Obesity and perceived work discrimination in Spain

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Disclosure statement:
None of the authors has any conflict of interest

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Abstract

Obesity is increasingly becoming a source of discrimination in many domains of living, including at the workplace. In this study we estimate obesity-related discrimination in work settings in Spain and explore its potential sources. We use data from the European Health Interview Survey conducted in 2009-2010. Our models control for a comprehensive set of demographic, socioeconomic, health, and work-related sickness characteristics. We run separate models for women and men, and stratify by type of occupation and by area obesity prevalence. Our results indicate that weight-related discrimination in work settings in Spain is concentrated among women with morbid obesity, particularly among those working in customer-facing jobs and living in areas with low obesity prevalence. These findings emphasise the persistence of the gendered nature of obesity-related discrimination, and provide evidence of a form of induced statistical discrimination. Employers' expectations of lower returns from obese workers in customer facing jobs might be driven by customers' preferences caused by social stigma. Furthermore, the role of area obesity prevalence highlights the impact of cultural social norms even within the same country.

Keywords: Discrimination; labour market; obesity

JEL codes: J70; E24; I10

Introduction

Before 1980, considerably less than 10% of the population in OECD countries were obese. In the following decades, rates doubled and, in some countries, tripled. Nowadays across the OECD, 18% of the adult population are obese (OECD 2014). In Spain, the prevalence of obesity has increased from 7% in 1987 to 17% in 2014 (MSSSI 2016).

Health consequences of obesity are substantial. Obesity is a key risk factor for a range of major chronic diseases (Malnick 2006), it is linked to a shorter life expectancy (Prospective Studies Collaboration 2009) and to a higher risk of disability (Andreyeva, Michaud, and van Soest 2007). Over and above the impact on their health, obese individuals face multiple forms of prejudice and discrimination in important domains of their lives (Puhl and Heuer 2009).

Studies on discrimination stem from different disciplines –sociology, management, medicine, ethics, economics– and are based on three related concepts originally defined by social psychologists: discrimination, stereotypes and stigma. Discrimination consists in giving (or receiving) a different treatment to a person solely because that person belongs to a certain group or social category. Stereotypical beliefs are 'generalisations about social groups that are inherently biased and logically faulty' (Klassen, Jasper, and Harris 1993). Stigma is a 'deep and generalised devaluation and social exclusion of a person as a whole, due to an individual deviance in a certain attribute' (Giel et al. 2010).

Traditionally, discrimination and its related concepts were associated with individual characteristics such as gender, race or sexual orientation. Increasingly, obesity is becoming recognised as a source of discrimination. The prevalence of weight/height discrimination increased in the USA from 7% in 1995–1996 to 12% in 2004–2006 ((Andreyeva, Puhl, and Brownell 2008), and the magnitude now is close to the reported rates of race and age discrimination.

Weight discrimination encompasses interpersonal discrimination in everyday life and institutional discrimination. The latter includes work-related discrimination, which covers hiring, career development, wages and barriers to access to certain positions and professions. Weight discrimination in the workplace may be due to stereotypical beliefs about obese people, which influence judgments and decisions of managers of human resources and attitudes of co-workers. These stereotypical beliefs include beliefs about lack of self-control, laziness, competence, emotional problems, health, absenteeism and likelihood of being accepted by others (Giel et al. 2010).

Discrimination is a complex phenomenon, which not always, or exclusively, reflects prejudicial preferences, but in some instances responds to attitudes based on rational expectations (OECD 2010). The theory of *statistical discrimination* has been developed from the seminal works by Phelps (Phelps 1972) and Arrow (Arrow 1973)

In the model by Phelps two groups, say, obese and normal weight, have different distributions of labour productivity; the employer uses the average of the respective distributions as a signal (or proxy) of the expected productivity of individual workers belonging to the group. As a result, skilled, hard-working individuals from the obese group suffer unfair discrimination. Over time, discrimination gets worse because the good performers who are obese are discouraged from investing in human capital as their estimated return on investment (average of the obese group) is lower than for the normal weight workers. Even if the average productivity is identical for both groups, according to the Phelps model, if the obese group has larger variance, the risk-averse employer will discriminate against obese candidates.

According to the Arrow's theory of statistical discrimination, systematic differences between both groups are endogenously determined as a consequence of diverse mechanisms, one of which is the existence of self-fulfilling stereotypes, and self-fulfilling prophecies, with endogenous skill acquisition. According to Arrow's model, discrimination is not a matter of preferences but of beliefs. The starting conditions will determine the persistence of group discrimination as a consequence of the rational behaviour of employers and the costs of getting information on worker's skills and productivity. Obese workers will not invest so much in human capital and therefore they will be paid lower wages.

The salient point of the theory of statistical discrimination is that unfair inequality may exist and persist even when economic agents (consumers, workers, employers, etc.) are rational and non-prejudiced, because it is caused by the fact that decision-makers use observable characteristics of individuals (group membership) as a proxy for unobservable, outcome-relevant characteristics. Contrary to these theories, Becker´s concept of *economic discrimination* (Becker 2010) consists in treating differently two workers belonging to different groups just because the employer has biased preferences against (or in favour) of one group (Phelps 1972).

A particular form of statistical discrimination relates with the fact that obese workers might be stigmatised by employees and co-workers, but also by customers. Therefore, this form of statistical discrimination involves the expectations that obese workers will be less accepted by customers, yielding to more discrimination in *customer-facing jobs*. Induced discrimination would be then a side-effect of social stigma. The evidence on

actual segregation against obese women in customer facing jobs is not consistent, according to a review (Giel et al. 2010), though some studies conclude that obese applicants were hired more easily for telephone sales than for face-to-face encounters with customers. Previous experimental studies have concluded that the weight-based bias is particularly strong for jobs that require extensive public contact, such as sales positions (Rothblum, Miller, and Garbutt 1988; Bellizzi and Hasty 1998; Rooth 2009). Nevertheless, a meta-analysis (Rudolph et al. 2009) failed to find a significant association between high/low public contact positions and actual work discrimination and concluded that the question deserves further research.

Discrimination may also be associated with the *social norm*. This is the reason why, for instance, white women in the USA have greater weight concerns than black women and consequently feel less confident when seeking jobs, which in turn, negatively impacts their wages (Roehling, Roehling, and Pichler 2007). Persons belonging to categories in which obesity is less common and less accepted (whites, the highly educated, high income) may be more likely to experience interpersonal and institutional discrimination (Carr and Friedman 2005). In areas and communities of low prevalence of overweight and obesity it may be more likely to hold negative attitudes toward obese persons. Conversely, in areas and communities of high prevalence of obesity the social norm is more relaxed (obesity is not a socially devalued attribute) and discrimination is expected to be lower.

