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Abstract

Obesity spreads more easily if is not perceived negatively. This may be the case among the poor, for whom fatness can be an external sign of wealth. We estimate the direct effect of overweight on emotional well-being in Mexico, a country facing the highest obesity rate in the world. Individual fatness is instrumented using variation in genetic predisposition. Results confirm a positive or insignificant effects of obesity among the poor and point to a depressing effect among the rich. This is consistent with contrasted norms, related to unequal development levels, which may exacerbate health inequality and justify targeted communication by health authorities.

Key Words : Emotional well-being, Obesity, Waist-to-Height Ratio

JEL Classification : D1, I12, I31

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1 Introduction

The highest rate of obesity in the world is now reached by Mexico. Around a third of the Mexican are obese while 70% of them are overweight or obese (compared to 69% of Americans, cf. FAO, 2013). This figure was only 10% at the end of the 1980s, before Mexico became a middle-income economy and began to urbanize, change food culture and partly adopt a Western lifestyle. Such a trend is also associated to a broader phenomenon of global obesity pandemic initiated in the US and now penetrating to developing countries (Prentice, 2006).[1]

Importantly, obesity is directly or indirectly related to numerous health problems, including increased incidence of several chronic illnesses like diabetes and heart diseases, and to lower life expectancy. This makes it a major problem for public health, which requires extreme attention by economists and social scientists (Bhattacharya and Sood, 2011) as well as by policy makers. Indeed, social expenditure related to obesity inflates rapidly, increasing the cost of publicly funded health services and adding to the burden of a large part of the population not covered by social security. The cost is also human, as obesity indirectly affects the quality of life through its effect on health condition, labor market outcomes (Cawley, 2000, 2004) or marriage (Clark and Etilé, 2009).
In this study, we are concerned with the direct impact of obesity on mental health. Excess fatness can affect individual emotional well-being by its social and psychological effect, related to self-perception and social acceptance. This effect is expected to be negative if people get stigmatized or lose self-esteem, as we may think following modern Western standards of beauty and body health. Yet social norms may shape the perception of one's own fatness, and its consequences thereof, quite differently. In some cultures, fatness is even associated to beauty. The population of Mexico is heterogeneous and characterized by very uneven levels of development. In such a complex, composite society, different segments of the population may be influenced by very different social norms. If we restrict this variation to an imperfect but simple correlate, income, it may be the case that the negative perception of excess fatness increases with it. Putting it simply, being plump may just be seen as a sign of prosperity for the very poor but a cause of social rejection for the rich.

We suggest an original way of checking this hypothesis. Rather than asking people about how they perceive obesity and their own weight status, which may lead to numerous misreporting problems, we estimate the impact of anthropometric measures of fatness on

[1] Similarly to the US case, excess body weight in Mexico disproportionately affects the poor and the youngest age groups, where obesity rates have been tripled in ten years. Women are slightly more affected than men (Fernald et al., 2004).

people's mental health. This approach allows revealing whether obesity affects emotional well-being, by checking the sign and magnitude of overweight among all the relevant determinants of individual well-being. Estimations are conducted on two waves of the Mexican Family and Life Survey (MxFLS), which contain the Waist-to-Height Ratio (WHtR), a more relevant measure of body size than the usual Body Mass Index (BMI). We focus on Mexican women, taken as a more homogenous group to interpret our results. Endogeneity caused by omitted variables and reverse causality is addressed by adding important controls (mean family happiness, lifestyle and background conditions), by including individual effects using panel data and by instrumenting individual obesity using genetic predisposition. The latter is proxied by the mean fatness of biological relatives. After controlling for indirect channels through which fatness may affect well-being (health, labor market outcomes, marriage), we interpret the effect we capture as the direct, social and psychological impact of fatness on mental well-being.

This paper contributes to the small literature on obesity and subjective well-being, with the intention to extract more causal results than in previous studies. Our findings consolidate existing evidence on the perception of obesity and how it is affected by norms (see also Graham and Felton, 2005). This approach is all the more important as political attempts to stop or reduce epidemic obesity may not be working if excess weight is not perceived as an issue by the obese themselves.
Results point to very contrasted effects of excess fatness on emotional well-being in Mexico. Essentially, we find a significant negative effect among the rich and a positive or insignificant effect in the intermediary group and among the poor. This result is a clear illustration that contrasted social norms, in a very unequal economy like Mexico, can exacerbate health inequality. We consistently find heterogeneous effects along other dimensions than income. That is, obesity depresses mental well-being among urban, educated, employed Mexican women and, in the working population, among those with a commercial or managerial activity. In contrast, overweight is positively related for rural, uneducated Mexican housewife. This heterogeneous effect, and particularly the fact that fatness is a socially acceptable or even rewarded attribute among the poor of Mexico, has clear implications for the design of policy interventions and calls for targeted public health communication to combat obesity efficiently.

The paper is organized as follows. Section 2 summarizes the literature while section 3 introduces our empirical approach. Section 4 presents the results, robustness check and heterogeneous effects. Section 5 concludes.

2 Background and Literature

We provide a brief outlook of the large literature on obesity, focusing on the important aspects for our analysis. We start with a review of the *determinants of obesity*, with a particular focus on the potential confounding factors of our analysis (reverse causality and omitted variables). Then we explore the effect of obesity on well-being, either indirectly through outcomes like labor market outputs and health, or the small literature on the direct impact of obesity on mental health. We end with a discussion on norms and the potentially heterogeneous perception of obesity in a very unequal country like Mexico.

2.1 Determinants of Obesity

Obesity as a collective phenomenon is related to a country's stage of development, as we further discuss below. As a poor country like Mexico becomes wealthier, obesity rates also rise. With globalization and the development process, farm workers and poor city-dwellers may be more likely subjected to "nutrition transition", i.e. the shift from traditional to Western diets that accompanies modernization and wealth. They may also be more prompt to acquire "modern habits associated with obesity" (Popkin, 2007) such as watching television, consuming more commercially-prepared foods, and eating more food away from home.

At a more individual and atemporal level, obesity is caused by a combination of genetic and environmental factors. There is a large literature on the determinants of obesity, nicely reviewed in surveys like Monasta et al. (2010) or Schmidhauser et al. (2009). We focus here on determining factors that may pertain to the omitted variable problem in our analysis, i.e. variables that may jointly affect obesity and well-being. Research in behavioral genetics suggests that part of the variation in weight is due to nongenetic factors such as individual choices and environment. Hence, the association between obesity and well-being may reflect individual differences in inherited lifestyle behavior and family background to some extent.[2] Yet, many studies point to the non-importance of such common household effects and strongly argue that the correlation in weight between biological family members is solely due to genetic factors. In a recent study, Lindeboom et al. (2010) find a strong association in obesity between parents and their biological children at all ages, yet this association is unaffected after controlling for a large set of demographic, socioeconomic and behavioral characteristics related to early life conditions and family background. They also conclude on the absence of association in weight status

[2]Some studies have characterized the role of family environment on the development of children's food habits and choices (Birch, 1999). Excess body weight has also been found inversely related to childhood socioeconomic status (Baum and Ruhm, 2009; McLaren, 2007; Zhang and Wang, 2004).

between parents and their adopted children. These results are in line with other studies on adoption and twins, pointing to the irrelevance of experiences shared among family members in determining individual differences in weight and obesity (Maes et al., 1997; Grilo and Pogue Geile, 1999). Medical studies reviewed in Grilo and Pogue-Geile (1991) show that family members with a family history of obesity bear a significant $40 - 70\%$ increased risk of obesity-related phenotypes, such as BMI, skinfold thickness, leptin levels and body fat measurements. We shall see that our own data point to similar findings, yet we nonetheless control for lifestyle and life condition during childhood when we estimate the effect of obesity on well-being.

