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Regional variation in colorectal cancer testing and geographic availability of care in a publicly insured population[☆]

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ABSTRACT

Despite its demonstrated effectiveness, colorectal cancer (CRC) testing is suboptimal, particularly in vulnerable populations such as those who are publicly insured. Prior studies provide an incomplete picture of the importance of the intersection of multilevel factors affecting CRC testing across heterogeneous geographic regions where vulnerable populations live. We examined CRC testing across regions of North Carolina by using population-based Medicare and Medicaid claims data from disabled individuals who turned 50 years of age during 2003–2008. We estimated multilevel models to examine predictors of CRC testing, including distance to the nearest endoscopy facility, county-level endoscopy procedural rates, and demographic and community contextual factors. Less than 50% of eligible individuals had evidence of CRC testing; men, African-Americans, Medicaid beneficiaries, and those living furthest away from endoscopy facilities had significantly lower odds of CRC testing, with significant regional variation. These results can help prioritize intervention strategies to improve CRC testing among publicly insured, disabled populations.

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1. Introduction

Colorectal cancer (CRC) is the third most common cancer diagnosis and the second leading cause of cancer death in the United States (Jemal et al., 2013). CRC is burdensome to human health and to the financial health of the health care system; total costs of caring for patients diagnosed with CRC in the United States are estimated to be more than \$14 billion per year (Mariotto et al., 2011). Routine screening for CRC among those aged 50–75 years can reduce the financial burden of CRC, as well as reduce incidence

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and death caused by CRC (Pignone et al., 2002). Studies suggest that several different screening test regimens (annual high-sensitivity Fecal Occult Blood Test [FOBT]; combination of high-sensitivity FOBT every 3 years and sigmoidoscopy every 5 years; or colonoscopy every 10 years) are nearly equally effective in reducing CRC incidence and death if patients adhere to one of the regimens (Zauber et al., 2008; Whitlock et al., 2008; Pignone et al., 2002; Levin et al., 2008). Importantly, CRC testing is cost-effective and with rising costs associated with treating advanced CRC, routine testing may lead to more timely detection of early stage cancers and become cost-saving (Lansdorp-Vogelaar et al., 2009).

Despite its demonstrated effectiveness, CRC test use is sub-optimal. Overall, CRC testing has increased since 2002, but current rates remain modest, with just 64.5% of age-eligible US adults being up-to-date with CRC testing in 2010 on the basis of self-reported data in the CDC Behavioral Risk Factor Surveillance Survey (BRFSS) (Joseph et al., 2012). Although overall rates have

increased during recent years, the likelihood of being up-to-date with CRC testing is particularly low for those living in non-metropolitan areas (65% versus 69% in metropolitan areas), those with low educational attainment (45% for less than high school graduates vs. 72% for college graduates); those with low household income (48% for incomes less than \$15,000 per year vs. 74% for incomes more than \$75,000 per year); minorities (52–65% for minorities vs. 66% for white adults); and those without a regular health care provider (32% for persons without a regular care provider vs. 68% for those with a regular care provider) (Joseph et al., 2012). As such, CRC testing has become an important health care disparity issue.

Myriad factors influence disparities in CRC testing, including individual-level, community-level, and health care system-level factors (Klabunde et al., 2005). Many of these factors operate on multiple levels; for example, an individual's minority race and whether s/he lives in a community with a more dense population of minorities both can have individual and interactive impacts on health and healthcare services received (Subramanian et al., 2009). As such, consideration of how these multilevel influences entwine is critical to understanding the probable reasons for CRC test underuse among vulnerable populations and intervening in meaningful and effective ways. Multilevel factors affecting cancer screening decisions include: gender, race, age, inability to travel to access care, competing health and non-health demands on time and energy, rates of local poverty, unemployment, and uninsurance (all of which affect availability of and access to health services), geographic barriers to care (e.g., living far away from an endoscopy center), absence of social support resources, (such as help with transportation), social isolation, provider unwillingness to accept publicly insured patients, limited resources to support high-quality decision making (such as patient navigation programs, reminder systems, screening registries, or scheduling systems), and absence of a preventive care infrastructure within the public health system (Zapka et al., 2010, 2003; Honeycutt et al., 2013; Mobley et al., 2010; Stanley et al., 2013; Golden et al., 2009; Pagan et al., 2008).