Empirically testing for weight-related discrimination is a complex matter due to potential reverse causality and omitted variables bias. Much of the literature has focused on experiments with simulated employment decisions as hiring or promotion. However, lab studies might lack of reliability in real world due to the artificial experimental setting and also due to the fact than many studies use student samples (Giel et al. 2010). Other studies use real data, based on self-selected samples and population representative samples. Most self-selected samples studies analyse groups of persons recruited in weight loss programs, fat acceptance programs or by-pass surgery. They may have a sample selection bias, because the attenders are more worried about the problem than the average overweighed workers. On the other hand, population representative samples normally lack the information required to effectively control for relevant factors affecting the relationship between work discrimination and bodyweight.

Most studies in the literature focus on actual discrimination in the labour markets; only few studies analyse perceived discrimination in the workplace (Spahlholz et al. 2016). Some authors have argued for the equal importance of subjective and objective discrimination, as the study of the subjective perception may contribute to the better knowledge of the two-way stigmatisation process of obese persons, or the self-fulfilling prophecies, in Arrow's terminology.

Our study exploits data from a large and representative sample of adult population in Spain to analyse perceived work discrimination due to weight bias; specifically we explore the statistical discrimination hypothesis by estimating separate models for workers in customer facing jobs and in non-customer facing jobs. We also analyse the social norm as a source of stigma and discrimination by exploiting the fact that the social norm may be different in the 17 Spanish regions, as the prevalence of obesity exhibits large regional variability. We test for sample selection due to working status and control for a rich variety of factors related to health conditions and work productivity available in the survey. Sex differences are accounted for by separating models for women and men.

Materials and methods

Data

We used data from the European Health Interview Survey (EHIS) conducted in Spain in 2009-2010. EHIS is managed by EuroStat, and access to data to the Spanish survey is available at the Spanish Ministry of Health statistics database. The first round of the Spanish EHIS included a series of questions regarding exposure to work discrimination, alongside measures of obesity and a comprehensive set of demographic, health and socioeconomic characteristics. A second round of the EHIS was conducted in Spain in 2014; however, it did not include a section on work discrimination.

In EHIS 2009-2010, questions on work-related discrimination were posed to individuals who were employed at the time of the survey, i.e. 9,895 individuals out of the 22,190 individuals aged 16 and over included in the survey (4,576 females and 5,319 males).

Variables

Perceived work discrimination

Discrimination was measured by responses to the question 'At your workplace, to what extent are you exposed to discrimination? Very exposed/somewhat exposed/not exposed'. The question was not specifically asked with regards to weight-related factors. We constructed a binary variable taking the value =1 if the individual reported being very exposed/somewhat exposed, and =0 otherwise. The reason for creating a binary variable was that only 104 individuals (1%) were in the "very exposed" category. We tested whether the binary specification yielded consistent results compared to models that used a categorical variable with all three categories separately.

Obesity

We explored obesity bias at the workplace by looking at the effect of obesity on reporting work-related discrimination. Obesity was measured by individual Body Mass Index (BMI), defined as weight in kilograms divided by height in metres squared. Weight and height were self-reported by the individual to the interviewer during the face-to-face survey interview. From this calculation, we used a binary indicator for obesity defined as =1 if BMI$\geq$30kg/m^2 and =0 otherwise. We also explored the effect of different categories defined as: <18.5kg/m^2 underweight; $\geq$18.5 and <25kg/m^2 normal weight; $\geq$25 and <30kg/m^2 overweight; $\geq$30 and <40kg/m^2 obesity; and $\geq$40kg/m^2 morbid obesity. Underweight and normal weight are used as the omitted categories. We also experimented with breaking down the obesity category (i.e. $\geq$30 and <40kg/m^2) into two groups: $\geq$30 and <35kg/m^2 obesity class I; and $\geq$35 and <40kg/m^2 obesity class II, but we found same results in both categories so combined them.

Other covariates

We examine whether the relationship between obesity and perceived work discrimination persists when demographic characteristics, socioeconomic variables, occupation type and health indicators are controlled for. We control for these variables because they may confound the observed relationship between body weight and perceived discrimination, as factors such as an older age, belonging to a minority ethnic group, being less educated or in poor health are associated with a greater likelihood of reporting discriminatory treatment and with the probability of being obese (Carr and Friedman 2005).

The specific indicators were as follows.

- Demographic factors included age and age squared; country of birth (=1 if Spain; =0 otherwise); marital status (dummy variables indicate if the person is married, single, widow, separated, divorced; married is the omitted category); population size of the municipality of residence of which there are 8,122 in Spain (dummy variables for <10,000, 10,000-50,000, 50,000-100,000, 100,000-400,000, >400,000 residents; <10,000 is the omitted category); and regional indicators for the autonomous community of residence of which there are 17 in Spain (Andalucía is the omitted category).
- Socioeconomic indicators consisted of educational attainment (dummy variables for illiterate, primary school, lower secondary, upper secondary, post-secondary non-tertiary, short-cycle tertiary, tertiary high education; illiterate is the omitted category); log-transformed monthly household income; and household size. Twenty percent of income values were missing and were imputed based on a linear regression on available income values against gender, age, country of birth, marital status, education, and employment status (working, retired, studying, taking care of the house and family, permanently unable to work). A binary variable indicating whether or not the income value was imputed was also included in the models (=1 if Yes; =0 otherwise).

- Occupation type was defined based on the ISCO88 categorisation (see http://ec.europa.eu/eurostat/ramon/documents/isco_88/isco_88_intro.pdf), which defines a set of groups according to the tasks and duties undertaken in the different occupations. We included 22 different occupation types (see Table 1), with armed forces being used as the omitted category.
- A set of health indicators that consists of: self-assessed general health based on responses to the question: 'How is your health in general? Would you say it was: very good (omitted category), good, fair, bad or very bad?'; whether or not the individual had a longstanding illness (=1 if Yes; 0 otherwise); whether or not the respondent experienced no limitations (omitted category), moderate or severe limitations on daily activities; whether or not the individual had severe vision, hearing or physical impairment (=1 if Yes; =0 otherwise); and a mental health

indicator. The latter was based on responses to the Short-Form 36 (SF-36) questionnaire items related to mental health. According to the methodology used in the survey based on the SF-36 manual, we created a variable based on responses to the following questions: 'How much of the time, during the past 4 weeks… have you been very nervous? Have you felt so down in the dumps that nothing could cheer you up? Have you felt calm and peaceful? Have you felt downhearted and depressed? Have you been happy?' Each question could take up to five values defined as 'all of the time/most of the time/some of the time/a little of the time/none of the time'. The derived indicator lies between 0 and 100, with larger values indicating a better mental health state.

- Productivity and work-related sickness: We include indicators based on responses to the questions: 'Are any of the diseases you had in the past 12 months caused or made worse by your job or by work you have done in the past?' (=1 if Yes; =0 otherwise), and 'in the past 12 months, how many days in total were you absent from work for reasons of health problems?' The latter variable was specified as a continuous measure.

