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RESEARCH ARTICLE

National Disparities in Colorectal Cancer Screening Among Obese Adults

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Introduction: Obesity is a major risk factor for colorectal cancer (CRC), particularly among men. The purpose of this study was to characterize the prevalence of guideline-adherent CRC screening among obese adults using nationally representative data, assess trends in screening strategies, and identify obesity-specific screening barriers.

Methods: Data from 8,550 respondents aged 50–75 years in the 2010 National Health Interview Survey, representing >70 million adults, were analyzed in 2015 using multivariable logistic regression. Prevalence of guideline-adherent CRC screening, endoscopic versus fecal occult blood test screening, and reasons for non-adherence were compared across BMI categories.

Results: Obese class III men (BMI ≥40), compared with normal-weight men, were significantly less likely to be adherent to screening guidelines (38.7% vs 55.8%, AOR=0.35, 95% CI=0.17, 0.75); less likely to have used an endoscopic test (36.7% vs 53.0%, AOR=0.37, 95% CI=0.18, 0.79); and had a trend toward lower fecal occult blood test use (4.2% vs 8.9%, AOR=0.42, 95% CI=0.14, 1.27). Among women, odds of guideline adherence and use of different screening modalities were similar across all BMI categories. Reasons for non-adherence differed by gender and BMI; lacking a physician screening recommendation differed significantly among men (29.7% obese class III vs 15.4% non-obese, p=0.04), and pain/embarrassment differed significantly among women (11.6% obese class III vs 2.6% non-obese, p=0.002).

Conclusions: Despite elevated risk, severely obese men were significantly under-screened for CRC. Addressing the unique screening barriers of obese adults may promote screening uptake and lessen disparities among the vulnerable populations most affected by obesity.

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INTRODUCTION

Colorectal cancer (CRC) is the third-leading cause of cancer and cancer death among both U.S. men and women.[1] Obesity is a major independent risk factor estimated to increase the risk of CRC by 60% and CRC mortality up to 90%.[2–5] Obese men and those with very high BMI have the greatest risk of both CRC and CRC death.[3–5] Potential links between excess adiposity and CRC include hormonal effects of insulin, changes in gut microflora, and systemic inflammation,[6,7] though suboptimal screening may also contribute. More than a third of U.S. adults are obese and prevalence is projected to exceed 40% by 2030.[8,9] As the obesity epidemic progresses, screening is increasingly important in reducing preventable CRC morbidity and death.

Despite evidence that screening reduces CRC mortality,[10] less than two thirds of U.S. age-eligible adults were up to date with CRC screening in 2012,[11] and several studies have shown that obese adults, especially women, are screened even less.[12–17] Other studies and systematic reviews have not shown BMI-related screening differences,[18–24] or alternatively, observed increased screening among obese subgroups.[25–28] These mixed results likely

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reflect variable screening modalities used, inconsistent BMI categories, and smaller, less-representative samples. Among studies using national data,[14,15,18,19,22–25,27,29,30] none explored guideline-concordant CRC screening among men and women in each obesity class to account for potential gender differences and obesity category thresholds.

In a 2016 update, the U.S. Preventive Services Task Force (USPSTF) expanded the recommended CRC screening options and encouraged clinicians to engage in shared decision making and individualize the testing strategy to one that will most likely get completed.[31] Identifying reasons for non-adherence, especially among high-risk subgroups such as the obese, is essential for determining strategies to promote screening uptake. Though CRC screening barriers are more clearly established for the overall population,[18,19,32] studies on BMI-related barriers are limited,[13] and none have investigated obesity-specific reasons for non-adherence using national data.

The first study objective was to use a nationally representative sample to test the hypothesis that fewer obese women, but not men, would be adherent to screening guidelines as in prior studies. Second, the association between BMI and use of invasive screening options was explored to elucidate obesity-related trends in screening strategies. Lastly, reasons for non-adherence were compared between genders and BMI categories to inform interventions to improve screening within the high-risk, obese population.

