were indeed larger than those from our probit regression models. However, these models were identified solely through the assumption of jointly normal disturbance terms, as our data does not contain a defendable exclusion restriction. For this reason we prefer estimates from probit regression models.

Results

Columns 1, 2 and 3 in Table 2 present estimates from the weight perception probit regressions for overweight samples (BMI ≥ 25), and columns 4, 5 and 6 present estimates for obese samples (BMI ≥ 30). The reported standard errors are clustered at the household level are reported to allow for correlation between weight perceptions and weight control of individuals living in the same household. The figures represent the percentage point change in the probability of feeling too heavy for a 1 unit change in log income (i.e. marginal effects). Note that moving from the 5th percentile to the 95th percentile of the income distribution (i.e. from impoverished to wealthy) has the effect of increasing log income by roughly 2.5. Thus, the first estimate in column 1 – 0.046 – implies that moving from a low to a high income increases the probability of (correctly) feeling too heavy by around 12%-points. The equivalent effect for overweight men is roughly 15%-points (relative to a sample mean of 64%, equalling a 23% increase).

Three key findings are gained from Table 2. First, regardless of the sample – male, female, overweight or obese – high income respondents are significantly more likely than low-income respondents to recognise they are 'too heavy'. Second, income effects are larger for men than women:

[1] Clearly, the order in which we add these variables to our model will impact on the subsequent estimates of the other controls. We include this exercise to highlight that income remains an important contributor to weight misperceptions and control even after we control for many other variables that are correlated with income.

using the baseline set of control variables, the male effect is roughly 2 times larger than the female effect in both the overweight and obese samples[2]. We have also considered whether there exists nonlinear relationships between log income and *heavy* and *losewgt*, but all higher order polynomial terms were insignificant for all subsamples used in the analysis[3]. A potential explanation is that low-income men are more likely to view larger body size as an indicator of prowess and dominance than high-income men, thus creating an income effect in body size perception (McLaren, 2007). Third, controlling for the respondent's area and their health has little effect on the income estimates. One potential explanation for significant income effects is that low-income regions tend to have insufficient health services, and therefore, residents of these regions receive less information regarding the thresholds for overweight and its dangers. However, the similarity of the estimates in rows (1) and (2) suggest that this is not the case.

It appears that part of the income effect – but not all – can be explained by higher income individuals having greater education and working in different occupation types. For example, the income effect for overweight males drops from 0.066 in model (3), to 0.044 in model (4) with education controls, and then to 0.028 in model (5) with occupation controls. Having a university degree is estimated in model (4) to increase correct weight perception (relative to no qualifications) by 5.2%-points, while having a managerial level occupation is estimated in model (5) to increase correct weight perception (relative to an unskilled, elementary occupation) by 8.4%-points.

An alternative estimation approach, which can aid interpretation, is to replace the continuous log income with income categorical variables. If we take this approach and include dummy variables indicating the quintile of the income distribution, we find that individuals in the top quintile (richest 20%) are 8 percentage points more likely to feel too heavy than individuals in the bottom quintile (poorest 20%) - estimated results available upon request. Equivalent effects for the female and male samples are 5 percentage points and 11 percentage points, respectively.

Our overall interpretation of the results in Table 2 is that income is an important determinant of weight perceptions given that income remains a significant predictor of perceptions even after controlling for a very large set of covariates that are correlated with income. In order to investigate whether our result is simply being driven by the fact that having income simply 'makes everybody feel fatter' – perhaps driven by a propensity to seek some idealised body image- we also examine whether income increases the propensity for an individual who is of normal weight to incorrectly perceive

[2] We note that additional analysis also highlights that consistent with previous literature, both in the UK and the US, we find that the income gradient with actual BMI is larger for females than males – this is true both for the general population and for the overweight population. However we find that the income gradient with other adiposity measures, such as the waist-to-height ratio, are larger for men.

[3] Estimates are available on request from the authors.

themselves as overweight. In this regression the estimate of the log of income is not significant (p=0.472). Thus it appears that the mechanism is truly that income promotes correct self-assessment.

Table 3 presents similar estimated income effects from the weight control models. We again find income to be a significant determinant of whether an individual is trying to lose weight. Importantly, these models are estimated with only those respondents who feel too heavy, and thus, income is having an effect on weight control even after controlling for the effect of income on weight perceptions. We again find the income effect is larger for men, at least in the overweight sample. For example, in the model that controls for demographics, area of residence, illness, education, employment and occupation, it is estimated that a rich overweight male is 12%-points more likely than a poor overweight male to be trying to lose weight. Unlike the weight perception results in Table 2, occupation and education do not appear to be modifying the relationship between income and weight control[4].