A second aspect which is important in our study is the role of mental health on obesity. This potential reverse causality is documented in the psychology literature, notably the fact that people with emotional disorders may be more prone to obesity. Results from a relatively recent review of longitudinal studies point towards bidirectional associations between depression and obesity (Luppino et al., 2010). In fact, mental health disorders can promote obesity through various behavioral channels such as the adoption of unhealthy lifestyles (use of food as a coping strategy, attrition from weight loss programs, etc.), psychological factors (like low expectations of weight loss attempts) and even biological ones (medication side effects). Therefore we shall control as much as possible for these factors in our estimations to circumvent possible reverse causality. Additionally, we shall exploit exogenous (genetic) variation in the propensity to be obese.

2.2 The Effects of Obesity on Individual Outcomes

Obesity may affect well-being indirectly through channels like labor market outcomes and health. These aspects are well documented in economic studies. In particular, there is a rich literature on the adverse effects of obesity on wages (Cawley, 2004; Morris, 2006; Brunello and D'Hombres, 2007; Johansson et al., 2009; Shimokawa, 2008) and employment opportunities (Garcia and Quintana-Domeque, 2006; Morris, 2007; Lundborg et al., 2007; Burkhauser and Cawley, 2008; Lindeboom et al., 2010).[3] Another obvious corollary of obesity is the health condition. Obesity is associated with a myriad of physical problems such as cardiovascular diseases, hypertension, type II diabetes, respiratory diseases, some types of tumors and more generally increased morbidity (WHO, 2005, Dixon, 2010).

[3]There are several explanations for the effect of obesity on labor market outcomes. First, discriminatory attitudes against obese individuals extend to the hiring process since obesity may be taken as a signal of negative characteristics such as a lack of self-control and laziness (Sobal and Stunkard, 1989; Puhl and Latner, 2007). Obesity may also be a parameter of productivity in occupations requiring physical labor or customer contact (Rooth, 2009). Finally, firms may have little incentive to employ obese people who are more likely to exhibit health-related work limitations and to imply additional costs (e.g. disability-related benefit payments).

Obesity does not only cause or exacerbate poor physical and health conditions. As documented in a fairly large medical and psychological literature, it also impacts on individuals' quality of life and psychological well-being (Roberts et al., 2000; Larsson et al., 2002; McElroy et al., 2004; Needham and Crosnoe, 2005). In studies for industrialized countries, depression is commonly found among obese people since they may face discrimination or be subject to stigmatization, dissatisfaction with themselves, remoteness from the society and feelings of insecurity. Intuition therefore naturally relates greater BMI with a lower life satisfaction because of weight-related stigma, lower self-confidence and social rejection. However, this outcome crucially depends on the perceived norms about excess body weight and belief statements about the obese. These may considerably vary across regions, ethnicities or over time.[4] Contrasted norms often coexist within a country.[5] Hence, we can expect to find considerable variation in the social effect of obesity in such an heterogeneous society as Mexico.

Surprisingly, there is little evidence on this topic in the economic literature. A few studies have actually explored the effect of BMI on life satisfaction or happiness data (Oswald and Powdthavee, 2007, use cross-sectional data for Germany and the UK; Clark and Etilé, 2011, use panel data for Germany and focus on social comparison between partners; Blanchflower et al. (2009) appeal to cross-section data from 29 European countries to study relative-weight concerns). Other studies additionally attempt to account for reverse causality when estimating the effect of fatness on SWB. Katsaiti (2012) finds a negative effect of obesity on happiness using cross sectional data from Germany, UK and Australia and IV estimations (the instrument is individual height, assumed correlated with BMI but not with well-being). Stutzer (2007) exploits Swiss data to examine the influence of obesity on happiness controlling for self-control (e.g. stress eating), based on the intuition that people unable to moderate their consumption also experience lower happiness due to obesity. To our knowledge, there is even more limited evidence for poor or middle income countries (we are only aware of Graham and Felton, 2005). Given the prevalence and epidemic propagation of obesity in Latin America, this provides a central motivation for our paper.[6]

[4] A number of ethnographic studies have detailed social contexts in which fat bodies reflect beauty, marriageability, attractiveness and an array of positive moral attributes such as closeness to God, generosity, fertility familial responsibility and social belonging (Brewis et al., 2011).

[5] For instance, American Samoa are conventionally understood to be fat neutral or positive, whereas widespread antifat ideals have been documented in the mainland US (see Brewis et al., 2011, for regional and international comparisons).

[6] Graham and Felton (2005) use Russian and US data to study the variance of obesity and its effects on well-being across different socio-economic cohorts. In the US, their results reveal a negative impact of obesity on life satisfaction, with stronger effects for whites (as opposed to black and hispanics), individuals in the top income quintile and those in higher status professions. In contrast, the authors find that Russian are more likely to be happy when obese. They attribute the result to the fact that obesity may reflect

2.3 Socio-economic Status and Social Norms.

Before turning to our empirical approach, we briefly discuss the link between economic development, norms and the incidence of obesity. Note that empirical evidence points to a "Kuznet curve" for obesity. Indeed, positive correlations between fatness and socio-economic status have been established in low income countries (for instance, between obesity and education in Guatemala, in Martorell et al., 1998) or among the poorest groups in middle income countries (for instance in Mexico, cf. Fernald, 2007, or in China and Brazil, cf. Monteiro et al., 2007, or Popkin, 2011). In contrast, BMI and socio-economic status are often negatively correlated in richer countries (Sobal and Stunkard, 1989).

The graph on the left hand side of Figure 1 confirms this intuition, illustrating the inverted U-shape relationship at the international level. Obesity rates increase with GDP per capita up to a level around PPP$25,000 then decrease (the US is an outlier, with high per capita income and a high prevalence of obesity). The same pattern can be found over the different income groups within a country. Using the data that we describe in the next section, we illustrate this for Mexico on the right hand side graph of Figure 1. Despite the high density of population at very low income levels, the overall trend consists in the same inverted U-shape pattern between per capita consumption and obesity. Coincidentally, the sign of this relationship changes at similar levels as in the first graph (around PPP$20,000).

A possible explanation for this pattern holds in the fact that the development process is accompanied by risk factors and notably cultural and nutritional changes. Moving up the income ladder is often accompanied by urbanization and an increasing influence of the US lifestyle on nutrition in urban environments. At the same time, individuals in low or middle income groups only have limited access to healthcare and few knowledge about healthy foods and physical activity that would help them control their weight. The poor may also have higher levels of uncertainty about the future, lower expectations and be less inclined to postpone consumption for future benefit or to pursue healthy lifestyles as an investment for their future. At higher earnings levels, in contrast, progress in education, access to healthcare services and increased awareness of health issues contribute to lower the prevalence of obesity. These factors may be reinforced by the effect of contrasted norms regarding body types, as discussed above. Among the poorest, fatness may well be

prosperity in Russia rather than being a sign of poor health and a cause for stigmatization. The authors investigate the presence of reverse causality by regressing their depression index on lagged values of BMI and lagged reported depression, controlling for person fixed effects. Their results suggest that the causality runs from overweight to happiness. Yet they acknowledge the possibility of unobserved/omitted variables that promote both the well-being and the weight gain of these respondents. Graham and Felton (2005) is the only study exploring heterogeneity in norms.

