Social Science & Medicine 82 (2013) 67–78

Contents lists available at SciVerse ScienceDirect

Social Science & Medicine

journal homepage: www.elsevier.com/locate/socscimed

# The impact of state-level nutrition-education program funding on BMI: Evidence from the behavioral risk factor surveillance system

Kerry Anne McGeary [a,b,c,*]

[a] Department of Economics, Miller College of Business, Ball State University, Muncie, IN 47306, USA
[b] Global Health Institute, Ball State University, Muncie, IN 47306, USA
[c] National Bureau of Economic Research, Cambridge, MA 02138, USA

ARTICLE INFO

*Article history:*
Available online 30 January 2013

*Keywords:*
United States
Obesity
Nutrition education
Price policy
Heterogeneity
Endogenous effects

ABSTRACT

Currently, there is insufficient evidence regarding which policies will improve nutrition, reduce BMI levels and the prevalence of obesity and overweight nationwide. This preliminary study investigates the impact of a nutrition-education policy relative to price policy as a means to reduce BMI in the United States (US). Model estimations use pooled cross-sectional data at the individual-level from the Centers for Disease Control's (CDC), Behavioral Risk Factor Surveillance System (BRFSS), state-level food prices from the American Chamber of Commerce Research Association (ACCRA) and funding for state-specific nutrition-education programs from the United States Department of Agriculture (USDA) from 1992 to 2006. The total number of observations for the study is 2,249,713 over 15 years. During this period, federal funding for state-specific nutrition-education programs rose from approximately $660 thousand for seven states to nearly $248 million for all fifty-two states. In 2011, federal funding for nutrition-education programs reached $375 million. After controlling for state-fixed effects, year effects and state specific linear and quadratic time trends, we find that nutrition education spending has the intended effect on BMI, obese and overweight in aggregate. However, we find heterogeneity as individuals from certain, but not all, income and education levels respond to nutrition-education funding. The results regarding nutrition-education programs suggest that large scale funding of nutrition-education programs may improve BMI levels and reduce obesity and overweight. However, more study is required to determine if these funds are able make the requisite dietary improvements that may ultimately improve BMI for individuals from low income and education-levels.



## Introduction

The average US Body Mass Index (BMI), defined as weight in kilograms divided by height in meters squared ($kg/m^2$), has increased dramatically since the 1980s. Due to this rise, more Americans are classified as overweight (BMI $>$ 25 $kg/m^2$) and obese (BMI $>$ 30 $kg/m^2$). This increase has serious implications for the state of national health. A substantial amount of cross-disciplinary research has investigated the potential reasons for the increase. The economics literature attributes the dramatic increase in average BMI to economic changes that alter Americans' preferences for exercise and high calorie, low-nutrient food and drinks (Cawley, 1999; Chou, Grossman, & Saffer, 2004; Cutler, Glaeser and Shapiro, 2003; Lakdawalla & Philipson, 2002; Philipson, 2001).

To incentivize proper nutrition, economic policies typically suggest altering the price of and/or access to low-priced foods that offer lower nutritional content. However, invoking policies affecting access or price may result in regressive effects that disproportionately and negatively impact those who are from a lower socioeconomic status without resulting in change. For this reason, other strategies that directly target consumer information may be more effective in reducing demand without imposing regressive losses on the most economically vulnerable.

This paper offers a preliminary study of the impact of federal spending on nutrition-education programs on three commonly examined weight outcomes: BMI, obesity and overweight. Despite a wealth of research on nutrition-education programs from other disciplines, such as public health and nutrition, the current literature fails to provide an *aggregate* economic analysis that compares different policies and the policies overall effects on BMI, obesity and overweight. The goal of this paper is to evaluate the impact of using nutrition-education programs to reduce individual-level BMI, obesity, and overweight, and to determine

* Department of Economics, Miller College of Business, Ball, State University, Whitinger Building 129, 2000 W. University Ave., Muncie, IN 47306, USA. Tel.: +1 765 285 4440; fax: +1 765 285 4313.
*E-mail address:* kmcgeary@bsu.edu.

0277-9536/$ – see front matter © 2013 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.socscimed.2013.01.023

this impact relative to price changes. To achieve this goal, we use over 2.2 million individual-level observations from the 1992–2006 waves of the Behavioral Risk Factor Surveillance System (BRFSS) from the CDC. The individual-level BRFSS data are matched by state and year with: 1) real cumulative funding for nutrition-education programs (per million) and 2) real food prices. While the use of real food prices are not controversial, the use of real cumulative funding warrants some explanation. We argue that the dynamic nature of obesity, e.g., the fact that it results from a *cumulative* increase in BMI, demands the use of real *cumulative* funding when compared to *contemporaneous* real funding – *levels*. In fact, we find that increases in real cumulative nutrition-education funding is consistent with improving BMI and reducing obese or overweight among individuals from certain, not all, income and education-levels.