Finally, we investigate whether the income relationships in Tables 2 and 3 hold equally for younger (<40) and older (≥40) sub-samples. The estimates in Table 4 are from probit models estimated with the baseline set of controls and samples of overweight respondents. They suggest that the effect of income on the probability of correctly perceiving yourself as ‘too heavy’ is larger for older respondents. For example, the effect for older female respondents is twice as large as the effect for younger female respondents (0.039 versus 0.020), while the difference between older and younger male respondents is 20%-points (0.066 versus 0.046). In contrast, the estimation results from the weight control models suggest that the estimated income effect does not differ by age.

Discussion

This work investigates explanations for the strong relationship between SES and obesity using a large survey of overweight British adults. The aim is to better understand why the poor are more likely to have elevated BMIs, so that effective policy interventions can be developed. Our work finds that overweight low income individuals are more likely to incorrectly believe they are a healthy weight, and

[4] A potential avenue for exploration at this point may seem to be checking whether the income effect on weight perceptions and control documented in Tables 2 and 3 respectively can be partially explained by differences in discount rates. This is in line with the literature that suggests that time preference links to BMI (Komlos et al (2004), Smith et al. (2005), Borghans and Golsteyn (2006), Ikeda et al (2010) and Courtemanche et al (2011). To test this possibility we estimated probit regression models of weight perceptions with variables representing smoking status and weekly alcohol consumption. The results show that these variables were not statistically different from zero. Moreover, the estimated income effect was unchanged by their inclusion. This is however not out of line with the fore mentioned literature given that we study a group of overweight people who may already have a high discount rate regardless of income.

conditional on weight misperceptions, less likely to attempt weight loss. Both of these effects are larger for males than females.

Clearly, these two findings feed into very different policy options. Firstly, for those who incorrectly believe they are a healthy weight, further research is needed to investigate the underlying drivers. People often rely on comparison with peers to make assessments of their weight status, rather than relying upon medical advice. Given that obesity has become the norm within low-income groups, the existence of such effects implies that people with lower incomes tend to be less concerned with being overweight, reinforcing the obesity-income relationship. This problem may arise because of mixed messages in the media concerning optimal body weight size. Deciphering these mixed messages is more likely to be achieved by those of higher socioeconomic status. The implication of this reasoning is that more public education on what constitutes overweight and the dangers associated with being overweight may be needed, especially in low-income neighbourhoods.

This is however not the end of the story, as our results also highlight that there are many who realise they are overweight but are not attempting weight loss. Again, the cause for this may lie with peer effects models. That is, within a peer group, friends may realise they are overweight but reinforce bad eating and exercise habits. Therefore whilst it is not that peer group effects cause the SES/obesity gradient per se, they do contribute to the growing disparity once a threshold number of individuals with low SES are overweight.

Furthermore, it may be more difficult for those of lower socio-economic status to lose weight given that their home environment often lacks the necessary inputs such as an availability of healthy foods and exercise opportunities. The latter extends from lack of gyms through to safe areas for walking. Clearly, to remedy such environmental level factors would involve policy changes that go beyond health policy.

It should be noted that some commentators argue that any policy to address the obesity epidemic is paternalistic and should be avoided. That is, we should not intervene as individuals rationally choose their own weight (by consuming and expending a certain number of calories). Clearly, it is unlikely that individuals can weigh up the costs and benefits, both future and present, of this choice. It is also unlikely that the overweight weigh up the costs that fall on the health service owing to the obesity epidemic. As discussed, these costs are expected to rise to £10 billion per year by 2050 with no government action Butland et al., 2007). Equally they are unlikely to consider the wider costs to society and business, such as decreased tax revenue and loss of productivity due to related illnesses, which are estimated to reach £49.9 billion per year (2007 prices) if the obesity epidemic is allowed to continue its current increasing trend (Butland et al., 2007). Therefore, we argue that policy makers must take some action, and from our work, additional education on body image and adopting a healthy life style for low-income households could be beneficial, without being regressive. Perhaps these could be piloted in a subset of low income neighbourhoods initially so cost effectiveness can be gauged. A bigger challenge lies with addressing the environmental factors that may inhibit individuals losing weight. While the literature has done well in highlighting that various environmental factors do indeed influence a person's health status, the next challenge is to identify the one or two factors that could do the 'heavy lifting' with respect to addressing the obesity epidemic.

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Table 1: Summary of Selected Variables for Sample of Overweight Respondents

	Mean	SD	Min	Max
Feels 'too heavy'	0.750	0.433	0	1
Is 'trying to lose weight'	0.608	0.488	0	1
Body mass index (BMI)	29.618	4.150	25.002	59.448
Log household income	10.058	0.757	7.553	12.080
Age	42.750	9.828	25	60
Married	0.696	0.460	0	1
Separated / divorced	0.119	0.324	0	1
Number of children	0.819	1.082	0	7
Black Caribbean or African	0.020	0.139	0	1
Asian	0.023	0.150	0	1
Limiting long-standing illness	0.232	0.422	0	1
Non-limiting long-standing illness	0.190	0.393	0	1
University degree	0.156	0.363	0	1
Vocational qualification	0.140	0.347	0	1
A Levels	0.108	0.311	0	1
O Levels	0.258	0.437	0	1
Employed during past week	0.789	0.408	0	1

Note: Descriptive statistics calculated using 9,089 respondents with BMI>25.