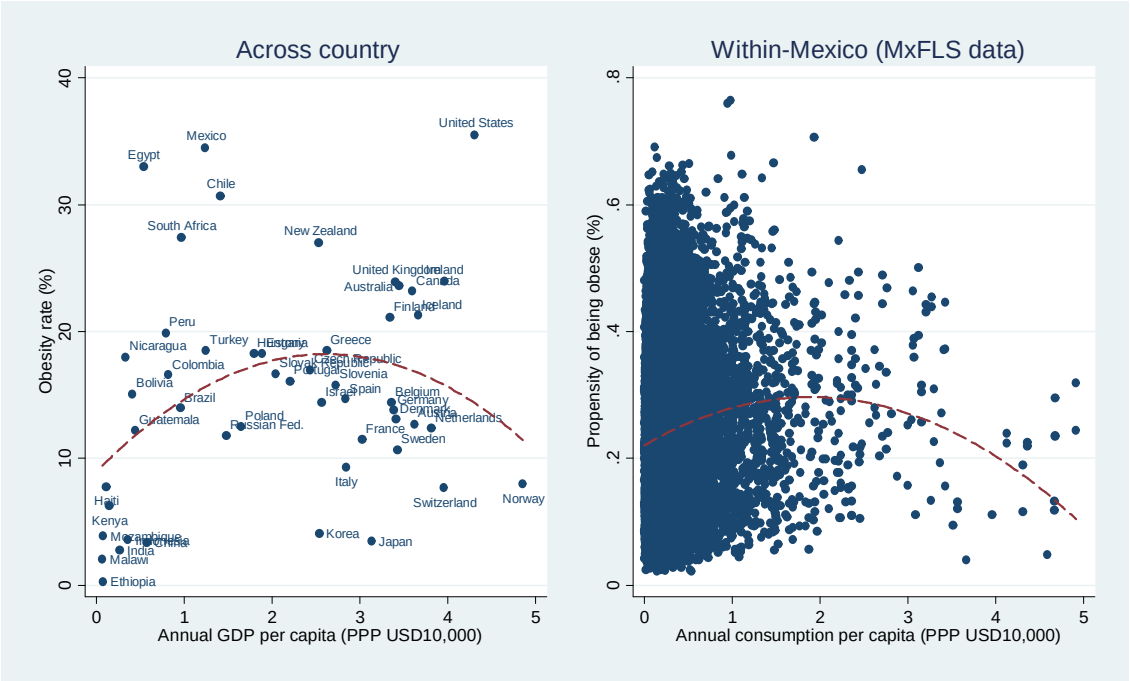

Figure 1: Obesity and Living Standards Across- and Within-country

a symbol of making one's way out of poverty while individuals in the top of the distribution may adopt Western standards regarding body mass and physical appearance.

3 Empirical Approach

3.1 Empirical Strategy

Assume that subjective well-being (SWB) and fatness have the following relationship for an individual i at time t:

$$SWB_{it} = \alpha_i FATNESS_{it} + X_{it}\beta + C_{it}\gamma + \mu_{it} + \epsilon_{it} \tag{1}$$

where $FATNESS$ denotes a continuous measure of fatness (WHtR) or a dummy for obesity (as defined below). We also include a vector X_{it} of SWB determinants (age, marital and family status, education, income), some possible confounders C_{it} and individual unobserved effects μ_{it}. As discussed in section 2.2, obesity may affect SWB indirectly through channels like health status and labor market outcomes. Hence, it is important to account for an extensive set of individual health and labor market characteristics in C_{it}.

In addition, the term μ_i captures unobserved genetic and non-genetic factors affecting well-being which are time-invariant and can in principle be estimated using panel data. The coefficient on fatness, α, may capture an average direct effect of excess fatness on mental well-being. More interestingly, we can estimate heterogeneous effects $\alpha_i = Z_{it}\alpha$ along individual characteristics Z_{it} such as income groups, urban versus rural groups or different education levels. Our main results focus on three different income groups $i = 1, 2, 3$ corresponding to the poor (bottom income quintile), the rich (top quintile) and the intermediary group (quintiles 2-4).

Investigating the effect of obesity on SWB is made complex by potential endogeneity issues including omitted variables and reverse causality. As discussed in section 2.1, the former consists of unobserved factors that may affect both well-being and the weight status. These include (i) inherited family characteristics, if the genes that influence obesity are the same as (or interact with) genes related to depression, (ii) factors related to the individual environment (including parents' socio-economic conditions and early life living conditions) and (iii) the role of family influence in terms of food habits and general lifestyle. Reverse causality is principally related to the adoption of unhealthy lifestyle or medication as the channels through which mental health disorders could affect obesity, as seen in 2.1.

Genetic confounders (i) can be dealt with by introducing individual effects in panel estimations. Admittedly, the panel we avail of is very short (two waves), which is a frequent and unfortunate characteristic of panel data in developing countries. Even though, we can control for time-invariant heterogeneity possibly correlated with SWB and fatness. Random effects (RE) do not deal with this correlation. Fixed effects (FE) make that we lose crucial time-invariant variables such as region (urban/rural), education or childhood conditions. For this reason, we prefer the Mundlak-Chamberlain "quasi-fixed effects" (QFE) model. The auxiliary distribution of individual effects is specified using within-means of key time-varying characteristics (health, income and marital status).[7] Another, maybe more convincing strategy to deal with (i), i.e. with the fact that mental well-being and fatness may be codetermined by genetic background, is the introduction of the mean SWB of biological relatives among individual characteristics in C_{it}.

To address the potential bias due to non-genetic confounders (ii) and (iii), we account for a rich set of proxies for background socio-economic status (we use parents' education level) and childhood conditions (we recover information on sanitary conditions and water access

[7] Another problem with FE estimations is that they rely on time variation only ("within" estimator) while variation in obesity status over the three years of the panel may not be sufficient. The advantage of QFE is also that "between" variation (across individuals) allows combining panel estimation and an IV strategy, as suggested hereafter.

during childhood) as well as information on current and past lifestyle choices (including eating greasy food, smoking and practicing physical exercise). While these controls are important, they may not cover the full set of unobservable factors or deal fully with reverse causality.[8]

Thus we also instrument fatness using genetic predisposition to obesity. A close measure of this is the *average fatness of biological relatives* (defined as a parent, child or sibling), which we use as our main instrument. This is motivated by the growing literature using genetic markers as instruments. The idea was first introduced by Cawley (2000) and has since been used in papers on the association between obesity and labor market outcomes (Cawley, 2004, Burkhauser and Cawley, 2004, Brunello and D'Hombres, 2007, Shimokawa, 2008, Davey Smith et al., 2009, Lindboom et al., 2010). The central argument is that strong association in body size between biological family members mainly reflects genetic factors. While the mean fatness of biological relatives may explain much of the individual propensity to be fat due to genetic transmission, as discussed in section 2.1, it is unlikely to affect SWB once all our controls are in place. We further discuss the validity of the instrument below.

3.2 Data

We use the Mexican Family and Life Survey (MxFLS), a nationally representative panel of Mexican households and individuals. It is conducted for two waves (2002 and 2005) and provides information on a wide array on social, economic, demographic and health behaviors. It contains an extensive health survey applied to all household members who participated in an in-home physical health assessment. Detailed information was collected on anthropometrics, health conditions, emotional well-being, chronic illnesses as well as self-reported health ratings. The initial sample size consists of $31,579$ women. In the analysis, we keep women aged 14 to 70 years old (which excludes 34% of the initial sample). We also take out pregnant and breastfeeding women (3%), observations with missing dependent or independent variables (15%), outliers for fatness measures (6%), which gives a working sample of $13,545$ observations.