Statistical methods

In the EHIS data only individuals currently employed were asked about their exposure to work-related discrimination. This could bias the analysis because obese individuals might be less likely to be in employment due to factors associated with weight-related discrimination. If there are unobserved factors that influence the probability of being employed which also influence perceived discrimination at work, our estimates would be affected by sample selection bias. We investigate this issue by testing for selection bias using a sample selection model (Heckman 1979).

In these models, we assume that a variable *D* is only observed if another latent variable *E* is positive,

$$D^* = \beta X + \mu_1$$

$$E^* = \gamma Z_i + \mu_2 \qquad \text{Eq. 1}$$

Where $D*$ is an unobserved latent variable such that $D* \geq 0$ if $D = 1$ and $D* < 0$ if $D = 0$, and $E*$ is defined similarly. $E = 1$ if we observe D, and zero otherwise. In our study, D represents the probability of reporting exposure to work-related

discrimination, among individuals who report being employed, and E represents the probability that the individual is currently in employment. X and Z are vectors of regressors (including obesity indicators) and the error terms μ_1 and μ_2 are jointly normally distributed, independently of X and Z, with zero expectations (Wooldridge 2003).

Identification of the sample selection model relies on including some explanatory variables that enter the first-stage equation (employment equation) but do not enter the second stage regression (discrimination equation). In other words, X is a subset of Z, and Z includes additional variables that act as instruments. We used the unemployment rate in the autonomous community of residence in 2009 (as provided by the Institute of National Statistics) as exclusion criteria in the second equation. We expect that unemployment rate in the region of residence affects the probability of having a job, but it would not affect the probability of being discriminated at work once the individual has a job, conditional on the other covariates. We tested this assumption by looking at the significance of the instrument on the discrimination equation.

The nonselection hazard (also known as the inverse Mills ratio) is computed from the probit employment model and added as an extra variable in the second stage regression of the outcome D on the set of explanatory variables. Thus, the model for the probability of reporting perceived work discrimination is,

$$D^* = \beta\ X + \rho\lambda + \mu$$
$$\lambda = \varphi(\gamma\ Z) / \Phi(\gamma\ Z) \qquad \text{Eq. 2}$$

where $\Phi(.)$ is the cumulative distribution function of the standard normal distribution and $\varphi(.)$ is the corresponding probability density function. This model is the binary two-stage model version of the sample selection model developed by Heckman, 1979 (Heckman 1979). We test for sample selection by looking at the significance of the estimated selection coefficient λ included in the second equation.

In the absence of evidence of sample selection bias, we conduct logistic regression models on the binary dependent variable, and we compare the results with those obtained when using ordered models that allows for the discrimination variable to take three levels (very exposed; somewhat exposed; no exposed) instead of the binary specification (very exposed/somewhat exposed; no exposed). We test whether the

obesity indicators coefficients are statistically significantly different across binary and ordered model specifications using the *suest* command in STATA.

In addition to running models on the full sample for men and women, we also stratified by *i)* the type of occupation and *ii)* the obesity prevalence of the region of residence. The models stratified by occupation type were defined by whether or not individuals worked in customer-facing activities, which comprised: customer services clerks (ISCO 42), service workers, shop and market sales workers (ISCO 51-52), and sales and services elementary occupations (ISCO 91). Obesity prevalence was measured by collapsing individual BMI≥30kg/m^2 in the sample by the 17 Spanish autonomous communities in the data. Obesity prevalence ranged from 12% to 23% across regions. Analyses were then stratified by whether individuals lived in a region with an obesity prevalence below/above the median. We used EHIS data to estimate regional obesity prevalence as there is no other independent publicly available source of data on this in Spain.

We run five models in each case, where we add increasingly more sets of covariates besides obesity. Model 1 includes demographic factors only; in Model 2 we add socioeconomic characteristics; in Model 3 we additionally control for occupation type; in Model 4 we add health variables; and, in Model 5 we include the productivity and work-related sickness indicators.

Models were stratified by gender and adjusted for clustering at the primary sample unit level. We compute and present average partial effects for the obesity indicators (using the *margins* command in STATA) to allow for the quantitative interpretation of the role of obesity on perceived work discrimination. Analyses were undertaken in STATA version 12.0/SE.

We tested for multicollineary using Variance Inflation Factors (VIF). We conducted a number of diagnostic tests on our models (link test, Hosmer and Lemeshow test, residual diagnosis measures) and calculated several goodness-of-fit measures (Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), pseudo R-squared). In addition, the categorical assessment of model fit was explored via sensitivity, specificity and percentage of correctly classified predictions values; we used the sample mean of the dependent variable as cut-off for determining whether an observation had a predicted positive outcome.

Results

Summary statistics

Table 1 presents the summary statistics of the variables used in the models. Nearly 7% of female workers reported being exposed (very exposed/some exposure) to work-related discrimination, while under 5% of male workers reported the same thing. Obesity is more prevalent among men, with over 16% of males categorised as obese (BMI ≥30) as compared to 9% of females. However, the percentage of females who are morbid obese (BMI≥40) is larger than the percentage of males, 0.5% versus 0.3%. It is worth noting that these figures are based on a subsample of individuals in employment; figures for obesity (morbid obesity) across the full -employed and non-employed- survey sample were slightly higher at 18% (0.5%) and 16% (1%), for males and females, respectively.

Model results

We first tested for sample selection bias. We found that our exclusion criteria, unemployment rate in the region of residence, significantly predicts (weakly so for males) the likelihood of being employed, even after controlling for the full set of individual demographic, socioeconomic and health factors (p value =0.023 and =0.092, for females and males, respectively). However, this variable did not affect the probability of perceiving work discrimination among those currently working (p value =0.764 and =0.779, among females and men, respectively). We thus used this variable as exclusion criteria in the selection models.

We found no evidence of sample selection bias. The selection coefficients were found to be non-significant in every model conducted on the full samples (see first row in Table 2).

We thus moved to non-sample selection models, and compared the results of binary and ordered discrimination models, which yielded similar results (the obesity indicators coefficients were not statistically significantly different across model specifications, p values =0.9837 and =0.3982, for females and males, respectively). For ease of interpretation, we present only the output of the binary models, which allow us to

compute a single set of marginal effects: marginal effects of obesity based on the logistic models of perceived work discrimination are presented in Table 2.

In separate models we show the impact of obesity included as a binary indicator and also as a four-category variable (underweight and normal weight are omitted categories). Each column in Table 2 shows the marginal effect of the obesity variables estimated in models with increasingly more sets of covariates as control variables (i.e. Model 1 to Model 5), as previously described. We present the effects among the full working sample, among those working/not working in customer facing-jobs and among those living in areas below/above median obesity prevalence, separately for women and men. We found no signs of collinearity; VIF values were lower than 10 for the full set of covariates (5.17 and 5.23 in the female and male sample, respectively). Some variable categories perfectly predicted the outcome variable in some models and so were dropped (the dropped variables in Model 5 in full working sample are indicated in Appendix 1). Appendix 2 summarises the results of model diagnostic tests and goodness-of-fit measures. We ran these tests on the models that include obesity as a four-category variable. The results show no sign of specification errors and goodness-of-fit measures generally improved in models that included more control variables. Analyses excluding observations that were identified as outliers based on residuals values yielded the same conclusions as the analyses including all observations.

