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Economic Evaluation of the effect of Quitting Smoking on Weight Gains: Evidence from the United Kingdom

Luca Pieroni, PhD[1],*, *L. Minelli, MS*[2], *L. Salmasi, PhD*[1]

[1]*Department of Political Science, University of Perugia, Perugia, Italy;* [2]*Department of Experimental Medicine, Public Health Section, University of Perugia, Perugia, Italy*

ABSTRACT

Objective: This article estimated the causal effect of quitting smoking on body weight gains in the United Kingdom to evaluate whether savings in health costs deriving from smoking prevention and its related diseases are greater than the costs associated with increased obesity. **Methods:** We used a longitudinal data set extracted from two waves (2004–2006) of the British Household Panel Survey, which includes information on smoking and a large number of sociodemographic variables. We modeled the effect of quitting smoking on body weight accounting for heterogeneous responses from individuals belonging to different clinical classes of body mass index (BMI) (i.e., overweight and obese individuals). National Health Service costs associated with smoking were then used to implement a cost-benefit analysis, comparing the advantages of smoking reductions with the costs associated with increased obesity. **Results:** The BMI was found to increase by 0.26 points for quitters compared with those who continued to smoke. The estimated BMI increase was larger for overweight (0.49 points) and obese (0.76 points) people. This result does not change when different control groups are examined. From an economic perspective, the National Health Service cost reductions attributable to quitting smoking were £156.81 million whereas the lost benefit for unintended increases in body weight was £24.07 million. **Conclusions:** This article found that the health benefits associated with quitting smoking are greater than the costs associated with increased overweight and obesity.

Keywords: Obesity, quitting smoking, BHPS dataset, health care costs and benefits.

Introduction

In the last few decades, obesity has become a substantial risk factor for a number of severe and chronic diseases that constitute the main causes of death, including heart disease, strokes, some types of cancer, and other serious life-shortening conditions such as type 2 diabetes. Similar patterns of the prevalence of overweight and obesity are shown in the United States and Europe, although in the old continent they reach a lower absolute level [1].

In the United Kingdom, obesity has constantly risen by 8 to 9 percentage points over the last 15 years, sex trends being similar. The burden on the National Health Service (NHS) associated with the excess weight was estimated to have increased in the period 1998 to 2006 from 1.5% to 2.6% of total health expenditure. Estimates by the NHS forecast that the cost to the service, directly attributable to obesity, may rise to £5.3 billion by 2025.

Over the last two decades, another clearly evident trend that has pervaded Western countries has been the decline in the rate of smoking. Simultaneous examination of smoking and body weight trends has led to mixed evidence on this relationship [2–5], although some recent works have established the existence of a significant negative causal nexus between smoking and body weight [6–10]. This result is also supported by the medical literature, which shows how smoking reductions imply changes in metabolic rates and eating habits, leading to the unintended consequence of weight gains [11–13]. These studies, however, never analyzed whether the savings in health care costs associated with quitting smoking were larger or smaller than the increased costs required in treating obesity.

In this article, we sought to contribute to this literature by comparing social costs due to increased obesity with benefits from quitting smoking in the United Kingdom. To achieve this aim, we evaluated the heterogeneous effects of quitting smoking for individuals belonging to various body mass index (BMI) clinical classes. We used a longitudinal data set extracted from two waves (2004–2006) of the British Household Panel Survey (BHPS) that includes information on smoking and a large number of sociodemographic variables. We exploited the fact that we observed a random sample of the population of smokers in two periods, in which some subjects made the transition from smoking to nonsmoking status. Our model allowed us to include

* *Address correspondence to:* Luca Pieroni, Department of Political Science, University of Perugia, Via Pascoli 20, Perugia 06123, Italy. E-mail: luca.pieroni@unipg.it.

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a full set of interactions between treatment and BMI classes. In this way, we could estimate the effect of changes in smoking habits on BMI for overweight and obese individuals, which are of particular interest for policymakers.

Our empirical strategy used a *difference-in-differences* (DID) approach to control for time-invariant unobservable confounders and used various "control groups," in addition to the natural control group of "smokers," to account for other possible sources of bias related to reverse causality or omitted variables.

The article is organized as follows. First, we document a significant increase in body weight for quitters. Although point estimates are not very large in magnitude, weight is found to increase particularly in obese individuals. Second, sensitivity analysis generally confirms these findings when various control groups are used to account for various sources of bias. Third, results from a cost-benefit analysis indicate that quitting smoking implies much larger savings in health costs than the costs required in treating increased obesity.

