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Lack of private health insurance is associated with higher mortality from cancer and other chronic diseases, poor diet quality, and inflammatory biomarkers in the United States

Marisa A. Bittoni [a,d,*], Randy Wexler [b], Colleen K. Spees [a,d], Steven K. Clinton [c,d], Christopher A. Taylor [a,b]

[a] The Ohio State University, College of Medicine, Division of Health Sciences and Medical Dietetics, Columbus, OH, United States
[b] The Ohio State University, College of Medicine, Department of Family Medicine, Columbus, OH, United States
[c] The Ohio State University, College of Medicine, Division of Medical Oncology, Columbus, OH, United States
[d] The Ohio State University Comprehensive Cancer Center, Columbus, OH, United States

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ABSTRACT

Objective. The lack of health insurance reduces access to care and often results in poorer health outcomes. The present study simultaneously assessed the effects of health insurance on cancer and chronic disease mortality, as well as the inter-relationships with diet, obesity, smoking, and inflammatory biomarkers. We hypothesized that public/no insurance versus private insurance would result in increased cancer/chronic disease mortality due to the increased prevalence of inflammation-related lifestyle factors in the underinsured population.

Methods. Data from the Third National Health and Nutrition Examination Survey participants (NHANES III;1988–1994) were prospectively examined to assess the effects of public/no insurance versus private insurance and inflammation-related lifestyle factors on mortality risk from cancer, all causes, cardiovascular disease (CVD) and diabetes. Cox proportional hazards regression was performed to assess these relationships.

Results. Multivariate regression analyses revealed substantially greater risks of mortality ranging from 35% to 245% for public/no insurance versus private insurance for cancer (HR = 1.35; 95% CI = 1.09,1.66), all causes (HR = 1.54; 95% CI = 1.39,1.70), CVD (HR = 1.62; 95% CI = 1.38,1.90) and diabetes (HR = 2.45; 95% CI = 1.45,4.14). Elevated CRP, smoking, reduced diet quality and higher BMI were more prevalent in those with public insurance, and were also associated with increased risks of cancer/chronic disease mortality.

Discussion. Insurance status was strongly associated with cancer/chronic disease mortality after adjusting for lifestyle factors. The results suggest that inadequate health insurance coverage results in a substantially greater need for preventive strategies that focus on tobacco control, obesity, and improved dietary quality. These efforts should be incorporated into comprehensive insurance coverage programs for all Americans.

Introduction

The availability of quality health insurance remains a prevalent barrier to optimal health in the United States despite recent strategies targeting health care reform. Although the Affordable Care Act has resulted in an additional 12 million individuals gaining health insurance, it has been estimated that 31 million Americans will remain uninsured by 2024 (Congressional Budget Office (CBO)). Gaps in coverage, including lack of uniform Medicaid coverage among states, personal choice to remain uninsured, lack of awareness of the new health reform laws, and problems enrolling contribute to limit access to care (Congressional Budget Office (CBO); Institute of Medicine (IOM), 2009; McWilliams, 2009).

According to the Institute of Medicine and other reports (Institute of Medicine (IOM), 2009; Wilper et al., 2009; Ayanian et al., 2000), adults who lack insurance and suffer from cancer, cardiovascular disease (CVD), stroke, asthma and other chronic conditions are more likely to experience poorer health outcomes, reduced quality of life, and premature death, compared to their insured counterparts. Adequate insurance coverage protects against devastating costs of catastrophic illness, provides access to preventive health care and screening, and may provide care earlier in the disease process for improved outcomes (Institute of Medicine (IOM), 2009; Hadley, 2003; Baker et al., 2002; Institute of Medicine (IOM), 2002; Kronick, 2009; Robinson and Shavers). The lack of adequate insurance is especially prevalent in segments of the population experiencing social and economic disparities (DeNavas-Walt et al., 2011; Smedley et al., 2003; The Agency for Healthcare Research and Quality, 2007). The associations between cancer mortality and multiple lifestyle factors, such as dietary intakes (World Cancer Research Fund (WCRF)/American Institute for Cancer

* Corresponding author at: The Ohio State University College of Medicine, P.O. Box 21170, Columbus, OH 43221, United States.
E-mail address: bittoni.1@osu.edu (M.A. Bittoni).