The results show that while the binary obesity category is non-significant in any model, females who are morbidly obese are more likely to report discrimination at work. However, in the full sample models, this effect of morbid obesity becomes non-significant when we control for health characteristics. For females working in customer-facing jobs, the impact of morbid obesity on work-related discrimination remains even when controls for health and productivity (i.e. sickness absence) are included. Morbid obese women are 7 percentage points more likely to report work-related discrimination than normal weight females in this subsample; the effect is non-significant among those working in non-customer facing jobs. Furthermore, morbid obese women who live in regions where obesity prevalence is low experience significantly more discrimination at work (with a probability 11 percentage points larger than normal weight females) that is not explained by other factors, while morbidly obese females living in areas with high obesity prevalence do not experience a larger degree of discrimination. We found no evidence of an effect of obesity on perceived work discrimination among males, nor in

the full sample, neither among males working in customer-facing activities or living in areas with low obesity prevalence, once we control for the set of included covariates.

Appendix 1 shows the effect of all the variables included in Model 5 (full models). Among females, the following variables increase the probability of reporting work-related discrimination: age (with inverse U-shape); living in areas with a larger population size; in a smaller household; working on certain types of occupations -especially armed forces, physical and engineering science associate professionals, and plant and machine operators and assemblers-; having a limiting illness; a worse mental health score; becoming sick due to work-related issues; and taking more sick leave days. Age, mental health and sickness related to work have a similar impact on perceived discrimination among males, while the other variables are non-significant in the male sample. Instead, being non-Spanish and highly educated significantly increases perceived discrimination at work for men, while these factors do not appear to affect women.

Discussion

Our findings suggest that weight-related discrimination in work settings in Spain is concentrated on women with extreme obesity. These results are consistent with the findings of a recent review (Spahlholz et al. 2016), which concluded that perceived weight discrimination is more frequent in women and in individuals with higher BMI values. This highlights the 'gendered' nature of obesity discrimination, which might happen due to 'the ideal of beauty in today's western societies and the interpretation of overweight. The beauty ideal puts more pressure on women to be slim than on men' (Giel et al. 2010). There is clear and abundant evidence that work discrimination is particularly strong for women (Puhl and Brownell 2001). Furthermore, the shift in the BMI distribution over time might explain why discrimination is now centred on morbid obese individuals, as overweight and (non-morbidly) obese people are a norm today rather than an exception in many countries, including Spain.

Importantly, our study also shed light onto the underlying sources of discrimination. We identified that the role of obesity in perceived discrimination varies significantly by whether the job requires extensive public contact. This finding suggests a form of

induced *statistical discrimination*, by which organisations attempt to show a good-looking appearance of their employees in customer facing jobs (Pingitore et al. 1994) under the expectation that customers will respond worse to obese workers and productivity will therefore be lower in this group. Statistical discrimination at the workplace becomes a consequence of customer preferences due to social stigma. Furthermore, we found that independently of the occupation, extremely obese females that lived in areas where obesity prevalence was low also experienced a larger degree of discrimination. This result indicates that the *social norm* also plays a significant role in work-related discrimination, especially in regions where obesity is considered a transgression of cultural norms.

A series of issues warrant further discussion. First, we focus on perceived rather than actual discrimination; whether such perceptions reflect what individuals actually encounter in their lives is unclear (Andreyeva, Puhl, and Brownell 2008). However, perceived work related discrimination, even if it might not correspond to actual discrimination, does deserves being studied as it provokes psychological distress (Pavalko, Mossakowski, and Hamilton 2003) and work-related attitudes and behaviours, which in turn might cause organisational distress (Roehling, Roehling, and Pichler 2007) and reflected appraisals, a concept indicating that negative self-perceptions are a reaction to the perception of negative views by others (Carr and Friedman 2005). The literature finds that perceived weight discrimination in some countries is lower than actual weight discrimination (Rothblum et al. 1990). This might be due to the fact that some obese workers believe the negative stereotypes of obesity are true, and feel that weight-related mistreatment is not unfair. They thus become victims of the interiorisation of the stigma.

EHIS data on work-related discrimination pertains to exposure to discrimination at the individual current workplace. Therefore, we might not be able to observe discrimination taking place in other stages of the employment cycle, such as among those searching for a job. Previous evidence on the link between obesity and employment status is mixed with some studies finding a significant effect (Tunceli, Li, and Williams 2006; Morris 2007; Kinge 2016; Katsaiti and Shamsuddin 2016), while others have not found an impact of obesity on employment (Cawley 2004; Lindeboom, Lundborg, and van der Klaauw 2010; Norton and Han 2008). Also, EHIS work-related discrimination measure is not a direct measure of obesity-related discrimination at work, but work-related

discrimination in general. Therefore, it is crucial to control for other potential sources of discrimination in our analysis. The large number of covariates we include in our models are aimed to control for this issue, including age, sex, country of birth, socioeconomic characteristics, physical and mental health status, productivity, etc.

Also, importantly, the relationship between obesity and perceived discrimination is likely to be driven by causal effects in both directions. We aim to estimate the effect of obesity on perceiving discrimination but some studies have gathered evidence of the same link taking the opposite perspective. A longitudinal study of a sample of 6,157 American adults over a four-year period concludes that weight discrimination, rather than motivating individuals to lose weight, increases risk for obesity (Sutin and Terracciano 2013). With cross-sectional data it is not possible to estimate causation, although some of the variables included in our models might alleviate this issue to some extent: responses to whether any of the health conditions individuals had were caused or made worse by their job might partly capture the fact that some individuals become obese due to exposure to weight-related discrimination at work.

It is also worth noting that beauty or physical fitness is a specific qualification required for some jobs or positions (as actor or catwalk´s model), just as cognitive abilities or social capacities are required for other jobs. If job performance is related to bodily characteristics, keeping obese workers away from those positions would not be discrimination but a sign of efficient allocation of human resources. That may be the reason why obese persons are underrepresented in highly physically demanding jobs. We tried to estimate models on a subsample of individuals employed on physically demanding occupations to explore the potential role of obesity. However, the small sample size in this subsample did not allow for these models to be conducted.

Previous research suggests that perceived discrimination is associated with physical and mental health factors (Spahlholz et al. 2016). In our study we are able to control for a set of general health characteristics and mental health scores. We found that particularly mental health plays a significant role in perceived work discrimination among both women and men. The relationship between obesity, mental health and subjective discrimination thus deserves further research.