Subjective Well-Being. Emotional well-being refers to the emotional quality of an individual's past four weeks. The related survey is composed of 21 questions asking respondents about the frequency at which they have experienced different feelings such as sadness, insecurity, sleeplessness, etc., during the past four weeks. In the original data

[8]Even longer panel would not help if time-invariant individual heterogeneity does not account for non-random shocks that can affect both SWB and fatness (for instance individual response to bad events that consists both in depression and fatness-increasing behavior, e.g. medication).

set, emotional well-being is measured on a 4−point scale with the following categories: "1. Yes, sometimes", "2. Yes, a lot of times", "3. Yes, all the time", and "4. No". This section was taken directly from a mental health questionnaire designed and tested by the *Mexican Institute of Psychiatry* to diagnose depressive syndromes among Mexicans. We make use of the questions that can be matched with the 12-item of the General Health Questionnaire (GHQ-12) that is widely used for assessing subjective well-being in economics and psychology (e.g., Clark and Oswald, 1994, 2002). GHQ-12 is usually found to be highly correlated with direct reports of overall life satisfaction and happiness. Exact question items used to construct our GHQ-10 measure of well-being from both MxFLS and referring to the original GHQ-12 questions are reported in Table A.1.[9] The scoring system simply consists in summing up the answers as it is done in the GHQ-12, which gives scores on a scale from 10 to 40. We have experimented alternative aggregation methods including Principal Component Analysis, which all lead to very similar results. We now turn to the independent variables.

Measures of Fatness. The covariate of interest in our analysis is the individual fatness measure. The primary measure for monitoring and studying the prevalence of obesity and its effects has historically been the Body Mass Index (BMI), calculated as weight (in kilograms) divided by the square of height (in meters). There is no doubt that the simplicity of the BMI and data availability have been key in drawing attention to obesity as a major public health problem. Nevertheless, the use of more accurate measures of fatness is increasingly advocated, specifically those reflecting the distribution of body fat as opposed to its total amount.[10] The richness of the MxFLS allow us to exploit the Weight-to-Height Ratio (WHtR), defined as the person's waist circumference divided by his/her height (both measured in centimeters). The WHtR is an index of central obesity that is gaining recognition in the scientific community. First, it is more sensitive than BMI to early warning of morbidity, mortality and other health risks associated with obesity. Second, it may allow the same boundary values for people from different genders, ethnicities and age groups (Ashwell and Hsiech, 2005). Finally, it is a 'shape' index, and thus a more 'visible' fatness indicator than BMI (Johanson et al., 2009). We shall report

[9] Only two items of the GHQ-12 could not be covered with the Mexican questionnaire while most of the unused questions appeared to be redundant with GHQ-12 questions.

[10] BMI may be skewed by very high muscle mass. There are other issues. The percentage of body fat increases with age while BMI may not reflect this increase (WHO, 1995). Also, the association between BMI and health varies with ethnicities. BMI may therefore incorrectly indicate obesity. For instance, Burkhauser et al. (2008) find that the rise in the prevalence of obesity is detectable 10–20 years earlier when obesity is defined using skinfold thikness instead of BMI. In a different but related context, Johansson et al. (2009) conclude to a risk that labor market penalties associated with obesity are measured with bias in the absence of measures of body composition.

our main results using WHtR as a continuous measure of fatness, or an obesity binary variable calculated using conventional thresholds of 0.60 for WHtR.[11]

Other Independent Variables. A detailed description of independent variables is reported in Table A.2. SWB estimations include socio-demographic variables like age, living in a rural area, log of per capita expenditure, marital status, a year dummy (2005 versus 2002) and dummy variables for the different Mexican states. Labor market conditions include being employed, voluntarily out of the labor force (housewife) or being job seeker. Because obesity is associated with many chronic illnesses, we account for them in our estimations, including diabetes, cardiovascular diseases (CVDs), arthritis and others (mainly cancers, migraine and gastric ulcer). We also make use of four lifestyle variables on nutrition habits (eat greasy food), practice of physical activity as well as present and past smoking behavior. Finally, family income might not reflect living standards earlier in childhood. However, as discussed above, obese people may come from a background with lower socio-economic status. Hence, we take into consideration parental education and childhood health conditions (access to piped water and sanitation at age 12).

3.3 Instruments

To construct our instrument, we use information on an individual's relation to the household head (spouse, father/mother, father/mother in law, son/daugther, son/daugther in law, brother/sister, etc.). This allows us to identify biological relatives of the head and of his/her spouse. We only consider relatives aged 14 years and over in the construction of the instrument since we also want to use their SWB to calculate a family mean SWB, as indicated above. Hence, our IV estimation is conducted on a smaller sample than the initial selection. The first sample ("IV1") uses information on the fatness of biological relatives (parents, siblings and/or children) to calculate mean fatness ($8,215$ observations). An even more restrictive version ("IV2") accounts for the mean fatness of parents and/or siblings only ($3,774$ observations).[12] Table A.3 in the Appendix provides summary statistics for the three main selected samples (baseline, IV1 and IV2). The main issue with the construction of IV samples is the necessary change in demographic composition. Samples IV1 and IV2 exclude two demographic groups, i.e. childless couples and single households, plus a negligible fraction of less typical household types. Nonetheless, Table A.3 shows

[11] A boundary value of 0.50 for WHtR indicates increased health risks for people in different age, gender and ethnic groups. The threshold of 0.60 has been proposed as the threshold for taking action. The latter gives a rate of obesity (32%) in our sample which is more comparable to the rate obtained with the BMI (28.5%), using the World Health Organization rule defining obesity as a BMI above 30.

[12] A third group ("IV3") collects individuals for which we have the fatness measures for both parents and siblings ($2,433$ observations). It is used for overidentification tests hereafter.

that fundamental characteristics are not affected by this selection. Figure A.1 in the Appendix additionally shows that for the remaining demographic groups, the exclusion of childless couples and singles does not considerably change the household structure of these samples compared to our baseline selection.

We make three important remarks on the validity of the instrument. First, its validity rests on the claim that the mean fatness of biological relatives explains much of the individual propensity to be obese through genetic transmission. Even if the transmission of behaviors, like eating habits, plays a role, recall that we control for lifestyle variables in our estimations. We also suggest an informal but important check of this claim. Columns (1) and (2) of Table A.4 in the Appendix report OLS estimates of individual fatness on parsimonious specifications including (1) the fatness of biological relatives, gender and age, (2) the latter plus parental education and childhood conditions. Clearly, there is a strong relationship between an individual's weight status and the body weight of her biological relatives, which suggests that we do not have a problem of weak instrument. The instrument alone explains 26.8% of the variance in individual fatness, which may be due to the fact that a significant part of the variation in body weight is genetic in origin (see also section 2.1). A comparison of columns (1) and (2) reveals that adding non-genetic factors that pertain to the family background and early life conditions does not have a noticeable effect on the explanatory power of the instrument. Despite the fact that we do not avail of a very broad set of family/childhood conditions, this piece of evidence tends to confirm that intergenerational correlation in obesity is greatly imputable to genetic variation while common family environment plays less of a role.

Second, a potential concern with our instrument is the fact that genes of obesity may be correlated with genes determining mental well-being. Mean fatness of biological relatives may indeed denote a family type characterized by high level of emotional distress. Moreover, even if relatives' obesity was purely random, living with obese relatives may affect one's SWB directly simply because these relatives have themselves higher chances of being depressed. For these reasons, it is important to account for individual effects (QFE) that may reflect the "family type" and, more importantly, to directly include a "family effect" in terms of mental well-being. As discussed above, all our estimations do include the mean SWB of biological relatives in the set of controls.[13] The coefficient on this family effect is highly significant and, in the OLS model, the R2 increases by 43%, pointing to strong genetic or shared environmental factors underlying the association between the respondent's and her family's mean well-being.