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Research(AICR), 2007), physical activity (World Cancer Research Fund (WCRF)/American Institute for Cancer Research(AICR), 2007; Thune and Furberg, 2001; Haskell et al., 2007), smoking and alcohol (World Cancer Research Fund (WCRF)/American Institute for Cancer Research(AICR), 2007; Seitz et al., 2012; Shiels et al., 2013; International Agency for Research on Cancer (IARC), 2004; International Agency for Research on Cancer (IARC), 2010), obesity (World Cancer Research Fund (WCRF)/American Institute for Cancer Research(AICR), 2007; Rohrmann et al., 2007; Parekh et al., 2010; Vucenik and Stains, 2012), and exposure to environmental carcinogens (US Department of Health and Human Services (USDDHS), 2010; International Agency for Research on Cancer (IARC), 2012) have also been well-documented.

The current study examined the hypothesis that higher mortality in those lacking adequate health insurance is partly due to the greater prevalence of disease-associated lifestyle risk factors. Our objective was to provide a deeper understanding of the relationships between health insurance and risk of mortality from cancer and other chronic diseases, such as CVD and type-2 diabetes. Furthermore, we simultaneously examined the effects of insurance status in relation to lifestyle factors associated with disease risk and mortality. For example, smoking is clearly linked to CVD and cancer, yet its prevalence relative to health insurance status is not well-documented (Charafeddine et al., 2013; Jorm et al., 2012). We also assessed the effect of dietary patterns, using the Healthy Eating Index (HEI), which is based on US Dietary Guidelines for Americans 2010, and provides a more optimal approach than examining individual nutrients relative to mortality risk (World Cancer Research Fund/American Institute for Cancer Research, 2007; Kant, 2004; Kennedy et al., 1995; Kennedy, 2008). In addition, the obesity epidemic in America contributes significantly to the risk of diabetes (World Health Organization (WHO), 2000; Day and Bailey, 2011) and mortality from CVD (Association AH, 2014) and several cancers (World Cancer Research Fund/American Institute for Cancer Research, 2007; Calle, 2007). We, therefore, explored the association between obesity and insurance status on mortality risk. Finally, we examined the relationship between C-reactive protein (CRP), an inflammatory biomarker that has shown associations with cancer and other chronic disease (Manabe, 2011; Chaturvedi et al., 2010), and insurance status on mortality. We hypothesized that private insurance status would result in better cancer/chronic disease mortality outcomes, and that diet, lifestyle, and inflammation-related factors would significantly impact the insurance–mortality relationship.

Methods

The data in this study were from the Third National Health and Nutrition Examination Survey (NHANES III), which was conducted by the National Center for Health Statistics (NCHS) (U.S. Department of Health and Human Services Third National Health and Nutrition Examination Survey, 1996; NCHS (National Center for Health Statistics), 1992). NHANES III was used versus more recent NHANES datasets because it provided a longer follow-up time and larger sample size. NHANES III used a complex, multi-stage, stratified sample of civilian, non-institutionalized persons aged two months or greater (National Center for Health Statistics (NCHS), 1994), and was conducted from October 1988–1994 in two phases. In NHANES III, 33,994 (86%) of the 39,695 total participants were interviewed in their homes. Participants were then invited to mobile examination centers (MECs) for a medical exam. A detailed description of design specifications and methods can be found in the Plan and Operation of the Third National Health and Nutrition Examination Survey, 1988–1994 (U.S. Department of Health and Human Services Third National Health and Nutrition Examination Survey, 1996; National Center for Health Statistics (NCHS), 1994).