In conclusion, we found that weight-related discrimination in work settings in Spain is concentrated among women with morbid obesity. We also found that perceived

discrimination varies significantly by type of job and prevalence of obesity. Our results indicate that the most vulnerable groups likely to experience discrimination at work due to their weight are females with extreme obesity, working on customer services occupations and who live in areas where obesity prevalence is low. These findings emphasise the persistence of the gendered nature of obesity-related discrimination, and provide some evidence of a form of induced statistical discrimination. Employers' expectations of lower returns from obese workers in customer facing jobs might be driven by customers' preferences caused by social stigma. Furthermore, the role of area obesity prevalence highlights the impact of cultural social norms even within the same country.

Funding details

This work was funded by the Ministry of Economy and Competitiveness (MINECO) of Spain, under the programme "Programa Estatal de Investigación, Desarrollo e Innovación Orientada a los Retos de la Sociedad, Plan Estatal de Investigación Científica Técnica y de Innovación 2013-2016 under Grant ECO2013-48217-C2-1. (http://invesfeps.ulpgc.es/en). The funder had no influence on the conduct of this study or the drafting of this manuscript.

Disclosure statement

Authors have no conflict of interest.

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Table 1. Summary Statistics by gender group

		Females		Males	
		Mean	**SD**	**Mean**	**SD**
Discrimination at work - Very exposed/some exposure		0.0678	0.2514	0.0470	0.2117
Obesity variables					
Obesity (BMI ≥30)		0.0929	0.2903	0.1650	0.3712
Low weight (BMI < 18.5)		0.0342	0.1819	0.0027	0.0520
Normal weight (BMI ≥18.5 & <25)		0.6320	0.4823	0.3605	0.4802
Overweight (BMI ≥25 & <30)		0.2408	0.4276	0.4718	0.4993
Obese (BMI ≥30 & <40)		0.0883	0.2838	0.1619	0.3684
Morbid obese (BMI ≥40)		0.0046	0.0674	0.0031	0.0555
Demographic variables					
Age		41.96	10.67	42.57	10.71
Country of birth - Spain		0.8879	0.3155	0.9083	0.2886
Marital status					
Married		0.5476	0.4978	0.6429	0.4792
Single		0.3015	0.4590	0.2926	0.4550
Widowed		0.0340	0.1813	0.0079	0.0887
Separated		0.0472	0.2122	0.0211	0.1437
Divorced		0.0692	0.2538	0.0346	0.1828
Size of municipality					
Less than 10,000		0.1785	0.3830	0.2135	0.4098
Between 10,000-50,000		0.2479	0.4318	0.2632	0.4404
Between 50,000-100,000		0.1408	0.3479	0.1515	0.3585
Between 100,000-400,000		0.2481	0.4320	0.2261	0.4184
More than 400,000		0.1847	0.3881	0.1456	0.3528
Socioeconomic variables					
Educational attainment					
Illiterate		0.0025	0.0501	0.0019	0.0439
No primary education		0.0242	0.1537	0.0344	0.1823
Primary education		0.1386	0.3455	0.1903	0.3926
Lower secondary		0.1502	0.3573	0.1923	0.3941
Upper secondary		0.1538	0.3608	0.1559	0.3628
Post-secondary non-tertiary		0.1077	0.3101	0.1006	0.3008
Short-cycle tertiary		0.0847	0.2784	0.0932	0.2908
Tertiary high education		0.3381	0.4731	0.2308	0.4214
Household income					
Log household income		7.5546	0.4856	7.5691	0.4472
Household income missing		0.1947	0.3960	0.1874	0.3903
Household size		2.77	1.20	2.90	1.18
Occupation type variables (ISCO88)					
00	Armed forces	0.0018	0.0427	0.0147	0.1204
11	Legislators and senior officials	0.0043	0.0658	0.0060	0.0772
12	Corporate managers	0.0117	0.1073	0.0308	0.1727
13	Managers of small enterprises	0.0395	0.1949	0.0635	0.2439
21	Physical, mathematical and engineering science professionals	0.0073	0.0852	0.0240	0.1531
22	Life science and health professionals	0.0334	0.1796	0.0174	0.1308
23	Teaching professionals	0.0635	0.2439	0.0304	0.1717
24	Other professionals	0.0334	0.1796	0.0213	0.1444
31	Physical and engineering science associate professionals	0.0121	0.1094	0.0377	0.1906
32	Life science and health associate professionals	0.0423	0.2012	0.0085	0.0919
33	Teaching associate professionals	0.0279	0.1646	0.0128	0.1123
34	Other associate professionals	0.0599	0.2373	0.0645	0.2456
41	Office clerks	0.1145	0.3184	0.0497	0.2174
42	Customer services clerks	0.0857	0.2799	0.0256	0.1578
51	Personal and protective services workers	0.1298	0.3361	0.0654	0.2473

52	Models, salespersons and demonstrators	0.0971	0.2962	0.0530	0.2241
61	Skilled agricultural and fishery workers	0.0126	0.1114	0.0387	0.1929
7	Craft and related trades workers	0.0206	0.1419	0.1913	0.3933
8	Plant and machine operators and assemblers	0.0229	0.1494	0.1175	0.3220
91	Sales and services elementary occupations	0.1577	0.3645	0.0513	0.2206
92	Agricultural, fishery and related labourers	0.0103	0.1009	0.0184	0.1344
93	Labourers in mining, construction, manufacturing and transport	0.0114	0.1063	0.0559	0.2298
General health variables					
Self-assessed health					
Very good		0.2125	0.4091	0.2261	0.4184
Good		0.5846	0.4929	0.6219	0.4850
Fair		0.1577	0.3645	0.1311	0.3376
Bad		0.0379	0.1910	0.0168	0.1286
Very bad		0.0073	0.0852	0.0041	0.0636
Long-standing illness - Yes		0.4558	0.4981	0.3907	0.4880
Limiting long-standing illness					
No limitations		0.8341	0.3721	0.8786	0.3267
Moderate limitations		0.1511	0.3582	0.1074	0.3096
Severe limitations		0.0148	0.1209	0.0141	0.1180
Health impairment					
Severe vision impairment		0.0057	0.0753	0.0046	0.0680
Severe audition impairment		0.0023	0.0477	0.0044	0.0666
Severe physical impairment		0.0352	0.1842	0.0164	0.1272
Mental health – SF-36 index for mental health dimension		76.57	18.29	81.91	15.82
Productivity and work-related sickness					
Sickness due to work-related issues - Yes		0.1792	0.3835	0.1313	0.3378
Days taken as sick leave in past year (number)		12.13	43.98	8.09	35.02
Sample size		4,381		5,170	

Note: BMI = Body Mass Index; SD = Standard Deviations

Table 2. The impact of obesity on perceived work discrimination (marginal effects)