Finally, one may argue that $FATNESS_{it}$ depends on the heterogeneity in α_i and, in

[13]Note that we use the same definition of relatives as in the instrument, yet results are broadly unchanged when extending "family SWB" to all the relatives present in the household.

particular, on different social norms. Consider heterogeneous effects α_i across three income groups $i = 1(\text{poor}), 2(\text{middle}), 3(\text{rich})$, as we do in our estimations. If the rich suffer from obesity ($\alpha_3 < 0$) while overweight is a sign of prosperity among the poor ($\alpha_1 > 0$), then individuals in these different groups will behave differently.[14] We believe this is not an issue for our identification strategy. Indeed, identification is obtained within each group separately, not between groups.[15] For a given norm, and assuming that the norm is homogeneous within each group, the well-being effect of fatness is captured by how people diverge from this norm due to factors that are beyond their control. Once we account for family background, these factors are essentially the genetic variation in the propensity of being obese. Arguably, genetics may have been shaped by a weight-related norm that affected our parents or ancestors, yet it was certainly different from the current norm that influence how we perceive our own weight status. The current norm does affect the endogenous part of $FATNESS_{it}$, controlled for by lifestyle variables, but not the exogenous genetic variation used for identification.

4 Results

4.1 Main Results

Our main estimates are reported in Table 1. Alternative estimations include OLS, quasi-fixed effects (QFE) and instrumental variable (IV) approaches, as discussed above. Standard errors are calculated with clustering at the individual level to account for correlation in the error term of each individual present in both years of the panel. Since we are interested in heterogeneous effects that may reflect contrasted norms within Mexico, we report estimates α_i for the three income groups $i = 1, 2, 3$ as defined above.

OLS and Quasi-Fixed Effects Estimations. We start with estimations where $FATNESS_{it}$ corresponds to a simple dummy for obesity. OLS results, in column (1), show a positive effect of obesity on the GHQ-10 well-being index among the poor and a negative effect among the rich, with coefficients closer to zero in the middle group. Yet, none of these effects are statistically significant. In column (6), OLS estimations are conducted using a continuous measure of fatness (WHtR), which captures weight variation beyond the obesity threshold. The pattern is nonetheless similar, with a positive effect of fatness on the

[14] This is simply the consequence of our previous discussion in 2.3 on how norms influence behavior, and the subsequent association between the prevalence of obesity and income levels. This is also visible in Table A.2 where we report higher WHtR and obesity rates for the poor.

[15] As a matter of fact, separate estimations on the different income groups yield similar results to pooled estimations with interaction terms. This is certainly due to the lack of "common support" of explanatory variables like background conditions across groups.

poor and a negative effect on the rich. Both effects are this time statistically significant. In Columns (2) and (7), the panel dimension is used to eliminate some of the variation due to unobserved factors. Yet, probably because of limited variation in weight status over time, QFE estimates are very similar to OLS results. More (exogenous) variation is necessary to lift all concerns of endogeneity and we now turn to IV estimations.

Table 1: Impact of Obesity on Emotional Well-being of Mexican Women

Income Group	Coeff.	Obesity (binary)					Fatness (continuous)				
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		OLS	QFE	IV	IV + QFE	IV2	OLS	QFE	IV	IV + QFE	IV2
Poor	obese / WHtR	0.264	0.260	1.004**	1.053**	1.971***	2.641*	2.601*	6.735	6.995	16.15***
		(0.260)	(0.260)	(0.450)	(0.449)	(0.594)	(1.391)	(1.388)	(4.490)	(4.459)	(6.235)
	higher education	0.821	0.783	0.821	1.012	1.077	1.318	1.340	1.441	1.683*	0.448
		(1.033)	(1.035)	(1.015)	(1.035)	(1.106)	(1.060)	(1.050)	(1.002)	(1.005)	(1.111)
Middle	obese / WHtR	-0.0996	-0.0995	0.577**	0.557**	1.438***	-0.410	-0.409	5.650**	5.330**	6.014*
		(0.131)	(0.131)	(0.271)	(0.269)	(0.334)	(0.724)	(0.724)	(2.518)	(2.497)	(3.148)
	higher education	0.453**	0.455**	0.452**	0.432**	0.593**	1.312***	1.319***	1.502***	1.493***	1.507
		(0.218)	(0.218)	(0.217)	(0.218)	(0.248)	(0.327)	(0.327)	(0.335)	(0.336)	(0.976)
Rich	obese / WHtR	-0.232	-0.233	-5.101***	-5.052***	-1.575	-2.540*	-2.548*	-9.950**	-9.934**	-11.26**
		(0.236)	(0.236)	(0.732)	(0.747)	(1.869)	(1.498)	(1.500)	(4.567)	(4.590)	(5.136)
	higher education	1.008***	1.007***	0.988***	0.972***	1.271***	2.709***	2.697***	2.495***	2.472***	-1.385
		(0.274)	(0.275)	(0.268)	(0.270)	(0.380)	(0.739)	(0.739)	(0.717)	(0.724)	(2.177)
Instrument (a)		No	No	IV1	IV1	IV2	No	No	IV1	IV1	IV2
Individual effects (b)		No	QFE	No	QFE	No	No	QFE	No	QFE	No
R2		0.12	0.12	0.09	0.10	0.07	0.13	0.13	0.11	0.12	0.10
# Observations		8,215	8,215	8,215	8,215	3,774	8,215	8,215	8,215	8,215	3,774

Estimates are the effect of obesity dummy (obese=1 if WHtR>0.6) or WHtR (continuous) on GHQ-10 emotional well-being index, as well as the effect of higher education for comparison. Poor, middle and rich refer to quintiles 1, 2-4 and 5 of the income distribution respectively. (a) Instrument is mean fatness of parents, siblings & children (IV1), or of parents & siblings (IV2). (b) QFE: quasi-fixed effects estimations. *, **, *** : significant respectively at 10, 5 and 1 percent levels.

IV Estimations. We first use the mean WHtR of all biological relatives as the instrument (IV1). As argued above, mean fatness in the family has a strong explanatory power on individual fatness and this is primarily the reflection of genetic transmission. An inspection of the first-stage estimation, i.e. a regression of individual fatness on the full set of individual characteristics of the main model plus the instrument, confirms that this is a strong instrument. We find a coefficient of .318 on mean WHtR,[16] significant at the 1% level, and the F-test passes the standard threshold of 10 by a very large margin (F-statistic of 541). Results of the second-stage estimation with binary obesity are re-

[16] This coefficient was .401 in the slightly more specific first-stage estimation presented in Table A.4 (column 2). Similar estimates are also found in Cawley (2004).

ported in column (3) of Table 1. They confirm the existence of contrasted effects across the different income groups, with positive effects on the poor/middle income groups and a very large depressing effect of obesity on the rich. All the coefficients are now significant. When continuous fatness is used, we observe the same trend in column (8) and particularly a more pronounced poor/rich divide than with OLS or QFE estimates. The coefficient for the poor is now less precisely estimated, and not significant, while the middle group shows a significant and positive effect of fatness on well-being. Larger positive effects on the poor/middle groups compared to OLS estimates confirm the existence of a downward bias, which could be caused by omitted factors affecting well-being negatively and contributing to weight gains. Combining IV and QFE in columns (4) and (9) does not change our conclusions. Columns (5) and (10) report estimation results when narrowing the instrument to be the mean fatness of parents and siblings only (IV2), rather than *all* biological relatives. Moving from IV1 to IV2 necessarily affects the results drastically due to the considerable reduction in sample size and the change in household structure. Nonetheless, the main pattern is preserved, with the usual divide between poor/middle and rich Mexican.[17]