For the present study, data from NHANES III participants were prospectively examined to determine the effects of public/no insurance versus private insurance on the risk of mortality from cancer, all causes, CVD (included heart disease, hypertension, cerebrovascular disease and diseases of the arteries and circulatory system) and diabetes. The criteria for inclusion in this study were: (a) age > 40 years, and (b) study participants were cancer-free when they began the study (i.e. they had never been told by a doctor that they had cancer, with the exception of non-melanoma skin cancer). This prospective study followed cancer-free individuals from the time of entry into the NHANES III study until death or December 1, 2006.

Measures

Household adult questionnaire

The NHANES III Household Adult Questionnaire included all data collected during the household interviews for adults aged >17 years. Demographic and lifestyle data, such as age, sex, race, education, and smoking were obtained from the Household Adult Questionnaire. At the end of the interview, the respondent's blood pressure was measured three times (a second set of measurements was obtained at the MEC). Interviews were conducted by field staff, who received intensive initial training and formal retraining to ensure that high skill levels were maintained. The data collection system was automated in Phase 2, during which interviews were conducted using computer-assisted personal interview. Details on survey instruments and forms, training manuals and data collection procedures are published elsewhere (U.S. Department of Health and Human Services Third National Health and Nutrition Examination Survey, 1996).

MEC physical examination

Blood and urine specimens were obtained at the MEC within one month of the interview, where several lab tests and measurements were performed, including anthropometric measurements, such as height, weight, and body mass index (BMI). While some of the blood and urine analyses were performed in the MEC laboratory, most analyses were conducted elsewhere by contract laboratories (U.S. Department of Health and Human Services Third National Health and Nutrition Examination Survey, 1996; National Center for Health Statistics (NCHS), 1994). For those who could not visit the MEC, a limited home examination was conducted.

Healthy eating index

The HEI provides a measure of overall quality of an individual's diet by assessing compliance with federal dietary guidelines and recommendations (Kennedy et al., 1995). The US Department of Agriculture calculated HEI components and overall scores from dietary recall interviews collected for NHANES. The overall HEI score is the sum of 10 dietary components, which includes grains, fruits, vegetables, dairy, meat, dietary fats, saturated fats, cholesterol, sodium and variety. Each component has a maximum score of 10 and a minimum score of zero. The maximum overall HEI score is 100. A score of zero was assigned to a food group if no items from that category were consumed. For each of the five food group components of the HEI, individuals who consumed the recommended number of servings received a maximum score of 10.

CRP analysis

CRP was obtained from serum samples stored at −70 °C, which were analyzed within 2 months of collection. CRP was analyzed using a fully automated Behring Nephelometer Analyzer System (Behring Diagnostics, Inc, Somerville, NJ). Additional details about the specific methods for quantifying CRP are provided elsewhere (Gunter and McQuillan, 1990).

Ascertainment of mortality through National Death Index linkage

The outcome measure for this prospective study was mortality from cancer, all causes, CVD and diabetes, which was ascertained through a record linkage process using mortality data from the National Death Index (NDI). The NHANES III database was linked with NDI mortality records through December 31, 2006 (Madans and Hunter, 1996; National Center for Health Statistics (NCHS), 2005). This linkage was performed through probabilistic matching using several criteria to confirm a match, such as name, social security, and date of birth (National Center for Health Statistics (NCHS), 2005). The underlying cause of death was established from ICD-9 codes through 1998 and ICD-10 codes for 1999–2000, but the final cause of death data was determined by ICD-10 codes after adjusting for changes between coding systems ((Statistics) Q5 NNCfH, 2006).

Statistical analysis

Descriptive statistics

Descriptive statistics were calculated for all variables, with frequencies and percentages shown for discrete variables and means and standard deviations (SDs) calculated for continuous variables. Tests of statistical significance were also shown, with chi-squares performed for discrete variables and t-tests

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