Estimating the precise impact of nutrition-education programs at an individual-level is ambitious with these data. However, much can be gained from analyzing these data to understand the effects over time and across groups. The analysis is complicated by concerns regarding structural endogeneity, e.g., the bias introduced by unobserved influences. For example state-level "nutrition awareness", attitudes toward "health behavior improvement", or policy response to increasing average weight trends, may confound the estimation. The empirical model employed here explicitly controls for such unobserved, and potentially biasing, effects through the use of year fixed effects, state-fixed effects, state linear-time trends and quadratic time trends. Our strategy will mitigate the impact from *attitudes* or otherwise *unobserved* state-level variation, time variation and state-specific variation over time is included in the model. Therefore, this paper contributes to the literature in several substantial ways. First, it provides an aggregate investigation of the impact of nutrition-education policy on individual-level weight outcomes. Second, the study assesses the impact of nutrition-education policy while controlling for price variations (across states and overtime). Third, the study controls for *unobserved* variation or *attitudes* that are specific to each state and year, in addition to all *unobserved* variation at the state-level that changes over time and at differing rates. To our knowledge, this is the first study in any discipline to investigate the impact of nutrition-education policy across states and time while controlling for other important economic factors such as price and income. Extant studies that investigate price policy have done so using state-fixed effects to control for state-level attitudes and strategies to combat obesity, at best. Again, this paper improves on previous work by holding state-level policies and expenditures to combat obesity constant in models that use state-fixed effects, year fixed effects and state-specific time trends.

## Background

### *BMI, obesity and overweight*

The dramatic increase in prevalence of overweight and obesity among individuals 18 years of age and older has been a concern. The Centers for Disease Control (CDC) monitors changes in obesity and overweight using data from the National Health and Nutrition Examination Survey (NHANES), collected at various time intervals, and the Behavioral Risk Factor Surveillance System (BRFSS), collected annually. The NHANES data estimate a 19% increase in overweight and 55% increase in obesity over the roughly 15 - year period between NHANESII (1976–1980) and NHANESIII (1988–1994). The obesity prevalence continued to rise an additional 42% over the 15 years from NHANESIII (1988–1994) to NHANES (2003–2004), while the prevalence of overweight remained fairly constant, at 18%, over that same time period (CDC, 2006).

Data from the BRFSS provide additional evidence of this nationwide increase in the average BMI. We acknowledge that BMI is not a perfect measure of overall fatness or health of an individual. However, given the current state of the literature we selected BMI as the most widely accepted measure of obesity (Burkhauser & Cawley, 2008). Fig. 1 demonstrates the increase in the average BMI for the US population between 1992 and 2006. The trend and its persistence is a dilemma faced by policy makers given that the average BMI is approaching the obese range. This increase in the average BMI has continued even after the problems associated with increasing BMI and obesity were identified and while expenditures on weight-loss services and products designed to aid weight reduction, including medical procedures and pharmaceuticals has risen dramatically (Reuters, April 21, 2009).

### *Associated medical complications and costs*

The pool of literature documenting the costs associated with obesity has increased since the mid-1990s. The importance and salience of the research derives from the well-documented adverse health outcomes associated with obesity and overweight (Allison, Fontaine, Manson, Stevens, & VanItallie, 1999; McGinnis & Foege, 1993). Obesity and overweight are currently associated with an increased risk of coronary heart disease, type-2 diabetes, certain cancers (endometrial, breast, and colon), hypertension, high cholesterol, stroke, liver and gallbladder disease, sleep apnea and respiratory problems, osteoarthritis, and gynecological problems (Kahn et al., 1997).

Given the well-documented complications associated with obesity, the literature has attempted to determine the costs associated with these complications and obesity in general. An often cited study from 2009 estimates the aggregate medical costs associated with obesity to be $147 billion (2008 dollars) using the Medical Expenditure Panel Survey (MEPS) (Finkelstein, Trogden, Cohen, & Dietz, 2009). This study further estimates the annual medical expenditures for an obese person to be $1429 (2008 dollars) greater than the expenditures for individuals with a BMI in a normal range (Finkelstein et al., 2009). Citing concerns regarding endogeneity, Cawley and Meyerhofer (2012) use same MEPS data and correct for endogeneity using an instrumental variables technique yielding a higher estimate of $2571 per year in additional annual medical costs for an obese individual (Cawley & Meyerhofer, 2012).

Table 1 presents the estimates for aggregate spending on obesity from two studies. Finkelstein, Fiebelkorn, and Wang (2003) estimates the aggregate spending attributed to obesity to be between $26.8 and $47.5 billion dollars per year (Finkelstein et al., 2003). Meanwhile, later Cawley and Meyerhofer (2012) estimates total medical expenditures from obesity to be $26.6 without accounting for the Medicare population. A point to note from Table 1 is obesity places a significant burden on publicly-funded health insurance

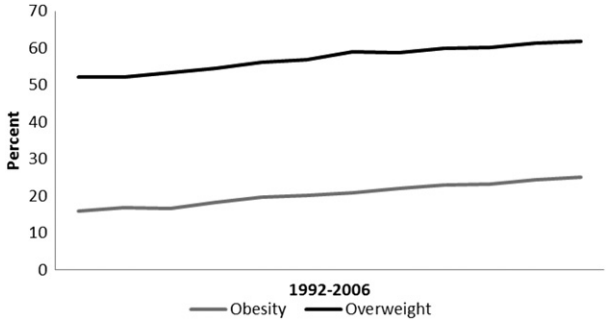


**Fig. 1.** National prevalence of overweight and obese.