Interpretation and Magnitude. The contrasted effects of weight status across income groups are well in line with the discussion in section 2 and the role of norms underlying a Kuznet curve of obesity. The increasing prevalence of obesity as income rises is consistent with a status effect, i.e. the fact that fatness may be a sign of prosperity or at least of making one's way out of poverty. Moving further up the income ladder is associated with increased health consciousness and stigma resulting from the adoption of different, possibly Western norms. This is exactly the pattern unveiled in our estimation: a positive effect among the poor, positive but smaller effect in the middle group and a very negative effect in the top of the distribution. If these results reflect the social and psychological effects of fatness on SWB, and the way it is affected by different norms, then there is serious concerns that these norms encourage obesity among the poor and, in this way, exacerbate health inequality in Mexico.

It is interesting to get a sense of how large these effects are. In fact, becoming obese increases (decreases) the well-being of the poor (rich) by around a quarter of (1.2 time) a standard deviation in GHQ-10 or by around 4% (19%) compared to the average SWB.

[17] The first-stage estimation shows a coefficient of .359 on the instrument, significant at the 1%. The F-test again passes the threshold of 10 by a large margin (F-statistic of 314). Note that with a sample where *both* parents and siblings are observed (IV3 sample), we can perform overidentification tests to check the exogeneity of the instruments. The drawback is of course that this sample is even smaller, i.e. around 2/3 of IV2. We use the two distinct variables as separate instruments: mean WHtR of the parents and mean WHtR of the siblings. In the first-stage estimation, the F-statistic is 185 (relevant instruments) and the p-value of the Sargan/Hansen test is 0.65, i.e. instruments pass the exogeneity requirement.

To get a better notion of the magnitude of these effects, Table 1 actually compares the coefficient on obesity to the coefficient on "higher education" (the omitted education category is "no education"). The effect of receiving higher education is of similar magnitude for all groups, yet insignificant among the poor (possibly because too few of them have this chance) and smaller among the middle income group. Columns (3)-(5) show that for the poor/middle groups, the effect of obesity is of the same order of magnitude as being educated (it is arguably larger in some specifications). This is in line with the interpretation in terms of social status suggested above. For the rich, however, being obese has a much larger impact (in absolute value) on emotional well-being, at least when IV1 is used. Indeed, its depressing effect is around five times larger, in absolute terms, than the positive impact of being educated. This is a large effect, all the more so as it excludes other negative consequences of obesity on well-being through channels like health and labor market outcomes (we investigate their role in more detail below).

4.2 More Heterogeneous Effects and Indirect Effects

Previous results have focused on an heterogeneous effect across broad income groups. The way social norms affect the relationship between obesity and SWB may well be defined along other, more qualitative but nonetheless relevant dimensions. In Table 2, we replicate our SWB estimations on sample IV1 while interacting individual obesity with education, employment status and a dummy for living in a rural area. Overall, these estimates tend to confirm our story and are in line with Graham and Felton (2005) for the US: Mexican women tend to be positively affected by excess fatness when they belong to the non-educated and rural groups, as well as when they are not employed (70% of women according to Table A.3). Effects are often not significant for the other group of educated, urban and employed women, which may be due to the fact that this group is small. Yet the sign of the coefficients are almost always negative for them, across all specifications. Note that these other dimensions of heterogeneity are just as important as income. Cultural beliefs about obesity and overweight may vary between rural areas and cities where norms, health care services and knowledge can evolve more rapidly (but pervasive western/US influence on food habit as well). Similarly, more educated women may be more aware of the health debilitating consequences of obesity and are negatively affected by over-weight.

We have also conducted estimations that differ according to profession status and occupational groups among a sub-sample of employed women (table of estimates available from the authors). We find that the negative SWB effect of excess fatness is particularly pronounced and statistically significant for women in services and sales, i.e. activities which

require more exposure. Women in occupations which involve to deal with customers or other types of social contacts may face more discrimination related to body size.

Table 2: Impact of Fatness on Emotional Well-being: Heterogeneity

	(1)	(2)
	IV	IV + QFE
Obese x educated	-3.662**	-3.580**
	(1.761)	(1.758)
Obese x uneducated	1.769***	1.724***
	(0.637)	(0.637)
Obese x working	-0.490	-0.492
	(1.823)	(1.807)
Obese x not working	1.260*	1.224
	(0.751)	(0.749)
Obese x urban	-1.307	-1.341
	(1.130)	(1.128)
Obese x rural	2.617**	2.600**
	(1.128)	(1.128)
# obs.	8,215	8,215

Notes: Dependent variable = GHQ-10 emotional well-being index. IV estimations of the effect of dummy variable obese (WHR>0.60). Instrument is mean fatness of parents, siblings & children (IV1).

Finally, we suggests alternative estimations where health status, marital status and labor market conditions are progressively added in the SWB equation. In this way, we can check whether the coefficient on obesity captures a direct effect of excess fatness, as we have claimed in this study, or is only a proxy for the indirect channels through which obesity affects individual well-being. Results in Table 3 show that the effect of obesity is relatively stable across the different specifications, which indeed support the idea that obesity has its own independent effect of mental health. The main exception is the effect of health in the middle income group. Since obesity is associated with bad health conditions, as discussed in section 2, ignoring health status considerably reduces the positive effect of obesity in this group. Controlling for objective health measures – i.e. moving from columns (2) to (1), (4) to (5) or (8) to (7) – leads back to the positive effect of health that we describe in our baseline results. These checks confirm that the effect of obesity emphasized in our main analysis is by and large a direct social and psychological effect of obesity on well-being, related to norms and social aspects. At least in the two tails of the income distribution, this independent effect is not affected by the health or labor market channels through which obesity may affect well-being.

Table 3: Sensitivity of SWB Effect of Obesity to Indirect Channels

Income Group	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Poor	0.981**	0.911**	0.858*	0.903*	0.959**	0.997**	0.913*	0.930**
	(0.450)	(0.463)	(0.479)	(0.467)	(0.456)	(0.444)	(0.472)	(0.459)
Middle	0.598**	0.389	0.465*	0.477*	0.656**	0.602**	0.645**	0.393
	(0.269)	(0.280)	(0.276)	(0.276)	(0.268)	(0.269)	(0.269)	(0.279)
Rich	-5.143***	-5.365***	-5.392***	-5.399***	-5.169***	-5.145***	-5.170***	-5.376***
	(0.698)	(0.729)	(0.736)	(0.733)	(0.701)	(0.698)	(0.701)	(0.725)
Controlling for:								
Health status	Yes	No	No	No	Yes	Yes	Yes	No
Marital status	Yes	Yes	No	No	No	Yes	No	Yes
Employment	Yes	Yes	Yes	No	No	No	Yes	No
R-squared	0.09	0.06	0.05	0.04	0.07	0.09	0.08	0.06
# obs.	8,215	8,215	8,215	8,215	8,215	8,215	8,215	8,215

Notes: Coefficients report the effect of obesity dummy on GHQ-10 emotional well-being index in our IV estimation (IV1: mean weight of parents, siblings & children as instrument). All regressions control for the full set of covariates. *, **, *** : significant respectively at 10, 5 and 1 percent levels.