METHODS

Study Sample

The National Health Interview Survey (NHIS) is an in-person, annual household survey conducted by the National Center for Health Statistics.[33] It employs a stratified, multistage cluster design with oversampling of subpopulations to produce generalizable estimates of the civilian, non-institutionalized U.S. population. A Cancer Control supplement is included every 5 years to collect additional cancer-related health information. The adult core component and cancer supplement are administered to a random adult member of each selected household. In 2010, a total of 34,329 households were surveyed with a final response rate of 60.8% among sampled adults.

Data were initially obtained from NHIS 2010 on 9,782 adults aged 50–75 years. Respondents were excluded if they did not complete the cancer supplement (n=264); reported a personal history of CRC (n=88); lacked height or weight information (n=801); or were underweight (n=79), yielding a final sample of 8,550 adults. This study was conducted in 2015 and received exemption by the Boston Medical Center IRB.

Measures

The primary independent variable was BMI, calculated based on self-reported height and weight. BMI categories were defined using the WHO obesity classification system[34]: normal weight (18.5–24.9); overweight (25.0–29.9); obesity class I (30.0–34.9); obesity class II (35.0–39.9); and obesity class III ($\geq$40.0). Underweight adults with BMI $<$18.5 were excluded given the study objectives.

For screening outcomes, adults were defined as "guideline-adherent" if they self-reported completion of one of the three 2008 USPSTF-recommended CRC screening options[10]: (1) colonoscopy within 10 years; (2) sigmoidoscopy within 5 years plus home fecal occult blood test (FOBT) within 3 years; or (3) home FOBT within the past year. Diagnostic testing counted for having received a screening test, as it would still qualify as age-appropriate screening. Use of invasive and non-invasive screening modalities were then analyzed separately, defined as having a (1) colonoscopy or sigmoidoscopy (collectively termed "endoscopy") within 10 years and 5 years, respectively, or (2) home FOBT within the past year. These two groups were not mutually exclusive; respondents reporting both endoscopy and FOBT were analyzed within both groups.

To identify screening barriers, age-eligible adults not up to date with the 2008 CRC screening recommendations were asked, *What is the most important reason why you have not had any kind of test to look for problems in your colon or rectum [ever or recently]?* Respondents could select one of the available answer options provided by NHIS. For the analysis of this study, responses for *never thought about it* and *didn't know I needed this type of test* were combined given the overlapping theme of lacking awareness of the need to screen. Additional answer options are described in the Results section.

Covariates and potential confounders were considered based on a priori significance or clinical relevance to CRC screening. Relevant sociodemographics included age, gender, race/ethnicity, language, insurance status, educational attainment, marital status, and U.S. region. Income was excluded as this information was missing for a large proportion of respondents. "Other race" included non-Hispanic Asians and all other non-Hispanic race groups other than whites and blacks. Self-reported race and ethnicity information was missing for 5.6% of the study sample; imputed race and ethnicity designation for these data was provided by NHIS using multiple imputation methods.[35] Healthcare-associated factors included the number of office-based medical visits in the past year; having a usual care source (excluding emergency departments); number of comorbid conditions; functional limitations; and general health status. Self-reported comorbidities were heart disease, hypertension, chronic obstructive pulmonary disease, asthma, stroke, diabetes, renal disease, and liver disease. CRC risk factors included smoking status, alcohol use, and family history of CRC, which was categorized as positive versus no/unknown family history because family history only influences CRC screening for individuals reporting a positive family history.[36]

Statistical Analysis

Sample characteristics were examined using descriptive statistics and compared across BMI categories using chi-square tests. CRC screening prevalences (guideline-adherent screening, endoscopic screening, and FOBT screening) were calculated as an unadjusted percentage within each BMI group, and multivariable logistic regression was used to determine the adjusted odds of screening for each of the BMI categories relative to the normal-weight group. To determine if missing screening data and receipt of diagnostic