Racial and Ethnic Variations in the Effects of Family History of Colorectal Cancer on Screening Compliance

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BACKGROUND & AIMS: Individuals with a family history of colorectal cancer (CRC) have a higher risk of developing CRC than the general population, and studies have shown that they are more likely to undergo CRC screening. We assessed the overall and race- and ethnicity-specific effects of a family history of CRC on screening. **METHODS:** We analyzed data from the 2009 California Health Interview Survey to estimate overall and race- and ethnicity-specific odds ratios (ORs) for the association between family history of CRC and CRC screening. **RESULTS:** The unweighted and weighted sample sizes were 23,837 and 8,851,003, respectively. Individuals with a family history of CRC were more likely to participate in any form of screening (OR, 2.3; 95% confidence limit [CL], 1.7, 3.1) and in colonoscopy screening (OR, 2.7; 95% CL, 2.2, 3.4) than those without a family history, but this association varied among racial and ethnic groups. The magnitude of the association between family history and colonoscopy screening was highest among Asians (OR, 6.1; 95% CL, 3.1, 11.9), lowest among Hispanics (OR, 1.4; 95% CL, 0.67, 2.8), and comparable between non-Hispanic whites (OR, 3.1; 95% CL, 2.6, 3.8) and non-Hispanic blacks (OR 2.6; 95% CL, 1.2, 5.7) (P for interaction $< .001$). **CONCLUSIONS: The effects of family history of CRC on participation in screening vary among racial and ethnic groups, and have the lowest effects on Hispanics, compared with other groups. Consequently, interventions to promote CRC screening among Hispanics with a family history should be considered.**

Keywords: Population Study; Database Analysis; Early Detection; Colon Cancer Prevention.

Colorectal cancer (CRC) is the second leading cause of cancer-related deaths in the United States. Mortality from CRC gradually has decreased during the past decade,[1,2] which partially may be attributable to removal of adenomatous polyps or earlier stage at diagnosis of CRC as a result of screening.[3,4] Nonetheless, racial and ethnic disparities in CRC outcomes persist and minorities are less likely to be up-to-date on CRC screening.[2,5,6]

Individuals with a family history of CRC have a higher risk of developing CRC than the general population.[7–15] An estimated 30% of CRC cases may have an inherited component, of which approximately 5% constitute a well-defined genetic syndrome such as Lynch and polyposis syndromes. The remaining familial CRCs likely are owing to multiple genetic factors and their interactions with the environment.[9,10] The risk of CRC in the latter group is between 2- and 6-fold compared with the general population, depending on kinship, number of relatives, and age at diagnosis of affected family members.[12–15] Siblings of patients with nonsyndromic CRC recently were shown to have a higher prevalence of adenomas and advanced neoplasms.[16] Risk stratification and screening recommendations for individuals with a family history of CRC depend on the details of the family history. Nevertheless, individuals with a family history of CRC should at the very least undergo average-risk screening, with colonoscopy being the preferred modality.[17–19]

Previous studies have suggested that individuals with a family history of CRC are more likely to undergo CRC screening than those without a family history[20–29] and that there may be racial and ethnic differences.[30–32] Nonetheless, previous studies generally compared racial and /ethnic groups with (or without) a family history of CRC with whites with (or without) a family history for the outcome of CRC screening. Although such comparisons provide evidence of differences between racial and ethnic groups, evidence of differences within racial and ethnic groups may be uniquely informative. Therefore, the aim of our study was to assess the impact of family history of CRC on CRC screening within racial and ethnic groups in a population-based sample.

Materials and Methods

Study Population

We used data from the California Health Interview Survey (CHIS)[33] to assemble a study population for addressing our aim. CHIS is a population-based, random-digit dial telephone survey conducted in multiple languages among noninstitutionalized California residents that uses a multistage sampling design to ensure that minority subgroups and rural populations are well-represented. The survey has been administered bi-annually since 2001 and queries information on a wide

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Abbreviations used in this paper: CHIS, California Health Interview Survey; CL, confidence limit; CRC, colorectal cancer; FOBT, fecal occult blood testing; NHIS, National Health Interview Survey; OR, odds ratio.

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range of demographic and health-related topics, similar to the National Health Interview Survey (NHIS).[34]

Our study used CHIS 2009 data[33] given the uniform availability of relevant exposure, covariate, and outcome information. All individuals between 50 and 75 years of age were eligible for our analysis because this group constitutes the generally accepted age range for average-risk CRC screening.[17–19,35] Although individuals with a family history of CRC may be recommended to initiate CRC screening before age 50 years, our objective was to compare the rate of CRC screening using average-risk guidelines so that we could compare those with a family history with those without a family history of CRC. This study was approved by the Dana-Farber–Brigham and Women's Hospital Cancer Center Institutional Review Board.