5 Conclusion

We explore the effect of fatness on mental health in Mexico. We focus on this country not only because of its world record in the prevalence of obesity, but also because extreme inequality can be exploited to characterize contrasted body-type norms. An heterogeneous effect of excess body size on well-being does indeed emerge from our results, pointing to a negative effect on the rich in sharp contrast to the positive effect on the poor and middle income groups. This pattern is relatively robust to alternative estimation strategies aimed at guarding us against reverse causality and omitted variable issues. Heterogeneity along other dimensions, like education and being rural, provides a consistent picture and supports the social norm interpretation. Traditional (poor, rural, uneducated) Mexico is similar to other poor regions of the world where being fat may be a sign of someone escaping poverty. Closer to Western standard, modern (rich, urban, educated) Mexico stigmatizes the obese. While this pattern is made possible by the coexistence of very contrasted groups in a country like Mexico, it is also in line with international comparisons. In rich countries, large bodies are socially discrediting and obesity comes at high emotional costs (e.g. Stutzer, 2007; Oswald and Powdthavee, 2007). Middle income countries may show fat neutral or even positive attitude toward weight taken as a symbol of wealth and higher social status (e.g. Graham and Felton, 2005, for Russia, or the present study for Mexico).

The main message of our study is that the contrasted perceptions of obesity, as revealed by SWB regressions, may enhance health inequality and contribute to the pandemic of obesity in emerging economies. Poor segments of the population do not seem to be

emotionally affected by obesity, which implies that they may not be sufficiently aware of the damaging effects of obesity on health or other outcomes. We conclude to the importance of directing health messages towards these groups. In particular, health and obesity prevention programs should be encouraged and directed toward those with low socio-economic status and living in rural areas. More efficient communication could also be designed if we better understand peer effects and contagion through networks. In the present study, we have ignored these aspects as SWB regressions aimed at providing a relatively broad picture of heterogeneous obesity effects. It is nonetheless important to understand diffusion mechanisms at a very disaggregated level. While much research has been conducted on social multipliers (Trogdon et al., 2008; Cohen-Cole and Fletcher, 2008; Fowler and Christakis, 2008) and the mechanisms through which peer effects operate regarding eating habits (Fortin and Yazbeck, 2011), further work should attempt to (i) collect appropriate data for developing countries deeply affected by obesity, (ii) understand how public policies can benefit from network effects.

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A Appendix

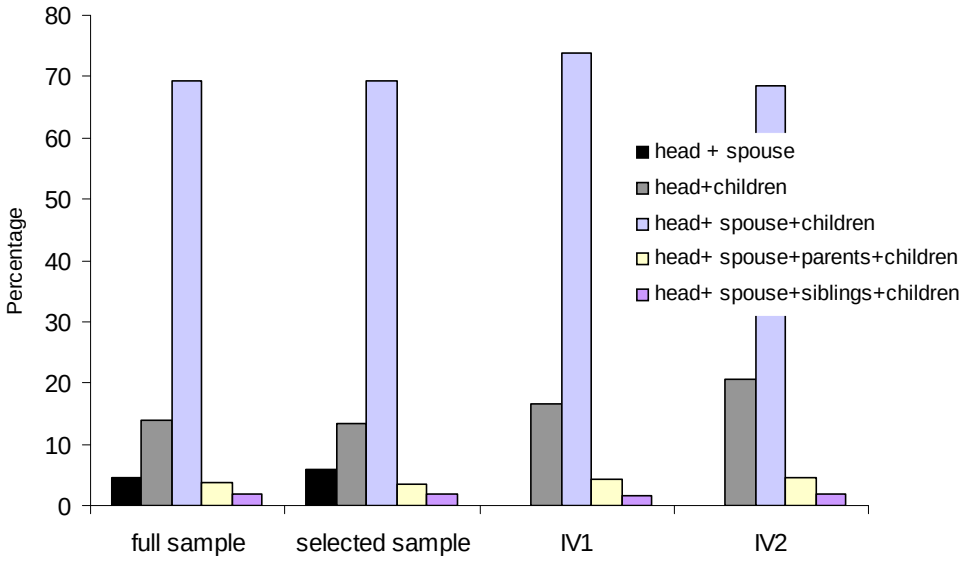

Figure A.1: Household Structure of the Different Selected Samples

Table A.1: Construction of GHQ Index of Emotional Well-Being

GHQ-12 measure of well-being	Equivalent in MxFLS Emotional well-being questionnaire*
1- When you are doing something, do you find that: 1) Can concentrate 2) Attention occasionally diverted 3) Attention sometimes diverted 4) Attention frequently diverted, cannot concentrate	In the last 4 weeks, have you had difficulties to focus on your daily activities?
2-Do you often lose sleep over worry? 1)Not at all 2) Occasionally 3)Fairly often 4)Very often	In the last 4 weeks, have you badly slept at night?
3- Can you play useful part in things? 1)Always can 2)Can play some positive roles 3)Can play positive roles poorly 4)Cannot play a positive role.	In the last 4 weeks, have you felt useless to your family?
4- Are you capable of making decisions? 1)Always have own opinions 2) Sometimes have own opinions 3)Do not have many own opinions 4)Do not have any personal opinion at all	No match
5-Are you constantly under strain? 1)Never 2)Sometimes 3)Fairly often 4)Very often	In the last 4 weeks, have you felt 1- nervous, sorrowful, anxious, or eager more than normal? 2- more irritated, or more angry than normal?
6- Do you feel you couldn't overcome difficulties? 1)Never 2) Sometimes 3)Fairly often4)Very often	In the last 4 weeks, have you felt fear of some things, as if you were waiting for something serious to happen?
7-Are you able to enjoy day-to-day activities? 1)Very interesting 2) Fairly interesting3)Not very interesting 4)Not interesting at all	In the last 4 weeks, have you lost interest on things?
8-Are you able to face problems? 1)Never 2) Seldom 3) Sometimes 4) Always	No match
9-Do you feel depressed? 1)Not at all 2) A little bit 3)Fairly seriously 4)Very seriously	In the last 4 weeks, have you 1- cried or felt like crying? 2- felt pessimist, or have you thought things will go wrong? 3-woken up spiritless (due to lack of energy or fear)?
10- Do you always lack confidence? 1)Not at all 2) A little bit 3)Fairly seriously 4)Very seriously	In the last 4 weeks, have you felt insecure, or lacking confidence in yourself?
11- Do you often think that you have no value? 1)Not at all 2) A little bit 3)Fairly seriously 4)Very seriously	In the last 4 weeks, do you think you have had a decrease in job performance or in daily activities?
12- Are you happy when you consider each aspect of your life? 1)Very happy 2)Fairly happy 3)Not very happy 4)Not happy at all	In the last 4 weeks, have you felt sad or anguished?

