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Original article

Mediating effects of cancer risk factors on the association between race and cancer incidence: analysis of the NIH-AARP Diet and Health Study

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ABSTRACT

Purpose: Racial disparities exist in the prevalence of cancer-related risk factors and incidence of cancer. The objective of this study is to determine if cancer-related risk factors mediate the association between race and cancer incidence.

Methods: We performed prospective analysis of data from the National Institutes of Health–American Association of Retired Persons Diet and Health Study, years 1995 through 2011. We compared differences in baseline characteristics between black and white participants using χ^2 tests and Wilcoxon tests, as appropriate. We determined risk of any cancer and the most common cancer types (i.e., breast, prostate, and colorectal) using Cox Proportional hazards models, adjusted for age, sex, marital status, education, health status, region, and adherence to guidelines on cancer-related risk factors (i.e., body mass index [BMI], smoking status, physical activity, nutrition, and alcohol consumption). We examined the mediation effect of cancer-related risk factors on the association between race and cancer incidence.

Results: Among 425,152 participants, 16,110 (3.79%) were black, and 409,042 (96.21%) were white. The white participants were more likely to be aged 65 years and older (35.33% vs. 25.93%), male (60.88% vs. 42.67%), married (70.37% vs. 48.26%), reside in Western US (30.14% vs. 23.88%), be physically active (46.72% vs. 41.94%), and have higher adherence scores (3.14 vs. 3.04). Blacks had reduced risk of breast cancer (adjusted hazard ratio [HR]: 0.82, 95% confidence intervals [CI]: 0.74–0.90) but higher risk of prostate (adjusted HR: 1.86, 95% CI: 1.75–1.98) and colorectal cancer (adjusted HR: 1.17, 95% CI: 1.05–1.31) compared with whites. Nutrition mediated the association between race and breast cancer (6.35% mediated, $P < .01$), whereas BMI mediated the association between race and colorectal cancer (7.99% mediated, $P < .01$).

Conclusions: Blacks were at reduced risk of breast cancer but increased risks for prostate and colorectal cancer incidence. Nutrition and BMI exerted small but significant mediating effects on the racial disparity in risk of breast and colorectal cancers, respectively.

Introduction

Modifiable risk factors, including diet, physical activity, body mass index (BMI), and smoking have consistently been associated with cancer risk [1–4]. The American Institute for Cancer Research/World Cancer Research Fund (AICR/WCRF) provide specific guidelines on the appropriate levels for each of these modifiable risk factors, and greater adherence to these guidelines has been associated with reduced risk of cancer among adults [5–8]. However, multiple studies show significantly poor adherence [9–11], increasing prevalence of obesity [12–14] and consistently low levels of physical activity among U.S. adults [15]. Racial disparities in the incidence of the major cancers have also persisted among U.S. adults for many decades [16]. Black adults are more likely to develop prostate, colorectal, and ovarian cancers, whereas white women are more likely to develop breast cancer. Racial disparities also exist in the prevalence

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of modifiable cancer risk factors; although overall adherence to the AICR/WCRF guidelines is low in all racial groups, blacks are more likely to be obese and less physically active compared with Whites [17]. Disparities in cancer-related risk factors may contribute to the observed disparities in cancer incidence; however, efforts to estimate the extent to which these modifiable cancer risk factors mediate the association between race and cancer incidence have been limited by the lack of high-quality prospective data with adequate number of blacks and whites represented. The purpose of this article is to estimate the direct, indirect, and total effects of race (black vs. white) on cancer incidence, accounting for the mediating effects of diet, physical activity, smoking, overweight/obesity, and excess alcohol use as well as a composite measure of overall adherence to AICR/WCRF guidelines.

Methods

Study participants

Data for this study were obtained from the prospective National Institutes of Health–American Association of Retired Persons (NIH-AARP) Diet and Health Study. The cohort consists of 566,398 adult American Association of Retired Persons members aged 50–71 years recruited in 1995–1996. At enrollment, participants completed a baseline questionnaire assessing lifestyle and behavioral risk factors such as smoking, alcohol, physical activity, and dietary patterns. Participants with self-reported cancer at baseline (n = 49,318), proxy respondents (n = 15,760), death record data only (n = 4,255), or those who had missing data on behavioral risk factors (62,347) and race (9,566) were excluded from analysis. The final analysis included 425,152 adults; 16,110 blacks and 409,042 whites with no prior history of any cancer before completing the baseline questionnaire (Fig. 1).