Variables

Up-to-date average-risk CRC screening was defined as self-reported use of a fecal occult blood test (FOBT) within the past year, flexible sigmoidoscopy within the past 5 years, or colonoscopy within the past 10 years. We did not distinguish between screening and diagnostic tests, particularly considering that prior studies indicated that self-reported reasons for screening often are inaccurate.[36–39] Family history of CRC was defined as having reported 1 or more first-degree relatives diagnosed with colon or rectal cancer. The age at cancer diagnosis in the family member was not ascertained in the survey.

Self-reported race and ethnicity were categorized according to the Office of Management and Budget Standards for Data on Race and Ethnicity,[40] which represent social rather than biologic measures.[41] Briefly, race was categorized as American Indian or Alaska Native, Asian, black, Native Hawaiian or other Pacific Islander, and white. Ethnicity was categorized as Hispanic and non-Hispanic. Race/ethnicity subsequently was categorized for our analysis as Asian, Hispanic, non-Hispanic black, non-Hispanic white, and other. The category of "other" comprised American Indian or Alaska Native, Native Hawaiian, or other Pacific Islander, and individuals who reported multiple racial and ethnic categories. Additional information ascertained in the survey included age, sex, marital status, education, insurance status, and household income.

Data Analysis

For descriptive analyses, we computed means (with standard deviations) and proportions while accounting for the complex survey design and population weights using PROC SURVEYMEANS and SURVEYFREQ, respectively, in SAS 9.2 (SAS Institute, Cary, NC). We estimated the overall and race/ethnicity-specific odds ratios (ORs) and 95% confidence limits (CLs) for the association between family history of CRC (compared with no family history) and average-risk CRC screening, as well as individual screening modalities. In addition, we explored potential statistical heterogeneity (ie, third-order interaction) for the association between family history and CRC screening by race/ethnicity and insurance type (employer-based/private, Medicare only/Medicare and Medicaid, Medicaid only/Healthy Family/other public program, or no insurance) given prior evidence that insurance type may be associated with CRC screening.[42]

Odds ratios were adjusted to reduce confounding bias based on covariates identified in a directed acyclic graph.[43] Briefly, this graphic method is designed to identify a minimal sufficient set of covariates for inclusion in a regression model to reduce confounding bias by applying an iterative algorithm (ie, the back-door test).[43,44] One major advantage of this method is that it helps avoid overadjustment and unnecessary adjustment of covariates that actually may increase rather than reduce bias if adjusted inappropriately.[43–45] Our directed acyclic graph (Supplementary Figure 1) incorporated assumptions based on subject-matter knowledge[46] of dependencies between factors that influence CRC screening and family history of CRC. Application of the back-door test[43,44] indicated that adjustment for age and race/ethnicity in the overall model, and age in the race/ethnicity-specific models, was minimally sufficient for reducing confounding bias in the association between family history of CRC and CRC screening. For comparison, we also estimated ORs and CLs using all covariates in our graph that were not intermediates (ie, age, race/ethnicity, sex, marital status, education, insurance status, and household income) rather than just the minimal sufficient set. CHIS uses a complex survey design and population weighting that, if ignored, would bias variance estimates and compromise generalizability.[47–52] Therefore, we used PROC SURVEYLOGISTIC in SAS 9.2 (SAS Institute, Cary, NC) to estimate ORs and CLs, which accounted for the complex survey design and population weights. In addition, effect heterogeneity by race/ethnicity was determined using interaction terms between family history and race/ethnicity in the models.

Sensitivity Analysis

Given that self-reported family history may be inaccurate, we quantitatively explored the potential impact of misclassified self-reported family history of CRC in our study using a deterministic sensitivity analysis (Stata Corp, College Station, TX).[53,54] This type of analysis seeks to improve interpretation by quantifying the uncertainty in estimation.[54] Briefly, we used published values of sensitivity and specificity of self-reported family history from a validation study in the general population[55] as a starting point for exploring how classification errors in self-reports could change our OR for the association between family history of CRC and CRC screening by any modality. We varied the paired-values of sensitivity and specificity to observe the change in OR from the original estimate. Of particular interest to us was the combination of sensitivity and specificity that could nullify our OR (ie, the magnitude of misclassification would make our OR equal to 1.0). The results subsequently were used to interpret whether the values required for a null OR were plausible.

Results

The unweighted sample comprised 23,837 California residents aged 50 to 75 years (Table 1). Population-weighting yielded an evaluable sample size of 8,851,003 individuals representative of the California population, of whom approximately half were female. Non-Hispanic whites were the largest racial/ethnic group (58%), followed by Hispanics (22%; 74% of whom were of Mexican origin), Asians (11%), and non-Hispanic blacks (6%). The majority of individuals were insured and had household incomes greater than the federal poverty level.

Family history of CRC (defined as $\geq$1 first-degree relatives with CRC) was reported by 7% of respondents. Non-Hispanic whites reported the highest proportion of individuals with a family history of CRC (8.2%), and

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