

Impact of socioeconomic status on longitudinal accumulation of cardiovascular risk in young adults: the CARDIA Study (USA)

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Abstract

Our objectives were to describe the trajectories of biological risk factors of cardiovascular disease in young adults, and to study the association of socioeconomic status (SES) with aggregate risk scores that summarize longitudinal risk accumulation from multiple risk factors. We used data from a prospective, bi-racial, cohort study of 18–30-year-old adults in the USA, initiated in 1985, with 10-year follow-up. SES was measured by parental education level, financial hardship during the study, and the participant's education level by the end of the study. We studied growth patterns of seven biological risk factors for cardiovascular disease using a semi-parametric, class-mixture model to identify clusters of individuals with distinct growth trajectories. Risk scores that summarize risk from all seven risk factors were created to reflect risk at baseline, longitudinal risk change over 10 years, and total accumulated risk. Multivariable regression was used to study their associations with SES within each race/gender group. We found tracking of all seven risk factors: in each case, the cluster with the highest baseline value maintained its position as the highest-risk cluster over the next 10 years. After adjustment for age, lifestyle, and healthcare access, SES was associated inversely with baseline risk score in women (black and white), with risk change score in all four race/gender groups, and with accumulated risk score in women (black and white) and in white men. Our findings suggest that individuals with high overall cardiovascular risk in midlife can be identified by their relatively higher values of risk factors in younger ages and that socioeconomic differences in cardiovascular risk start accumulating early in life.

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Introduction

Low socioeconomic status (SES) is associated with increased risk of cardiovascular disease in both men and

women, and in different ethnic groups (Adler et al., 1994; Wing, Barnett, Casper, & Tyroler, 1992; James, 1984). Risk factors for cardiovascular disease are also more prevalent in lower SES groups, both in the USA (Williams & Collins, 1995) and Europe (Manhem, Dotevall, Wilhelmsen, & Rosengren, 2000; Bobak, Hertzman, Skodova, & Marmot, 1999) and both in men and women (Matthews, Kelsey, Meilahn, Kuller, & Wing, 1989). SES-driven differences may, in fact, begin to accumulate early in life: Childhood social position is associated with adult levels of high density lipoprotein (HDL) cholesterol (Brunner, Shipley, Blane, Smith, & Marmot, 1999) and fibrinogen (Brunner et al., 1996). Also, in young adults, education level is inversely associated with 5-year weight gain (Burke et al., 1996) and 10-year incidence of high blood pressure (Dyer et al., 1999), while financial hardship is associated with 10-year incidence of hypertension (Matthews et al., 2002).

While these data point to SES effects on individual risk factors, there has been little documentation of the impact of SES on longitudinal accumulation of overall risk from multiple risk factors. Moreover, some studies have suggested that one's relative position in risk-factor distributions is determined in childhood (Clarke, Schrot, Leaverton, Connor, & Lauer, 1978; Sanchez-Bayle, Munoz-Fernandez, & Gonzalez-Requejo, 1999). Thus, it is not clear if changes in SES in young adulthood influence risk. Accordingly, our objective was to study the associations of SES and changes in SES with summary scores that reflect risk accumulation over 10 years from increases in multiple risk factors in 18–30-year-old adults. We hypothesized that some young adults who started the study with elevated risk factors would continue to have high values and show increases, and that low SES at baseline and declining SES over the study period would predict risk accumulation.

Methods

Study sample

Data came from the Coronary Artery Risk Development in Young Adults (CARDIA) Study, a prospective, bi-racial, cohort study, initiated in 1985 (Friedman et al., 1988). Briefly, 5115 men and women, ages 18–30 years, were recruited by telephone from two racial groups (non-Hispanic black and white) living in four urban areas in the USA. Sampling was stratified to achieve nearly equal numbers of blacks vs. whites, men vs. women, persons of age ≤ 24 vs. > 24 years, and persons with education high school or less vs. more than high school. The baseline examination was conducted in 1985 and included standardized questionnaires, blood pressure and anthropometric measurements, and a

fasting blood draw. Repeat examinations were conducted in 1987, 1990, 1992, and 1995. Overall retention by 1995 was 70% for black men, 81% for white men, 76% for black women, and 82% for white women. In addition, biological measurements were deleted for women who reported being pregnant at the time of the examination, because of the potential impact of pregnancy on these measurements; 78 black women and 101 white women reported being pregnant at least once. Our study sample consisted of the 4149 CARDIA participants who had baseline measurements of education level, financial hardship, and all seven biological risk factors (listed below), and had each of the seven risk factors measured at least once more in follow-up.

Measurements

Cardiovascular risk factors

We measured systolic and diastolic blood pressure, fasting glucose, fasting insulin, waist–hip circumference ratio, low density lipoprotein (LDL) cholesterol, and total-to-HDL cholesterol ratio, using standardized methods (Friedman et al., 1988). Glucose and insulin measurements were repeated only in 1992 and 1995; all other risk factors were measured at every visit.

Primary predictors

The SES indicators used as primary predictors were parental education, personal educational attainment, and financial hardship. In this young cohort, occupation category and income level are not as yet, reliable indicators of SES (Matthews et al., 2002).

At the baseline interview, the education level (highest grade/year of regular schooling completed; range 1–20+) of the participant's father (or 'man responsible for you as a child') and mother (or 'woman responsible for you as a child') were obtained, and the higher of the two was reported as the parental education level. Because there are definite socioeconomic benefits associated with specific credentials (such as graduation from high school and college), we categorized education level into four groups: less than high school education (< 12 years of regular schooling), high school graduation but no college (12 years of schooling), 1–3 years of college (13–15 years of schooling), and college graduation (≥ 16 years of schooling). The participants' own educational attainment was obtained at baseline and at every follow-up interview. Because many participants were still in the process of completing their education, analyses with the participant's own education were confined to the older stratum in the study sample; i.e., those individuals who were 25 years of age or older at baseline, and thus likely to have completed their education when the study began. Only 6% of participants in this group had not completed

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