	Females					Males				
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Full sample										
Sample selection coefficient	0.5432 (0.614)	0.2182 (0.568)	0.1834 (0.657)	-0.3303 (0.244)	-0.3019 (0.285)	-0.1086 (0.841)	-0.3567 (0.4504)	-0.3116 (0.607)	-0.7261 (0.181)	-0.7560 (0.186)
Obesity (BMI ≥30)	0.0213	0.0226	0.0227	0.0077	0.0084	-0.0002	-0.0001	0.0003	-0.0028	-0.0033
Overweight (BMI ≥25 &	0.0021	0.0029	0.0031	0.0000	-0.0003	-0.0021	-0.0022	-0.0015	0.0002	0.0004
Obese (BMI ≥30 & <40)	0.0152	0.0160	0.0168	0.0040	0.0043	-0.0030	-0.0030	-0.0021	-0.0041	-0.0045
Morbid obese (BMI ≥40)	0.0774**	0.0871**	0.0750**	0.0467	0.0497	0.0496	0.0497	0.0442	0.0353	0.0361
Sample size	4,381	4,381	4,376	4,373	4,345	5,170	5,170	5,166	5,154	5,124
Working in customer facing jobs (Customer services clerks (ISCO 42) + Service workers and shop and market sales workers (ISCO 51-52) + Sales and services elementary occupations (ISCO 91)										
Obesity (BMI ≥30)	0.0230	0.0294	N/A	0.0175	0.0178	0.0338	0.0290	N/A	0.0205	0.0224
Overweight (BMI ≥25 &	-0.0009	0.0022	N/A	-0.0024	-0.0015	0.0223	0.0205	N/A	0.0238	0.0233
Obese (BMI ≥30 & <40)	0.0136	0.0198	N/A	0.0106	0.0105	0.0386	0.0346	N/A	0.0305	0.0319
Morbid obese (BMI ≥40)	0.0902**	0.0933***	N/A	0.0671**	0.0681**	0.1735**	0.1605**	N/A	0.1016	0.1002
Sample size	2,058	2,058	N/A	2,056	2,043	1,009	1,009	N/A	1,006	1,002
Not working in customer facing jobs (Other ISCO 88 categories)										
Obesity (BMI ≥30)	0.0140	0.0116	N/A	-0.0077	-0.0058	-0.0052	-0.0049	N/A	-0.0066	-0.0073
Overweight (BMI ≥25 &	0.0038	0.0006	N/A	-0.0027	-0.0032	-0.0058	-0.0053	N/A	-0.0050	-0.0050
Obese (BMI ≥30 & <40)	0.0130	0.0086	N/A	-0.0110	-0.0093	-0.0097	-0.0091	N/A	-0.0109	-0.0117
Morbid obese (BMI ≥40)	0.0349	0.0570	N/A	0.0369	0.0456	0.0293	0.0307	N/A	0.0268	0.0272
Sample size	2,318	2,318	N/A	2,317	2,302	4,157	4,157	N/A	4,148	4,122
Living in areas with below median obesity prevalence										
Obesity (BMI ≥30)	0.0170	0.0149	0.0178	0.0058	0.0053	0.0075	0.0084	0.0067	-0.0009	0.0005
Overweight (BMI ≥25 &	0.0055	0.0033	0.0033	0.0027	0.0034	0.0011	0.0008	0.0019	0.0046	0.0049
Obese (BMI ≥30 & <40)	0.0073	0.0043	0.0068	-0.0034	-0.0039	0.0064	0.0071	0.0065	0.0009	0.0024
Morbid obese (BMI ≥40)	0.1149**	0.1313***	0.1345***	0.1095***	0.1110***	0.0555	0.0528	0.0407	0.0255	0.0314
Sample size	2,592	2,592	2,590	2,587	2,565	2,878	2,878	2,876	2,866	2,845
Living in areas with above median obesity prevalence										
Obesity (BMI ≥30)	0.0395	0.0413	0.0373	0.0137	0.0168	-0.0063	-0.0067	-0.0040	-0.0052	-0.0081
Overweight (BMI ≥25 &	-0.0012	0.0019	0.0021	-0.0014	-0.0029	-0.0080	-0.0087	-0.0085	-0.0050	-0.0046
Obese (BMI ≥30 & <40)	0.0340	0.0370*	0.0354*	0.0161	0.0179	-0.0135	-0.0141	-0.0112	-0.0104	-0.0134
Morbid obese (BMI ≥40)	0.0179	0.0130	-0.0048	-0.0427	-0.0352	0.0595	0.0537	0.0647	0.0584	0.0560
Sample size	1,789	1,789	1,786	1,786	1,780	2,292	2,292	2,290	2,288	2,279

Note: * 10% significance; ** 5% significance; *** 1% significance; N/A : Not Applicable. The models control for demographic factors (Model 1), and socioeconomic characteristics (Model 2), and occupational type (Model 3), and health status (Model 4), and sick leave days (Model 5).

Appendix 1. Marginal effects of selected full models on perceived work-related discrimination by age group

	Females			Males		
	Full sample	**Customer facing jobs**	**Low prevalence area**	**Full sample**	**Customer facing jobs**	**Low prevalence area**
Underweight/Normal weight (BMI ≥18.5 & <25) (Omitted category)						
Overweight (BMI ≥25 & <30)	-0.0003	-0.0015	0.0034	0.0004	0.0223	0.0049
Obese (BMI ≥30 & <40)	0.0043	0.0105	-0.0039	-0.0045	0.0319	0.0024
Morbid obese (BMI ≥40)	0.0497	0.0681**	0.111***	0.0361	0.1002	0.0314
Demographic variables						
Age	0.0067**	0.0024	0.0125***	0.0046**	-0.0048	0.0024
Age squared	-0.0001***	-0.0001	-0.0002***	-0.0001*	0.0000	0.0000
Country of birth - (=1 if Spain; =0 otherwise)	-0.0125	-0.014	-0.0088	-0.0262***	0.0042	-0.0298**
Marital status						
Married (Omitted category)						
Single	-0.0046	-0.0198	-0.0015	0.0004	-0.0181	-0.0045
Widowed	0.0038	0.0232	0.0079	0.0094	0.1114*	(dropped)
Separated	0.0063	0.0115	-0.0231	0.0022	0.0195	-0.0170
Divorced	0.0139	0.0453**	-0.0043	0.0057	-0.0435	-0.0462
Size of municipality						
Less than 10,000 (Omitted category)						
Between 10,000-50,000	0.0318**	0.0103	0.0370**	-0.0077	-0.0007	0.0055
Between 50,000-100,000	0.0447***	0.0573***	0.0493**	0.0146	0.0198	0.0194
Between 100,000-400,000	0.0373***	0.0220	0.0470**	0.0033	0.0206	0.0134
More than 400,000	0.0285*	0.0288	0.0535***	0.0126	0.0232	0.0229
Socioeconomic variables						
Educational attainment						
Illiterate/No primary education (Omitted category)						
Primary education	-0.0008	-0.0123	0.0119	0.0580*	0.9639***	0.0563
Lower secondary	-0.0046	-0.0017	-0.0066	0.0794**	0.9770***	0.0804*
Upper secondary	0.0057	0.001	-0.0003	0.0758**	0.9982***	0.0862*
Post-secondary non-tertiary	-0.0163	-0.0191	-0.0200	0.0721**	0.9782***	0.0794*
Short-cycle tertiary	-0.0207	-0.0259	-0.0172	0.0673**	0.9241***	0.0841*
Tertiary high education	-0.0007	0.0080	-0.0130	0.0765**	0.9569***	0.0784*

