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Exploring the association between low socioeconomic status and cardiovascular disease risk in healthy Greeks, in the years of financial crisis (2002–2012): The ATTICA study

Natasa Kollia [a], Demosthenes B. Panagiotakos [a,*], Ekavi Georgousopoulou [a], Christina Chrysohoou [b], Dimitrios Tousoulis [b], Christodoulos Stefanadis [b], Charalabos Papageorgiou [c], Christos Pitsavos [b]

[a] Department of Nutrition and Dietetics, School of Health Science and Education, Harokopio University, Athens, Greece
[b] First Cardiology Clinic, School of Medicine, University of Athens, Greece
[c] Department of Psychiatry, School of Medicine, University of Athens, Athens, Greece

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ABSTRACT

Background: Despite recent declines in mortality, cardiovascular disease (CVD) remains the leading cause of death in Europe today. Given the fact that many of the biological risk factors have already been identified, researchers still search for different modifiable factors that may influence CVD risk, among which SES gathers a great part of interest.
Aims: To explore the effect of low socioeconomic status (SES) on a 10-year cardiovascular disease (CVD) incidence, in the years of financial crisis.
Methods: This population-based study was carried out in the province of Attica, where Athens is a major metropolis. During 2001–2002, information from 1528 men (18–87 years old) and 1514 women (18–89 years old) was collected. Educational level and annual income were used to define their SES. After a 10-year of follow-up period (2002–2012), CVD incidence was recorded.
Results: Low compared to high SES class, at the ages above 45 years, was independently associated with increased 10-year CVD incidence [adjusted odds ratio and 95% confidence interval: 2.7 (1.5, 4.9)] but not among the younger participants. SES was also negatively associated with psychological components (all p-values < 0.001), diabetes mellitus ($p = 0.002$), obesity ($p = 0.087$) and physical activity ($p = 0.056$).
Conclusion: There is evidence for a consistent reverse relation between SES and the incidence of CVD and for higher CVD risk factors among less privileged individuals. The striking differences by SES underscore the critical need to improve screening, early detection, and treatment of CVD-related conditions for people of lower SES, emphasizing in the middle-aged groups.

1. Introduction

Socioeconomic status (SES) can be broadly conceptualized as one's position in the social structure. Although sociologists emphasize a Weberian approach of SES that encompasses the notions of class, status, power and the lifetime access to knowledge, resources, and opportunities, in everyday practice, in order to overcome methodological impasses, educational achievement, financial well-being and occupation are the most often used SES indicators [1]. SES is an important determinant of the likelihood that individuals and, consequently populations are exposed to environmental and other risk factors for health. It is clear that socioeconomically disadvantaged communities and individuals are often exposed to higher levels of risk factors than their less-disadvantaged counterparts, and they bear a disproportionate share of the health burden. Low SES has been linked to behavioral risk factors (e.g., tobacco, alcohol, diet), environmental factors, limited access to health services and psychosocial factors reducing physical or mental health [2]. SES has been associated both positively and negatively with cardiovascular disease (CVD) risk factors, morbidity, and mortality [3–5]. International comparisons generally show increased coronary heart disease (CHD) with industrialization and affluence, but variable patterns and trends are found within individual countries [6]. Early studies beginning in the 1930s, in the United Kingdom and United States, indicated a positive association between CHD and SES, with the highest SES groups having the highest prevalence of the disease [7,8]. More recently, an inverse association has been observed in developed countries worldwide [9–12]. Nowadays, the lowest SES groups have the highest CVD incidence. Correspondingly, lower SES groups also have the least favorable health characteristics, including obesity, cigarette smoking, hyperlipidemia, hypertension and lack of physical activity [13,14] and simultaneously have been associated with the worst

* Corresponding author at: 46 Paleon Polemiston St., Glyfada, Attica 166 74, Greece.
E-mail address: d.b.panagiotakos@usa.net (D.B. Panagiotakos).

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prognosis after a cardiac episode [15,16]. Despite the sharp declines in CVD mortality that occurred during the past 30 years, it is particularly disturbing that the aforementioned beneficial trends in CVD mortality have not been felt equally across all segments of society. Specifically, the most striking improvements in cardiovascular health have benefited wealthier, high-educated individuals, whereas progress among groups with lower SES has lagged. Simultaneously, it has been postulated that the gap between high-SES and low-SES populations seems to be widening [17].

Moreover, since the mid 2000s, the economic situation in European and other countries started deteriorating. This has generated a significant financial uncertainty, social insecurity and an increase in deaths related to chronic health conditions. This financial crisis has dramatically affected Greece, during the past 5 years. In this context, the present work aimed to evaluate the effect of SES on 10-year incidence (2002–2012) of CVD, in apparently healthy individuals living in a low CVD, developing European country, Greece that has seriously been affected by the global financial crisis during this follow-up period.

2. Methods

2.1. Sampling procedure at baseline examination (2001–2002)

The "ATTICA" study is a health and nutrition survey that was carried out in the province of Attica (including 78% urban and 22% rural areas) during 2001–2002. The invitation clarified that people with history of CVD or living in institutions or having chronic viral infections should not participate in the sampling. Of the 4056 invited individuals, 3042 agreed to participate (75% participation rate), 1528 women aged 45 ± 14 years and 1514 men aged 46 ± 13 years.

