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Persistent socioeconomic disparities in cardiovascular risk factors and health in the United States: Medical Expenditure Panel Survey 2002–2013

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ABSTRACT

Background and aims: Socioeconomic status (SES) has been linked to worse cardiovascular risk factor (CRF) profiles and higher rates of cardiovascular disease (CVD), with an especially high burden of disease for low-income groups. We aimed to describe the trends in prevalence of CRFs among US adults by SES from 2002 to 2013.

Methods: Data from the Medical Expenditure Panel Survey was analyzed. CRFs (obesity, diabetes, hypertension, physical inactivity, smoking and hypercholesterolemia), were ascertained by ICD-9-CM and/or self-report.

Results: The proportion of individuals with obesity, diabetes and hypertension increased overall, with low-income groups representing a higher prevalence for each CRF. Of note, physical inactivity had the highest prevalence increase, with the "lowest-income" group observing a relative percent increase of 71.1%.

Conclusions: Disparities in CRF burden continue to increase, across SES groups. Strategies to potentially eliminate the persistent health disparities gap may include a shift to greater coverage for prevention, and efforts to engage in healthy lifestyle behaviors.

1. Introduction

Cardiovascular disease (CVD) remains one of the most important public health problems worldwide. It has been well documented that a greater burden of established cardiovascular risk factors (CRF) significantly contributes to higher mortality, morbidity and financial risk [1,2].

A wide array of studies have sought to describe components of CVD that disproportionately affect society – in conjunction with CRFs – including sex [3], race/ethnicity [4], geographic residence [5], educational attainment [6], and socioeconomic status (SES) [7–10]. Socioeconomic status (SES) has been linked to worse CRF profiles and higher rates of CVD, with a large difference between

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high- and low-income populations [5,7], and an especially high burden of disease for low-income groups [8]. While the American Heart Association (AHA) 2020 Strategic Impact Goals advocates for the optimization of CRF profiles as a national goal, these income-based differences continue to persist at the national level. Accordingly, in this study, we aimed to quantify and describe the trends in prevalence of cardiovascular risk factors among US adults by SES from 2002 to 2013. These results will provide valuable insights on the scope of burden, allowing deliberation for focused policies targeting this critical social determinant of health to optimize cardiovascular health at the population level.

2. Materials and methods

2.1. Study design and sampling

We obtained data from the Medical Expenditure Panel Survey (MEPS) for the years 2002 through 2013. MEPS, created and administered by the Agency for Healthcare Research and Quality, is a national series of surveys of individuals and families, their health service providers, and employers, derived from the National Health Interview Survey. The Household Component of MEPS collects data about health services used, associated charges, amount paid, and sources of payment. Their responses are reported annually, and are assigned person-weight and variance estimation stratum to each respondent based on survey non-response and the characteristics of the national population of the survey year, following a complex multi-stage sample design [11]. This allows national representativeness of the MEPS data [12]. Since MEPS is comprised of publicly available de-identified data files, it was exempt from Institutional Review Board review [13].

MEPS data files included in this project comprise the full-year consolidated files and the medical conditions files; the former hold most demographic, economic and insurance-related characteristics, while the latter contains participants' self-reported and healthcare utilization-related diagnoses. After being transcribed verbatim at each survey, the reported diagnoses are translated into *International Classification of Diseases, 9th Edition, Clinical Modification* (ICD-9-CM) by professional coders [12]. We linked both files per year to get the most accurate results for each individual.