Household income						
Log household income	0.0146	0.0339***	0.0162	-0.0042	-0.0333*	0.0027
Household income missing	-0.0240**	-0.0424**	-0.0298**	-0.0083	-0.0242	-0.0048
Household size	-0.0101**	-0.0126**	-0.0158***	0.0003	0.0059	0.0000
Occupation type variables (ISCO88)						
11 Legislators and senior officials (Omitted category)						
0 Armed forces	0.9238***		0.8816***	0.025		(dropped)
12 Corporate managers	0.7182***		0.7584***	-0.0523		-0.0789
13 Managers of small enterprises	0.7098***		0.7238***	-0.0351		-0.0926*
21 Physical, mathematical and engineering science professionals	0.6682***		0.7219***	-0.0349		-0.0349
22 Life science and health professionals	0.7507***		0.7956***	0.0203		0.0295
23 Teaching professionals	0.7500***		0.7638***	0.0294		-0.0033
24 Other professionals	0.7715***		0.79***	0.0004		-0.0365
31 Physical and engineering science associate professionals	0.8103***		0.8382***	0.0292		-0.0049
32 Life science and health associate professionals	0.7459***		0.7742***	0.0407		0.005
33 Teaching associate professionals	0.7182***		0.7505***	-0.0427		-0.0355
34 Other associate professionals	0.7630***	N/A	0.7848***	0.0277	N/A	0.0108
41 Office clerks	0.7125***		0.7222***	0.0043		-0.0342
42 Customer services clerks	0.7383***		0.7518***	0.0126		-0.0203
51 Personal and protective services workers	0.7393***		0.7621***	0.0466		0.0248
52 Models, salespersons and demonstrators	0.7382***		0.7644***	0.0129		-0.0168
61 Skilled agricultural and fishery workers	0.7382***		(dropped)	0.0031		(dropped)
7 Craft and related trades workers	0.7458***		0.7496***	0.0039		-0.0164
8 Plant and machine operators and assemblers	0.7880***		0.7916***	0.0291		0.0004
91 Sales and services elementary occupations	0.7229***		0.7511***	0.0308		0.0023
92 Agricultural, fishery and related labourers	0.7253***		(dropped)	0.0299		(dropped)
93 Labourers in mining, construction, manufacturing and transport	0.7610***		0.7899***	0.0102		0.0036
General health variables						
Self-assessed health						
Very good (Omitted category)						
Good	0.0043	0.0065	0.0074	0.0101	-0.0091	0.0092
Fair	0.0166	0.0185	0.0376**	0.0139	-0.0337	0.0174
Bad	0.0019	-0.0093	0.0035	0.0287	-0.0839	0.0143
Very bad	0.0015	-0.0017	0.0017	0.0058	(dropped)	0.0532
Long-standing illness – (=1 if Yes; =0 otherwise)	0.0068	-0.0103	-0.0032	-0.0031	0.0093	0.0015

Limiting long-standing illness – No limitations (Omitted category)						
Moderate limitations	0.0248**	0.0151	0.0326	0.0158*	0.0679**	0.0079
Severe limitations	0.0455*	0.0509*	0.0335**	0.0088	0.0891	-0.0376
Health impairment						
Severe vision impairment (=1 if Yes; =0 otherwise)	0.0014	0.0095	-0.0023			
Severe audition impairment (=1 if Yes; =0 otherwise)	-0.0004	(dropped)	(dropped)	-0.0106	(dropped)	(dropped)
Severe physical impairment (=1 if Yes; =0 otherwise)	-0.0113	0.026	-0.0228	-0.0198	-0.0157	
Mental health – SF-36 index for mental health dimension	-0.0008***	-0.0008***	-0.0006**	-0.0012***	-0.0013**	-0.0012***
Productivity and work-related sickness						
Sickness due to work-related issues - (=1 if Yes; =0 otherwise)	0.0438***	0.0578***	0.0382***	0.0230***	0.0518**	0.0289***
Days taken as sick leave in past year (number)	0.0001*	0.0001	0.0002**	0.0000	-0.0001	-0.0001
Autonomous community						
Andalucía (Omitted category)						
Aragón	0.0055	0.0055		-0.0300	0.0086	
Asturias	-0.0038	-0.0168		-0.0061	0.0391	
Baleares	0.0128	-0.0092		0.0024	0.0251	
Canarias	0.0351*	0.0113		0.0249*	0.03	
Cantabria	0.0019	0.0373		-0.0539*	-0.0372	
Castilla León	-0.0635**	-0.0082		0.0027	(omitted)	
Castilla la Mancha	0.0078	0.0303		0.0087	0.0843*	
Cataluña	0.0173	0.0089	N/A	0.0168	0.037	N/A
Valencia	0.0103	0.0081		0.0021	0.0327	
Extremadura	0.028	0.0102		-0.0003	0.0804*	
Galicia	0.0083	0.0052		0.0240*	0.0522	
Madrid	0.0484***	0.0508***		0.0175	0.0678*	
Murcia	0.0494**	0.0283		0.0056	-0.0979*	
Navarra	0.0003	0.0161		0.0036	(omitted)	
País Vasco	0.0186	-0.012		0.022	0.1165**	
La Rioja	-0.0383	0.0386		-0.0433	0.0121	
Sample size	4,345	2,043	2,565	5,124	1,002	2,845

Note: * 10% significance; ** 5% significance; *** 1% significance; N/A : Not Applicable.