2.2. Baseline measurements

The baseline evaluation included information about socio-demographic characteristics (i.e., age, sex, marital status, mean annual income and years of school). The educational level of the participants was measured by the years of schooling. For simplicity participants were also classified into three groups: Group I: ≤9 years, Group II: up to high school or technical colleges (10–14 years) and Group III: university. Mean annual income during the past three years was recorded and the financial status of the participants was classified into four groups: low: ≤8000 €, medium: 8001–10,000 €, high: 10,001–20,000 € and very high: >20,000 €. To provide a more accurate estimate of participants' SES, a combination of education and income was implemented. Since the main aim of the present study was to investigate the risk among the weakest socioeconomically groups, participants were finally classified into the following three SES categories (classes): (i) Low SES (i.e., up to 9 years of schooling and low/medium income or up to 14 years of schooling and low income), (ii) high SES (i.e., 15 or more years of schooling and high/very income or 10–14 years of schooling and very high income) and (iii) moderate SES, including the rest of the participants. Recording of behavioral aspects included the ascertainment of dietary and other lifestyle habits (i.e., smoking status and physical activity). The evaluation of the nutritional habits was based on a validated semi-quantitative food-frequency questionnaire [18], the EPIC-Greek questionnaire, that was kindly provided by the Unit of Nutrition of Athens Medical School; overall dietary habits were evaluated using the MedDietScore (theoretical range 0–55) that incorporates the inherent characteristics of the Mediterranean diet [19]. For the ascertainment of physical activity status the translated and validated International Physical Activity Questionnaire (IPAQ) was used [20], as an index of weekly energy expenditure using frequency (times per week), duration (in minutes per time) and intensity of sports or other habits related to physical activity (in expended calories per time). Participants who did not report any physical activities were defined as physically inactive and the rest as physically active. Pack-years of smoking were calculated for all smokers. Current smokers were defined as those who were smoking at least one cigarette per day or had recently stopped smoking (during a year); the rest of the participants were defined as non-current smokers. The baseline evaluation also included a series of anthropometric and biochemical measurements which were used for the diagnosis of the metabolic syndrome. Participants were classified as having the metabolic syndrome or not, according to the definition provided by the National Cholesterol Education Panel — NCEP ATP III, consequently, if 3 or more of the following metabolic components are present: waist circumference ≥102 cm for males or ≥88 cm for females; triglyceride level ≥150 mg/dL; HDL cholesterol level <40 mg/dL for males or <50 mg/dL for females; blood pressure ≥130/85 mm Hg; fasting blood glucose ≥100 mg/dL [21]. Alongside, obesity was defined as Body Mass Index (BMI) >29.9 kg/m^2; hypertension as average blood pressure levels ≥140/90 mm Hg, or being on antihypertensive treatment; hypercholesterolemia as total serum cholesterol levels >200 mg/dL, or being on lipid-lowering treatment; and diabetes mellitus as fasting glucose levels ≥126 mg/dL, or on anti-diabetic treatment. Additionally, a sub-sample of 853 adult participants [453 men (45 ± 13 years) and 400 women (44 ± 18 years)] with similar distribution of gender, age and CVD risk factor profile compared to the entire sample (all p-values > 0.20), underwent complete psychological evaluations including the assessment of: (i) depression, using a translated and validated version of the Zung Self-Rating Depression Scale (ZDRS) [22], (ii) anxiety, using the Greek translation of the 20-item self-report State-Trait Anxiety Inventory (STAI), state version [23], (iii) irrational beliefs as a measure of dysfunctional behavior, using the validated Greek version of the Ellis' Irrational Beliefs Inventory [24] and (iv) hypochondriasis, using the validated Greek version of the Pilowsky's Hypochondriasis Inventory [25]. In all of the four administered psychometric instruments, higher scores indicate inferior mental health.

2.3. Follow-up examination in 2011–2012

During 2011–12, the study's investigators performed the 10-year follow-up. In order to participate in the follow-up all participants were initially appointed through telephone calls (89% of the participants) or face-to-face interviews when their telephone number was not available. Of the 3042 initially enrolled participants, 2583 were found during the follow-up (85% participation rate). No differences were reported regarding the distribution of sex ($p = 0.61$), as well as anxiety ($p = 0.08$) and depression levels ($p = 0.17$) between the participants that were found to follow-up and the participants that were lost to follow-up.

2.4. End-points

The end-points of this study were: (a) death from any cause or due to CVD, (b) development of non-fatal coronary heart disease (CHD) (i.e., myocardial infarction, angina pectoris, other identified forms of ischemia — WHO-ICD coding 410–414.9, 427.2, 427.6–, heart failure of different types, and chronic arrhythmias — WHO-ICD coding 400.0–404.9, 427.0–427.5, 427.9–), or (c) development of non-fatal stroke (WHO-ICD coding 430–438). Regarding CVD ascertainment medical records and hospital data were obtained. The adjudication was made by trained study's physicians and followed the International Statistical Classification of Diseases and Related Health Problems 10th Revision.

2.5. Bioethics

The study has been approved by the Institutional Ethics committee and all participants have been informed about the aims and procedures, and agreed to participate providing written consent.

Further details about the aims and the procedures of the ATTICA study may be found in the methodology paper [26,27].