Prior studies provide an incomplete picture of the importance of the intersection of multilevel factors affecting CRC testing across heterogeneous geographic regions where vulnerable populations live (Morrissey et al., 2012). Conducting rigorous multilevel analyses may help guide future resource allocation and community-based interventions to improve CRC testing among diverse communities with high numbers of publicly insured and medically vulnerable individuals.

Our research fills an important gap in the literature by reporting on the relative influence of individual-level and community-level predictors of CRC testing in North Carolina, (where community-level factors are operationalized at the county level) among Medicaid and Medicare enrollees turning 50 years of age. Because of eligibility criteria associated with Medicare and Medicaid enrollment, most 50-year-olds enrolled in Medicaid or Medicare in North Carolina are living with some type of disability and, thus, represent a particularly vulnerable population. Even with health insurance, disparities persist in receipt of cancer screening and other preventive services among people with disabilities. In a sample of 835 disabled women between the ages of 51–65 years, Wei et al. (2006) found that only 28.7% of women with public insurance pursued CRC testing, whereas 48.6% of women with private insurance were tested for CRC. Disability has also been found to be associated with many chronic conditions, including obesity, cancer, poor mental health, diabetes, heart disease, hypertension, and asthma (Wei et al., 2006) as well as an overall shorter cancer survival rate (McCarthy et al., 2007). In addition, persons living with disabilities are generally less compliant overall with cancer screening guidelines (Ramirez

et al., 2005; Armor et al., 2009) Therefore, disabled individuals may be a particularly vulnerable subpopulation for CRC testing, even when they have access to insurance. Understanding in greater detail the multilevel determinants of CRC testing among vulnerable populations, such as those living with disabilities, can help elucidate which targeted interventions are most likely to be successful in increasing CRC testing rates among these groups.

2. Methods

2.1. Overview

We sought to understand differences in relative rates of CRC testing across North Carolina's publicly insured population and identify areas of need, focusing on individual and county level predictors of CRC testing among people turning 50 years of age, the age group for which the US Preventive Services Task Force (USPSTF) recommends initiating routine CRC testing (USPSTF, 2008). Accordingly, we used insurance claims data from North Carolina Medicare and Medicaid linked to Area Resource File (ARF) and State Medical Facilities Plan (SMFP) data to examine multilevel determinants of CRC testing, including individual demographics, distance to endoscopy, availability of certain types of health care providers, and area-level poverty, education, unemployment, and racial composition. We estimated multilevel models with county level random effects and created county-specific maps depicting relative differences in multivariable-adjusted predicted probabilities of CRC testing.

2.2. Data

We acquired Medicaid and Medicare claims data from 2003 to 2008 for the population of North Carolina insured by either or both of these public insurance providers, providing us with substantial individual-level data about CRC testing. Geographic and health care service provider data from two additional sources were linked to the individual claims data by using county and ZIP code of residence. First, we used the ARF to incorporate county-specific sociodemographic and health care workforce information into our analyses. The ARF is frequently used to describe county level community contextual factors, such as income levels, employment status, and rural land. The ARF database is a collection of data from more than 50 sources, including the American Medical Association, the US Census Bureau, and the Centers for Medicare & Medicaid Services, and has more than 6000 county aggregate variables, including health measures. These data have been used frequently in prior studies of CRC testing (Hayanga et al., 2010; Koroukian et al., 2005, 2006). Second, we used historical SMFP data to identify endoscopy centers across the state and called each of these centers to verify information contained in the archived SMFP records, including, but not limited to, facility street addresses, (which were needed for geocoding), affiliate facilities (where applicable), and procedures performed. This information enabled us to calculate distance to nearest endoscopy center and to estimate annual county level endoscopy procedural rates.

2.3. Population and inclusion/exclusion criteria

The population of interest is publicly insured men and women living in North Carolina who turned 50 years of age during 2003–2008, reflecting current age-specific screening recommendations (USPSTF, 2008). Because guidelines differ on frequency of CRC testing by modality (USPSTF, 2008) (e.g., colonoscopy every 10 years, FOBT every year, flexible sigmoidoscopy every 5 years with FOBT every 3 years), we focused our analyses on tracking

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