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Original Research

Health care expenses in relation to obesity and smoking among U.S. adults by gender, race/ethnicity, and age group: 1998–2011

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ABSTRACT

Objectives: Obesity and smoking are two leading health risk factors and consume substantial health care resources. This study estimates and tracks annual per-capita health care expenses associated with obesity and smoking among U.S. adults aged 18 years and older from 1998 to 2011.

Study design: Retrospective data analysis.

Methods: Individual-level data came from the National Health Interview Survey 1996–2010 waves and the Medical Expenditure Panel Survey 1998–2011 waves. Annual per-capita health care expenses associated with obesity and smoking were estimated in two-part models, accounting for individual characteristics and sampling design.

Results: Obesity and smoking were associated with an increase in annual per-capita total health care expenses (2011 US$) by $1360 (95% confidence interval: $1134-$1587) and $1046 ($846-$1247), out-of-pocket expenses by $143 ($110-$176) and $70 ($37-$104), hospital inpatient expenses by $406 ($283-$529) and $405 ($291-$519), hospital outpatient expenses by $164 ($119-$210) and $95 ($52-$138), office-based medical provider service expenses by $219 ($157-$280) and $117 ($62-$172), emergency room service expenses by $45 ($28-$63) and $57 ($44-$71), and prescription expenses by $439 ($382-$496) and $251 ($199-$302), respectively. From 1998 to 2011, the estimated per-capita expenses associated with obesity and smoking increased by 25% and 30% for total health care, 41% and 48% for office-based medical provider services, 59% and 66% for emergency room services, and 62% and 70% for prescriptions but decreased by 16% and 15% for out-of-pocket health care expenses, 3% and 0.3% for inpatient care, and 6% and 2% for outpatient care, respectively. Health care expenses associated with obesity and smoking were considerably larger among women, Non-Hispanic whites, and older adults compared with their male, racial/ethnic minority, and younger counterparts.

Conclusions: Health care costs associated with obesity and smoking are substantial and increased noticeably during 1998–2011. They also vary significantly across gender, race/ethnicity and age.

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Introduction

Obesity and smoking and are two of the leading causes of preventable death in the U.S. and consume substantial social resources. In 2005, smoking was responsible for an estimated 467,000 or approximately one in five deaths, and obesity 216,000 or one in ten deaths among U.S. adults.[1] In 2009, the estimated annual cost of smoking in the U.S. was over $289 billion, including $156 billion in lost productivity and $133 billion in medical expenditures[2]; and the cost of obesity approached $300 billion, including $173 billion in lost productivity and $127-$147 billion in medical expenditures.[3,4]

Most existing studies estimated the impact of obesity and smoking on health care costs separately, at a single point in time, or for the entire unstratified sample.[5–13] Few studies examined the health care costs associated with obesity and smoking in a side-by-side comparison or population heterogeneities in incremental costs across individual demographics. Bertakis and Azari (2006) assessed the influence of obesity, smoking and alcohol abuse on medical charges in a university hospital in California, but medical charges might not be a valid proxy for cost.[14] Sturm (2002) investigated incremental medical costs attributable to obesity, smoking and problem drinking using data from the Healthcare for Communities survey conducted during 1997–1998.[15] Obesity and smoking were found to be associated with 36% and 21% increase in inpatient and outpatient spending and 77% and 28% increase in medications, respectively. Using data from the Medical Expenditure Panel Survey 1998 wave, Wee et al. (2005) explored the differential impact of obesity on health care expenditures among population subgroups, and reported the costs associated with obesity to vary across age and race.[16]

Tracking changes in health care costs associated with obesity and smoking among U.S. adults over time is critical in understanding the dynamics of the financial burden and informing policy interventions. In a recent retrospective cohort study, Moriarty et al. (2012) estimated the incremental costs of obesity and smoking from 2001 to 2007 among employees and dependents in the Mayo Clinic in Rochester, Minnesota.[17] Despite its longitudinal study design, no temporal trend in costs associated with obesity and smoking was reported, and the findings are constrained to a single managed care organization.

The current study adds a new data point to the literature by tracking annual per-capita health care expenses associated with obesity and smoking among U.S. adults 18 years of age and above from 1998 to 2011 using data from two nationally representative surveys.

Methods

Study sample

Individual-level data came from the National Health Interview Survey (NHIS) 1996–2010 waves linked to the Medical Expenditure Panel Survey (MEPS) 1998–2011 waves. NHIS is the nation's largest annual cross-sectional in-person household health survey, providing nationally representative estimates on the health status, access to and utilization of health care services, health-related behaviours and risk factors of the U.S. civilian non-institutionalized population through household interviews. This study used data from the Sample Adult Core (SAC) in the NHIS, which was a separate questionnaire administered for an adult 18 years of age and above who was randomly selected from each NHIS-participation household.

Data on individual characteristics in the SAC of the NHIS 1996–2010 waves were linked to their corresponding annual health care expenditures in the Household Component (HC) of the MEPS 1998–2011 waves by personal identifier and survey year. Conducted by the Agency for Healthcare Research and Quality (AHRQ), MEPS provides nationally representative estimates of health care use, expenditures, sources of payment, and health insurance coverage for the U.S. civilian non-institutionalized population. MEPS and NHIS are directly related and linkable because respondents in the HC, the core survey of MEPS, are a stratified random sample of those who participated in the prior year's NHIS. The shared sampling frame between the MEPS and the NHIS permits the integration between these two national surveys which expands analytic possibilities with enhanced capacity.[18] It should be noted that measures on the same individual from the NHIS (individual characteristics) and the MEPS (health care expenditures) are not synchronous but with a time lag of about a year.

The full sample consists of 129,130 adults aged 18 years and older who participated both the NHIS and the MEPS during 1996–2011. Among them, 811 who reported being pregnant at the time of interview, and 3175 who had missing values for individual sociodemographic, smoking status, alcohol use, body weight/height, or health care expenditures were excluded from the analyses, resulting in an effective sample of 125,955.

Obesity and smoking measures

Body mass index (BMI) was calculated from self-reported weight and height, and obesity is defined as a dichotomous variable for BMI $\geq$ 30 (non-obese people in the reference group). As part of the sensitivity analyses (results not shown), a refined categorization of BMI was adopted: normal weight (18.5 $\leq$ BMI < 25), overweight (25 $\leq$ BMI < 30), class I obesity (30 $\leq$ BMI < 35), and class II and III obesity combined (BMI $\geq$ 35). A dose–response relationship is evident: incremental health care costs estimated from multivariate analyses increased noticeably as moving to a higher BMI category (underweight [BMI < 18.5] excluded due to small sample size).

Smoking is defined as a dichotomous variable for answering 'yes' to the question 'Have you smoked at least 100 cigarettes in your entire life?' This classification combines former and current smokers (with non-smokers in the reference group), and is in line with the definition on smoking status adopted by the Centers for Disease Control and Prevention (CDC).[19] The other reason for the use of this definition is to facilitate result comparison with other studies on the medical cost of cigarette smoking which adopted the same definition.[8,15,20]

Health care expenditure measures

Total expenses in the MEPS consist of direct payments for health care provided during the year, including out-of-pocket