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Associations between contextual factors and colorectal cancer screening in a racially and ethnically diverse population in Texas

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ABSTRACT

Background: Colorectal cancer is the third most commonly diagnosed cancer and the third leading cause of cancer death in the United States. Increased attention has been given to understanding the role of local contexts on cancer screening behaviors. We examined the associations between multiple tract-level socioeconomic measures and adherence to colorectal cancer screening (CRCS) in Harris County and the City of Houston, Texas.
Methods: We conducted a cross-sectional multilevel study linking individual-level data on CRCS from the 2010 Health of Houston Survey with contextual data from the U.S. Census and the U.S. Department of Housing and Urban Development. We examined tract-level poverty, education, employment, income inequality, and foreclosure measures across 543 Census tracts. Analyses were limited to individuals aged 50–74 years ($N = 1720$).
Results: Overall, 58.0% of the sample was adherent to any recommended CRCS test. In bivariate analyses, increasing levels of area poverty, low education, unemployment, and foreclosures were associated with lower odds of adherence to CRCS. After controlling for individual-level covariates, only tract-level unemployment remained associated with adherence to CRCS (adjusted OR = 0.80; 95% CI: 0.66–0.99; $P = .037$).
Conclusions: Neighborhood socioeconomic disadvantage is increasingly recognized as a determinant of health, and our study suggests that the contextual effect of area unemployment may extend to cancer screening outcomes. Our finding is important to cancer control planners because we identified a contextual marker of disparity that can be used to target local interventions to promote CRCS and thereby reduce cancer disparities among non-adherent individuals who reside in communities with high unemployment rates.

1. Introduction

Colorectal cancer is the third most commonly diagnosed cancer and the third leading cause of cancer death in the United States [1]. Evidence shows that colorectal cancer screening (CRCS) decreases both incidence and mortality from cancer by discovering and facilitating removal of precancerous polyps and detecting cancer at early, more treatable stages [2,3]. The U.S. Preventive Services Task Force (USPSTF) strongly recommends CRCS by annual high-sensitivity fecal occult blood testing (FOBT), flexible sigmoidoscopy every 5 years combined with an interval FOBT, or colonoscopy every 10 years among average risk adults aged 50–75 years [4]. Despite national recommendations for screening, fewer than 65% of U.S. adults in that age range are screened at recommended intervals, and many have never had any type of CRCS [5]. Numerous studies indicate that individual-level characteristics such as socioeconomic status (SES) and health insurance coverage are associated with adherence to CRCS guidelines [6], but these factors do not fully explain the suboptimal screening.

Increased attention has been given to understanding the role of the local context on health outcomes and behaviors and on its

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interplay with an individual's characteristics [7–9]. Macintyre et al. [10] have conceptualized local environments as "structures of opportunities and resources" that may promote or restrict health in various ways. For example, access to quality local medical services, environments that support healthy behaviors, and education and labor market opportunities could influence an individual's health. Studies have shown that socioeconomically deprived neighborhoods lack adequate health services, present precarious social and material infrastructures, and offer fewer job opportunities compared with more affluent areas [11–13].

Although researchers have examined the influence of residential environments on CRCS outcomes, these findings are mixed [14]. For example, Thorpe et al. [15] found that New York City residents living in neighborhoods in which 30–45% of families were ≤200% the federal poverty level reported lower compliance with any timely CRCS test (adjusted OR = 0.76; 95% CI: 0.61–0.93) than those from higher income neighborhoods. Schootman et al. [16] also found that increasing area-level poverty rate was independently associated with never having had a colonoscopy or sigmoidoscopy (adjusted OR = 1.10; 95% CI: 1.01–1.19) or a FOBT (adjusted OR = 1.19; 95% CI: 1.12–1.27) among individuals living across 98 metropolitan or micropolitan statistical areas in the United States. Conversely, in a study using a nationally representative sample of Medicare enrollees, O'Malley et al. [17] reported no significant associations between three measures of area-level SES (poverty, median family income, and per capita income) and adherence to timely FOBT, sigmoidoscopy, or colonoscopy. Neither was area-level poverty associated with any modality of CRCS in a study conducted by Koroukian et al. [18] among Medicaid–Medicare beneficiaries. Some have argued that conceptual and methodologic limitations in this literature may account for the variation in findings [14]. For example, the majority of studies published in this field can be characterized by a reliance on a limited set of area-level SES measures, the use of large heterogeneous geographic areas, limited control for individual-level correlates of CRCS, and statistical analyses that do not account for the nested structure of multilevel data [14].