2.2. Participants and study variables

We limited our study population to adults at or above 18 years of age, with a BMI greater than 18.5 kg/m^2 and with a positive sampling weight (to achieve national representativeness). Socioeconomic status was defined by family income per the federal poverty level [FPL], a measure of income issued every year by the Department of Health and Human Services (lowest-income [<125% of the FPL], low-income [125% to <200% FPL], middle-income [200% to <400% FPL] & high-income [≥400% FPL]) [14–16]. CRF diagnoses included obesity, diabetes mellitus, hypertension, physical inactivity, smoking and hypercholesterolemia. Self-reported height and weight (to calculate obesity) and presence of active smoking were ascertained via questionnaires, while diabetes mellitus, hypertension and hypercholesterolemia were ascertained via self-report, or an associated ICD-9-CM code of 250, 401 or 272, respectively. Physical inactivity was identified based on individual's answers to the question: "*Do you currently spend half hour or more in moderate to vigorous physical activity, at least five times a week?*" [17], (per AHA's recommendation of 150 min per week of moderate/vigorous physical activity). Participants who answered "no" to this question were categorized as "physically inactive", and "physically active" otherwise. An important point to be made is that most respondents who engaged in this level of physical activity closely resemble what most researchers refer to as "exercise". Consequently, our categorization of "physically inactive" individuals does not necessarily mean "sedentary", but that the 2008 Physical Activity Guidelines Advisory Committee Report recommendations for physical activity were not met [18]. A "poor CRF profile" was defined by presence of ≥4 CRFs.

2.3. Statistical analyses

Prevalence was estimated using proportions, and linear regression models were used to estimate *p for trend*. Difference-in-differences analysis was used to gauge the gap between high-income vs lowest-income for every CRF comparing the initial and ending years of our study period, 2002–03 *vs.* 2012–13. Difference-in-differences analysis is often used to estimate the effect or change, depending on the scenario, between two groups over two time periods. Adjusted and unadjusted logistic regression models were used to assess the association for each CRF by SES in pooled data. All analyses took into account the complex design of MEPS.

3. Results

Our study population was comprised of 250,371 MEPS participants (46 ± 14 years of age, 49% male), translating to 215.7 million noninstitutionalized US adults. During the study period, the proportion of individuals with obesity increased overall, though more so among people of low SES (Table 1). Diabetes prevalence increased (from 9.6% to 12.8% in lowest-income, and 5.6% to 8.3% in high-income, both p *trends* < 0.001), as did hypertension prevalence (from 28.5% to 36.3% in lowest-income, and 24.2% to 33.4% in high-income, both p *trends* < 0.001), though the greatest relative change was observed among the middle/high-income SES groups. Prevalence of physical inactivity increased in all SES categories, with the lowest-income group observing the largest change (32.4% to 55.4%, compared to 39.8% to 47.4% in high-income, both p *trends* < 0.001), with relative percent change of 71.1% increase in this category. Prevalence of physical inactivity was highest among high-income individuals at the start of the study period, and has since shifted to a higher prevalence among lower SES categories. Smoking declined across time in all SES categories, and hypercholesterolemia showed no significant changes. Prevalence of poor CRF profile increased over time for all SES, except in the high-income SES category. While there were significant changes for CRFs in most groups, there has been a widening of the gap between high-income and lowest-income groups for the prevalence of physical inactivity (difference-in-differences 15.4%, $p < 0.01$) and poor CRF profile (difference-in-differences 3.1%, $p < 0.01$) when comparing 2002–03 *vs.* 2012–13. Overall, throughout the entire 12 years, lowest-income SES was associated with higher odds of being physically inactive (5–10% higher odds, depending on SES category, all $p < 0.05$) or having hypercholesterolemia (15–22% higher odds, depending on SES category, all $p < 0.05$) when compared to high-income SES in adjusted analyses. Furthermore, odds of obesity, diabetes mellitus, hypertension, and smoking increased across lowering SES categories; individuals with lowest-income SES had odds of: 1.34 of being obese, 1.42 of having diabetes, 1.31 of having hypertension and 2.57 of being smokers, (all $p < 0.05$), when compared to high-income individuals. The odds of having a poor CRF profile for lowest-income SES were 36% higher when compared to high-income SES (OR 1.36, 95% CI [1.30, 1.44]) (Table 1).

4. Discussion

In summary, our findings highlight low SES as a persistent determinant of cardiovascular health. We found that the

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