Cancer incidence

Incident cancer cases were identified through a linkage with cancer registries through December 31, 2011. Detailed information for each cancer diagnosis was obtained on diagnosis date, stage, grade, and first course of treatment within the first year of diagnosis. Incident cancer ascertainment in this dataset has been estimated to be about 90% complete [18]. In this study, data on any cancer, breast, colorectal, and prostate cancer cases were used for analysis.

Primary exposure variable

The primary exposure of interest in this study is self-reported race/ethnicity at baseline. Participants were defined as either black/African-American or white.

Cancer-related risk factors

The American Cancer Society and AICR/WCRF guidelines regarding body weight, physical activity, diet, smoking, and alcohol consumption were developed to guide cancer prevention efforts [19,20]. Here, we assessed adherence to the AICR/WCRF guidelines on five cancer-related risk factors; physical activity, BMI (in kg/m^2), alcohol use, smoking, and nutrition (fruit and vegetable intake). We

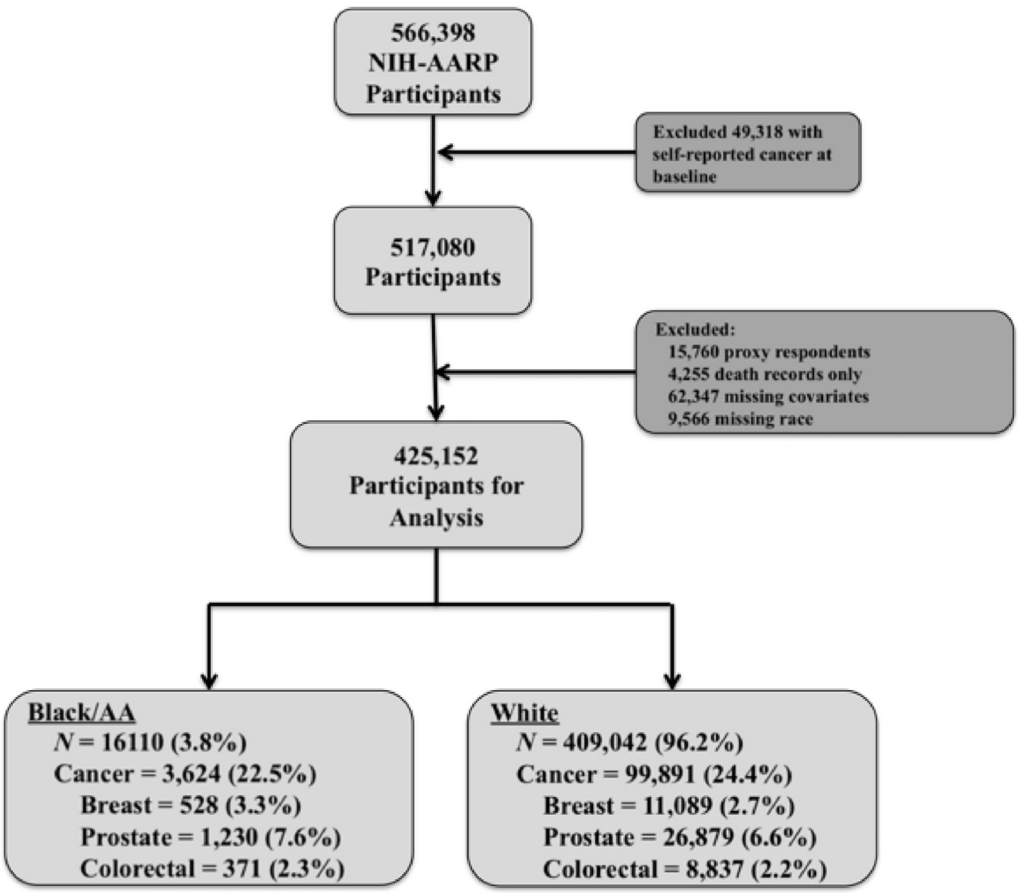

Fig. 1. National Institutes of Health–American Association of Retired Persons Diet and Health Study population flowchart and cancer incidence. AA = black.