Estimates of Health Care Costs Generated by Smoking and Obesity in the United Kingdom

There are very many works estimating the NHS costs of obesity and smoking in the United Kingdom, and so choosing which source to adopt to obtain reliable estimates is more difficult. Concerning the economic costs of smoking-related ill health in the United Kingdom, we follow the systematic review by Allender et al. [14]. The authors compared studies published between 1997 and 2007 and calculated the burden of ill health due to smoking in each country of the United Kingdom. In particular, population-attributable fractions for smoking-related diseases from the World Health Organization's Global Burden of Disease Project were applied to NHS cost data to estimate direct financial costs. After analyzing more than 4000 articles, the above authors concluded that 109,164 deaths were attributable to smoking-related disease in 2006, which were responsible for £5.17 billion in health care costs (5.5% of total health care costs).

In our assessment of weight excess in the United Kingdom, we preferred to use the study by The House of Commons Health Select Committee [15]. That study estimated that the total cost attributable to obesity (i.e., for individuals with a BMI of >30) was about £3340 million to £3724 million in 2002. About 30% of total costs were due to the direct health care costs of treating obesity and its consequences, including general practitioner consultations, in-patient and day case admissions, outpatient attendance, and the cost of drugs. The costs of treating obesity and its consequences were 2.3% to 2.6% of the NHS expenditure. The greater part of these costs, however, was attributable to treating the consequences of obesity, rather than obesity itself, including cardiovascular diseases, type II diabetes, stroke, angina, osteoporosis, and various types of cancers. There were also obesity-related costs generated by lost earnings (i.e., lost potential national output), which could be directly attributed to obesity. These were reported by McCormick and Stone [16] to be in the range of £2350 million to £2600 million, of which about 50% were attributable to premature mortality due to obesity and the other 50% to consequences of certified diseases related to obesity.

In this article, we used only direct costs to compare social costs due to increased obesity, with benefits from quitting smoking, because we did not have information about smoking costs generated by lost earnings and also because, as suggested by Morris [17], estimates of indirect costs connected with lost earnings are largely underestimated.

Methods

Data

The data set used in this work were extracted from the multipurpose BHPS, which reports information at both household and individual levels for a representative sample of the UK population. The original sample was composed of 5,500 households and 10,300 individuals, drawn from 250 areas of England, and was subsequently enlarged to include Scotland and Wales in 1999 and Northern Ireland in 2002. The data set has 18 waves: the first survey was conducted in 1980, but, for our purposes, we used a sample of two waves, the 14th and 16th waves, conducted, respectively, in 2004 and 2006 because data on height and weight were also collected. Although these two anthropomorphic characteristics were self-reported, the potential measurement errors over time are limited by the reduced time span covered by our sample (see, e.g., Shiely et al. [18]). We selected a balanced panel of 13,320 individuals for whom we had information about smoking habits and height and weight, which allowed us to calculate their BMI. Attrition is unlikely to be a problem in our data because the number of individuals who dropped out between the above two waves was quite limited. (The original sample was composed of 26,640 individuals, a number that later fell to 26,469. We also tested for differences between covariate distributions before and after balancing, and these were found not to be relevant. The tables are available from the authors upon request.) In fact, because nonresponse rates between 2004 and 2006 were very low, attrition problems were not likely to arise.

Model Structure

We examined a benchmark model in which BMI_{it} is the continuous measure of the BMI of an individual i at time t, and in which some fraction of the population reduces its cigarette consumption (e.g., nonrandom treatment). That is, individuals were observed in the pretreatment period $t=0$ and in the posttreatment period $t=1$, during which $D_{it}=1$ if an individual was exposed to the treatment between $t=0$ and $t=1$ and $D_{it}=0$ if not (control group).

From a theoretical point of view, we assumed that subjects "treated" in $t=1$ decided to reduce their smoking up to the extreme case of "zero cigarettes smoked" (i.e., quitting), a situation that is of great interest in the health economics literature [19,20]. With these premises, estimation of the causal effect of smoking on BMI was hindered by the presence of indigeneity, due to unobservable characteristics or reverse causality. To solve this problem, part of the literature uses a DID strategy with panel data (see, e.g., Baum [6] and French et al. [21]), which accounts for individual unobservable time-invariant characteristics affecting cigarette consumption and weight differently for treatment and control groups.

In view of the panel nature of our data set, we also adopted the DID approach and controlled for indigeneity by defining different control groups, to take account of the bias induced by reverse causality or time-varying unobservable characteristics (for more details, see the next section). We assumed that the outcome of interest (i.e., BMI) was generated through a component of variance process. A sufficient condition to identify the effect of smoking status changes is that selection for treatment, conditional on covariates, does not depend on individual transitory shocks. Because overweight and obese individuals are of great interest to policymakers, because preventing weight excess produces both significant gains in terms of health and reductions in terms of costs for treating their related illnesses, we considered possible heterogeneous treatment effects across BMI clinical