** answers are: 1. "Yes, sometimes", 2. "Yes, a lot of times", 3. "Yes, all the time", and 4. "No"*

Table A.2: Independent Variables Descriptions and Construction

Variables	Construction
Age	Continuous variable in years.
Community dassification	Communities were dassified by size, and four dummy variables were created following this dassification: 1) more than 100,000 inhabitants; 2) 15,000-100,000 inhabitants; 3) 2,500-15,000 inhabitants; 4)below 2,500 inhabitants. These four categories were then regrouped into a dummy variable: (1) rural (below 15,000 inhabitants), (0) otherwise.
States	13 dummy variables were created for the following Mexican states: Mexico, Sinaloa, Sonora, Veracruz, Yucatan, Yucatan, Baja California, Coahuila, Distrito Federal, Durango, Guanajuata, Jalisco, Michaacan, Morelos, Nuevo Leon, Oaxaca, and Puebla.
Education	Accordng to the International Standard Classification of Education (ISCED 97), the highest attained educational level was divided into four categories: `Without instruction', `Incomplete elementary school', `Incomplete junior high' and `More than junior high' education.
Household expenditures	Total household annual expenses were deflated by the number of adult equivalents in order to capture differences by age and economies of scale in consumption. The adopted approach to define the number of adult equivalents is the Oxford scale also known as the "old OECD scale". The oxford scale transforms the number of members into effective adult equivalents using the formula: AE= 1+ 0.7 (NADULTS -1) + 0.5 NCHILDREN , where AE refers to adult equivalent. The coefficient The coefficient 0.7 reflects economies of scale. The smaller this parameter, the more important economies of scale are considered to be. This is one of the most commonly used equivalence scales as parameters can be set at sensible values following the wealth and development level of each country. We use household consumption rather than income because expenditures tend to be less understated in less developed countries and most households engage in some consumption smoothing.
Marital status	Marital status was categorized as `single', currently `married' or `separated'. In this latter category were grouped separated, divorced, and widowed individuals.
Employment	Respondents were asked about their activity status using the question: "What was your main activity last week?". Persons who were attending school, retired or housewives/masters are dassified as `out of labor force'. Considered as employed are persons who engaged in an activity to help household expenditures in the reference week, as well as those who answered "yes" to the question "Do you have a job (or develop any activity that help the household expenditure), but didn't attend the past week?". Otherwise, individuals were categorized as `unemployed'.
Chronic Illnesses	The MxFLS asked individuals whether they have been diagnosed (by a doctor) with any chronic illness. I define a dummy variable for cardiovascular diseases `CVDs' which takes the value 1 if the subject dedares herself to be diagnosed with hypertension or heart disease, and 0 otherwise. Two other dummy variables were constructed for `Diabetes' and musculoskeletal disease. This later takes the value 1 if individual dedares to suffer from `Arthritis', 0 otherwise. All other categories of chronic illnesses proposed in the list (cancer, migraine, and gastric ulcer) were captured by a dummy called `Other chronic' that takes the value 1 if the women in question have been diagnosed with any of those diseases and 0 otherwise.
Smoking	Smoking was categorized as `smoker', `ex-smoker' or `non-smoker'. Current smokers were respondents who reported to have ever had the habit of smoking and to have never quit it in a frequent way. Ex-smokers were those who reported to have quit smoking. Otherwise, subjects were dassified as non-smokers.
Physical exercise	`Physical exercise' was deemed to apply to cases in which the individuals in question acknowledged making physical exercises as a routine during week days.
Parental education	Similar to individual's own education
Acces to piped water at age 12	Respondents were asked about the source of drinking water at which they had access at age 12. A dummy variable was created for each of the following response options: decanter, turbed inside the house, turbed outside the house, from a track, and carrying.
Sanitary services at age 12	Respondents were asked about the type of sanitary service of their dwelling at age 12. A dummy variable was created for each of the following response options: toilet, letrine, blind well, or no sanitary service.

Table A.3: Summary Statistics

		Baseline sample		IV1 sample		IV2 sample	
		Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Dependent variable							
GHQ-10		26.30	3.99	26.27	4.02	26.80	3.80
Fatness							
WHtR	all	0.560	0.09	0.56	0.09	0.51	0.08
	poor	0.561	0.10				
	middle	0.559	0.09				
	rich	0.549	0.09				
Obese % (WHtR > 0.6)	all	0.320	0.46	0.31	0.46	0.14	0.33
	poor	0.331	0.47				
	middle	0.323	0.47				
	rich	0.273	0.45				
Socio-economic charact.							
Age		36.54	14.81	36.27	15.14	23.37	8.98
Rural (%)		0.57	0.50	0.57	0.50	0.57	0.50
Log per capita household exp.		8.93	0.94	8.87	0.93	8.84	0.92
Married or cohabitating (%)		0.62	0.49	0.50	0.50	0.12	0.32
Separated or widowed (%)		0.10	0.31	0.11	0.32	0.06	0.24
Single (%)		0.28	0.45	0.39	0.49	0.82	0.38
Without instruction (%) *		0.10	0.30	0.09	0.29	0.02	0.13
Elementary (%) *		0.70	0.46	0.68	0.47	0.61	0.49
Junior-high school (%) *		0.14	0.35	0.15	0.36	0.26	0.44
Labor market charact.							
Employed (%)		0.30	0.46	0.32	0.47	0.36	0.48
Not in labour force (%)		0.68	0.47	0.65	0.48	0.59	0.49
Job seeker (%)		0.03	0.16	0.03	0.18	0.05	0.23
Health: chronic Illness							
CVDs (%)		0.13	0.34	0.12	0.33	0.04	0.20
Arthritis (%)		0.05	0.21	0.05	0.21	0.02	0.13
Diabetes (%)		0.06	0.24	0.06	0.24	0.01	0.11
Other (%)		0.14	0.35	0.14	0.35	0.10	0.31
Lifestyle behavior							
Eat greasy food (%)		0.30	0.24	0.30	0.24	0.32	0.25
Physical activity (%)		0.13	0.33	0.13	0.34	0.17	0.37
Smoker (%)		0.04	0.20	0.04	0.20	0.04	0.19
Ex-smoker (%)		0.03	0.16	0.02	0.15	0.02	0.13
Background/childhood conditions							
Parents: without instruction (%) *		0.25	0.43	0.24	0.43	0.08	0.26
Parents: elementary (%) *		0.60	0.49	0.62	0.48	0.72	0.45
Parents: junior-high school (%) *		0.10	0.31	0.08	0.28	0.12	0.33
Early life conditions **							
Instruments							
Average WHtR of biological relatives				25.37	4.26	26.89	3.85
Average BMI of biological relatives				0.52	0.08	0.56	0.07
# observations		13,545		8,215		3,774	

* omitted group is "more than junior or high school"

** not reported, include: type of sanitary service at age 12, source of drinking water at age 12

Baseline sample used for OLS, RE and QFE estimations. IV1 (resp. IV2) sample used with average fatness of all biological relatives (resp. parents and siblings) as instruments.

Table A.4: Correlation Between Own and Biological Relative's WHtR

	(1)	(2)
Mean WHtR of biological relatives (a)	0.402***	0.401***
	(0.0142)	(0.0143)
Type of sanitary service at age 12 (b)		
Letrine		-0.000298
		(0.00240)
Blind well		0.00417
		(0.00423)
No sanitary service		0.00130
		(0.00320)
Source of drinking water at age 12 (b)		
Turbed inside the house		-0.00310
		(0.00226)
Turbed outside the house		-0.00565
		(0.00388)
Carrying		-0.00209
		(0.00870)
From a track, other		-0.00282
		(0.00333)
Parental highest level of Education (c)		
Incomplete elementary		-0.00374
		(0.00366)
Incomplete junior high		-0.00717
		(0.00441)
More than junior high		-0.00861*
		(0.00454)
Constant	0.221***	0.229***
	(0.00774)	(0.00891)
Observations	7,012	7,012
R-squared	0.268	0.269

Note: Dependent variable is our fatness measure (WHtR). *, **, *** : significant respectively at 10, 5 and 1 percent levels. (a) Mean WHtR of parents and siblings (IV2 sample). (b) Omitted categories is "decanter" for access to piped water and "toilet" for sanitation at age 12. (c) Omitted category is "no instruction" for parental education.