Appendix 2. Model diagnostic assessment and goodness-of-fit tests

	Females					Males				
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Full sample										
Linktest _hat (p-value)	0.195	0.001	0.001	>0.001	>0.001	0.851	0.350	0.897	0.020	0.023
_hat^2 (p-value)	0.680	0.176	0.863	0.762	0.806	0.189	0.550	0.075	0.081	0.071
Pseudo R-square	0.0495	0.0595	0.0813	0.1398	0.1413	0.0399	0.0497	0.0759	0.1273	0.1264
Hosmer–Lemeshow (p-value)	0.0213	0.4728	0.6877	0.0943	0.3880	0.1830	0.6253	0.2250	0.3395	0.2741
AIC	2126.5	2124.4	2116.9	2005.4	1997.8	1946.0	1943.3	1936.8	1856.6	1842.4
BIC	2324.5	2379.8	2506.3	2445.8	2463.3	2149.1	2205.4	2336.3	2328.1	2319.9
Sensitivity	62.63%	67.00%	63.64%	68.69%	68.81%	54.32%	58.02%	66.67%	67.49%	67.92%
Specificity	63.74%	63.20%	65.53%	73.06%	73.46%	65.25%	65.09%	66.28%	71.68%	71.99%
Correctly classified	63.66%	63.46%	65.40%	72.76%	73.14%	64.74%	64.76%	66.30%	71.48%	71.80%
Obs. with stand. residuals >3	176	178	167	144	147	198	202	188	160	159
Sample size	4,381	4,381	4,376	4,373	4,345	5,170	5,170	5,166	5,154	5,124
Working in customer facing jobs (Customer services clerks (ISCO 42) + Service workers and shop and market sales workers (ISCO 51-52) + Sales and services elementary occupations (ISCO 91)										
Linktest _hat (p-value)	0.609	0.052	N/A	>0.001	>0.001	0.948	0.385	N/A	0.107	0.067
_hat^2 (p-value)	0.336	0.940	N/A	0.194	0.183	0.341	0.745	N/A	0.455	0.558
Pseudo R^2	0.0694	0.0863	N/A	0.1710	0.1724	0.0688	0.0928	N/A	0.1458	0.1483
Hosmer–Lemeshow (p-value)	0.8398	0.6625	N/A	0.1231	0.5997	0.7372	0.4896	N/A	0.8827	0.6625
AIC	965.4	966.0	N/A	907.3	897.7	537.4	538.1	N/A	533.0	533.0
BIC	1139.9	1191.2	N/A	1194.3	1190.0	679.9	715.1	N/A	764.0	768.7
Sensitivity	60.00%	58.46%	N/A	64.62%	64.84%	85.92%	81.69%	N/A	84.51%	81.69%
Specificity	71.21%	71.63%	N/A	76.43%	76.40%	41.68%	48.29%	N/A	55.94%	56.71%
Correctly classified	70.51%	70.80%	N/A	75.68%	75.67%	44.80%	50.64%	N/A	57.95%	58.48%
Obs. with stand. residuals >3	86	80	N/A	57	56	37	37	N/A	32	31
Sample size	2,058	2,058	N/A	2,056	2,043	1,009	1,009	N/A	1,006	1,002
Not working in customer facing jobs (Other ISCO 88 categories)										
Linktest _hat (p-value)	0.013	0.001	N/A	>0.001	>0.001	0.492	0.029	N/A	>0.001	>0.001
_hat^2 (p-value)	0.582	0.216	N/A	0.812	0.947	0.466	0.734	N/A	0.921	0.905
Pseudo R^2	0.0727	0.0821	N/A	0.1288	0.1309	0.0576	0.0667	N/A	0.1203	0.1195
Hosmer–Lemeshow (p-value)	0.8306	0.2149	N/A	0.4288	0.5447	0.5070	0.0588	N/A	0.1702	0.3158
AIC	1173.3	1181.0	N/A	1145.5	1143.0	1412.4	1670.3	N/A	1361.5	1346.0
BIC	1345.7	1405.2	N/A	1432.9	1435.8	1608.7	1417.0	N/A	1684.3	1674.8
Sensitivity	71.26%	70.06%	N/A	71.86%	71.26%	54.07%	55.23%	N/A	65.70%	64.50%
Specificity	58.58%	61.04%	N/A	67.44%	67.63%	71.94%	72.22%	N/A	76.89%	77.49%
Correctly classified	59.49%	61.69%	N/A	67.76%	67.90%	71.21%	71.52%	N/A	76.42%	76.95%
Obs. with stand. residuals >3	84	78	N/A	74	74	144	140	N/A	122	122
Sample size	2,318	2,318	N/A	2,317	2,302	4,157	4,157	N/A	4,148	4,122
Living in areas with below median obesity prevalence										
Linktest _hat (p-value)	0.143	0.026	0.001	>0.001	>0.001	0.246	0.191	0.492	0.250	0.349
_hat^2 (p-value)	0.922	0.591	0.631	0.935	0.861	0.617	0.692	0.482	0.078	0.057
Pseudo R^2	0.0367	0.0536	0.0839	0.1454	0.1482	0.0268	0.0341	0.0634	0.1157	0.1150
Hosmer–Lemeshow (p-value)	0.8225	0.5416	0.3913	0.3076	0.5988	0.6955	0.3363	0.8909	0.3129	0.7038
AIC	1228.5	1225.8	1223.8	1168.7	1160.2	1117.8	1127.5	1128.3	1092.3	1083.3
BIC	1316.4	1366.4	1469.9	1479.1	1476.1	1201.3	1264.7	1372.4	1390.3	1386.9
Sensitivity	63.10%	63.10%	63.69%	60.12%	60.48%	42.86%	52.14%	64.29%	71.43%	68.12%
Specificity	58.42%	62.13%	65.69%	74.99%	74.73%	70.64%	65.89%	63.85%	70.14%	70.34%
Correctly classified	58.72%	62.19%	65.56%	74.02%	73.80%	69.28%	65.22%	63.87%	70.20%	70.23%
Obs. with stand. residuals >3	66	108	102	82	82	88	119	108	97	96
Sample size	2,592	2,592	2,590	2,587	2,565	2,878	2,878	2,876	2,866	2,845
Living in areas with above median obesity prevalence										
Linktest _hat (p-value)	0.030	0.003	>0.001	>0.001	>0.001	0.982	0.0533	0.596	>0.001	>0.001
_hat^2 (p-value)	0.143	0.042	0.038	0.419	0.640	0.523	0.084	0.377	0.816	0.894
Pseudo R^2	0.0262	0.0402	0.0667	0.1445	0.1440	0.0320	0.619	0.0972	0.1670	0.1726
Hosmer–Lemeshow (p-value)	0.5586	0.8240	0.7559	0.5588	0.3446	0.7951	0.3129	0.2266	0.6901	1091.3
AIC	934.6	941.3	953.6	905.0	902.0	841.9	841.8	843.3	803.7	793.3
BIC	1016.9	1073.1	1195.1	1212.3	1214.6	922.2	973.7	1084.3	1102.0	1091.3

Sensitivity	61.24%	65.12%	65.12%	70.54%	69.53%		48.54%	58.25%	72.82%	66.99%	66.67%
Specificity	53.73%	55.90%	62.22%	70.85%	71.13%		69.44%	67.66%	69.00%	73.50%	74.64%
Correctly classified	54.28%	56.57%	62.43%	70.83%	71.01%		68.50%	67.23%	69.17%	73.21%	74.29%
Obs. with stand. residuals >3	49	89	76	54	55		90	91	70	58	57
Sample size	1,789	1,789	1,786	1,786	1,780		2,292	2,292	2,290	2,288	2,279

Note: Linktest uses the linear predicted value (_hat) and linear predicted value squared (_hat^2) as predictors in the model. AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; Obs. with stand. residual >3 = Observations with standardised residual greater than 3 or smaller than -3