In this study, we address some of the limitations and extend research by using multilevel modeling to examine the association of multiple area-level SES measures, at the tract level, with CRCS. In addition, we examined a broader range of area-level SES measures than previously explored in the cancer screening literature (e.g. income inequality, foreclosures). We hypothesize that residing in socioeconomically disadvantaged areas will be associated with poor adherence to CRCS recommendations, even after controlling for individuals' characteristics. Our hypothesis is guided by Macintyre's conceptual framework [10] and by empirical studies [15,16,19–21] that suggest there are place effects on health via collective opportunities and resources.

2. Methods

2.1. Data sources and study population

We conducted a cross-sectional multilevel study using data from the 2010 Health of Houston Survey (HHS), the U.S. Census Bureau, and the U.S. Department of Housing and Urban Development. All individual-level data were obtained from the 2010 HHS, a population-based survey of randomly chosen households in the city of Houston and Harris County, Texas. Harris is the third most populous county in the U.S. and the most populous one in Texas. The survey is the area's most extensive health survey to date and collects data on a wide variety of health topics, providing communities with information about their unmet health needs [22]. Briefly, the 2010 HHS employed an address-based design to capture households with landline phones, cell phone—only households, and households without telephones in order to overcome limitations associated with random digit dialing telephone interviewing. The survey also used a multistage sampling design to assure a representative sample of ethnic minorities and low income residents. The survey was administered in English, Spanish, and Vietnamese with responses recorded by telephone interviewers, on a secure web site, or in a mail-in questionnaire. Individuals were eligible to participate in the survey if they were ≥18 years. The cooperation rate (% of all individuals interviewed out of all eligible units ever contacted) was 62.6%, and response rate (% of all individuals interviewed out of all eligible sample units in the study, not just those contacted) was 28.9%. The 2010 HHS sample consisted of 5116 adults. A more detailed description of the overall study design and sampling methods are provided elsewhere [23].

All area-level data were aggregated at the Census-tract level and were linked to individual HHS respondents using a restricted data file of the 2010 HHS that contained Census-tract information for each participant. Data on area-level poverty, education, employment, and income inequality came from the U.S. Census Bureau (5-year estimates from 2010 Census' American Community Survey) and data on area-level foreclosures were obtained from the U.S. Department of Housing and Urban Development (18-month period through June 2008). On the basis of existing CRCS guidelines [4], we included adults between the ages of 50–74 in this study (the survey did not collect data on cancer screening practices among individuals 75 years of age or older). Thus, our study sample consisted of 1720 age-eligible individuals (Level 1) distributed across 543 Census tracts (Level 2). The mean sample size by tract was 3.2 individuals (range: 1–20). This study was approved by the Committee for the Protection of Human Subjects at The University of Texas Health Science Center at Houston.

2.2. Measures

2.2.1. Dependent variable: adherence to CRCS

The USPSTF screening guidelines in effect during the data collection period of the 2010 HHS were used to determine the main outcome, a dichotomous measure of timely receipt of any CRCS. An individual was considered adherent if he/she reported having a FOBT in the previous 12 months, a flexible sigmoidoscopy in the previous 5 years, or a colonoscopy in the previous 10 years. The 2010 HHS questionnaire on CRCS consisted of standardized questions adapted from the Behavioral Risk Factor Surveillance Survey. Use of FOBT was assessed by asking whether or not the participant ever had the test and if so how recently. Likewise, the participant was asked whether or not he/she ever underwent either sigmoidoscopy or colonoscopy and if so how recently.

2.2.2. Tract-level socioeconomic variables

Because we hypothesized that health is influenced by neighborhood environments through the availability of structures of opportunities and resources, we tested a number of tract-level measures relevant to such contexts: (1) poverty (% of individuals living below the U.S. poverty line), (2) education (% of adults aged ≥25 years without high school education), and (3) unemployment (% of individuals aged ≥16 years in the labor force who are unemployed). These three measures provide a meaningful summary of the specified area's SES and show data that can be compared over time and across regions [24]. In addition, we tested an area-level measure of income inequality based on the Gini coefficient [25], a statistical dispersion measurement that ranks income distribution on a scale between 0 and 1. A tract that scores 0 has perfect equality of income distribution among its residents. Conversely, a Gini coefficient of 1 expresses maximal income