Table 2: Estimated Effects of Log Household Income on Self Reported Weight Perceptions

	Overweight Sample			Obese Sample		
	All	Females	Males	All	Females	Males
(1) Baseline controls	0.046***	0.032***	0.059***	0.021***	0.012***	0.034***
	(0.006)	(0.005)	(0.011)	(0.004)	(0.004)	(0.008)
(2) + Area of residence	0.046***	0.032***	0.060***	0.019***	0.009***	0.034***
	(0.006)	(0.005)	(0.011)	(0.004)	(0.003)	(0.008)
(3) + Illness	0.050***	0.034***	0.066***	0.019***	0.009***	0.033***
	(0.006)	(0.005)	(0.011)	(0.004)	(0.003)	(0.009)
(4) + Education & employment	0.036***	0.028***	0.044***	0.016***	0.007**	0.032***
	(0.006)	(0.006)	(0.013)	(0.004)	(0.003)	(0.010)
(5) + Occupation	0.028***	0.025***	0.028**	0.011**	0.003	0.022**
	(0.006)	(0.006)	(0.013)	(0.004)	(0.003)	(0.010)
Sample size	9089	4373	4716	3164	1740	1424

Note: Figures are the estimated marginal effects of log household income from separate probit regression models where the dependent variable equals 1 if the individual thinks they are "too heavy". Standard errors are clustered at the household level. *, ** and *** denote significance at .10, .05 and .01 levels. Samples restricted to those that are overweight (BMI>25) or obese (BMI>30). The controls variables are: (1) gender (in full sample models), BMI, age, age squared, married, divorced, number of children, black, Asian, year 1997 and year 1998; (2) plus rural, metropolitan, north-east, north-west, Yorkshire, west-Midlands, east-Midlands, south-east, south-west; (3) plus long-standing illness and limiting long-standing illness; (4) plus degree, vocational qualification, A levels, O levels, and employment status; (5) plus occupation groups: professional, associate professional and technical, administrative and secretarial, skilled trades, personal service, sales and customer service, plant and machine operatives, and elementary.

Table 3: Estimated Effects of Log Household Income on Weight Control for 'Too Heavy' Sample

	Overweight Sample			Obese Sample		
	All	Females	Males	All	Females	Males
(1) Baseline controls	0.033***	0.026***	0.041***	0.024**	0.032**	0.016
	(0.008)	(0.009)	(0.013)	(0.011)	(0.013)	(0.018)
(2) + Area of residence	0.037***	0.028***	0.044***	0.029**	0.036***	0.019
	(0.008)	(0.009)	(0.013)	(0.011)	(0.013)	(0.019)
(3) + Illness	0.042***	0.031***	0.053***	0.033***	0.037***	0.028
	(0.008)	(0.009)	(0.014)	(0.012)	(0.013)	(0.020)
(4) + Education & employment	0.043***	0.034***	0.051***	0.032**	0.037**	0.032
	(0.009)	(0.010)	(0.016)	(0.013)	(0.015)	(0.023)
(5) + Occupation	0.039***	0.029***	0.047***	0.030**	0.038**	0.026
	(0.010)	(0.011)	(0.017)	(0.014)	(0.016)	(0.024)
Sample size	6819	3812	3007	3002	1694	1308

Note: Figures are the estimated marginal effects of log household income from separate probit regression models in which the dependent variable equals 1 if the individual thinks they are "too heavy". Standard errors are clustered at the household level. *, ** and *** denote significance at .10, .05 and .01 levels. Samples restricted to those that are 'too heavy' and also overweight (BMI>25) or obese (BMI>30). See the note to Table 1 for control variables.

Table 4: Estimated Effects of Log Household Income by Age and Gender

	Perception		Control	
All aged <40	0.031***	(0.010)	0.033***	(0.012)
All aged ≥ 40	0.053***	(0.007)	0.032***	(0.010)
Females aged <40	0.020**	(0.009)	0.027**	(0.013)
Females aged ≥ 40	0.039***	(0.007)	0.025**	(0.012)
Males aged <40	0.046**	(0.019)	0.038*	(0.021)
Males aged ≥ 40	0.066***	(0.012)	0.039**	(0.016)

Note: Figures are the estimated marginal effects of log household income from separate probit regression models. Standard errors are clustered at the household level. *, ** and *** denote significance at .10, .05 and .01 levels. Samples restricted to those that are overweight (BMI>25) and also to those who are 'too heavy' for weight control models. Baseline controls used – see note to Table 1.

Figure 1: Obesity-Income Gradient for Females and Males based on BMI