# ABSTRACT

Title of Dissertation: PREVENTIVE SERVICES USE - DISPARITIES AND CHANGES FOLLOWING HEALTH CARE REFORM

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The federal Patient Protection and Affordable Care Act (ACA), signed into law on March 23, 2010, changes the landscape of U.S. health care through expanded insurance access, enhanced consumer protections, emphasis on wellness and disease prevention, and cost control. This dissertation is composed of three papers that investigate different aspects of preventive services. The studies use nationally representative data from the National Survey of Family Growth and the Medical Expenditure Panel Survey and employ Andersen's Behavioral Model of Health Services Use as a theoretical model.

The first study explores the variations by race/ethnicity and income in the use of various preventive services among the uninsured. The study employs multivariate logistic regression to estimate the differences in receipt of eight preventive services by race/ethnicity among uninsured adults aged 18 years and older. The main findings show that increasing income generally decreases racial/ethnic disparities and that African Americans and Hispanics generally fared better than Whites in meeting USPSTF guidelines for preventive service utilization.

The second article focuses on the impact expanded access to health insurance in young adults had on use of contraceptive and unintended pregnancy. This study used a difference-in-differences approach to identify a causal relationship between the policy and outcome. The main findings showed that young adults did not improve at a greater rate than their slightly older counterparts in either the use of FDA approved contraceptives or in unintended pregnancy.

The third article examines colorectal cancer screening practices in the Medicare population before and after Medicare rules changes under the ACA. Multivariate and single difference multivariate logistic regression models were estimated and showed that the partial elimination of cost-sharing by beneficiaries only partially impacted CRC screening.

The results demonstrate the importance of understanding the determinants of preventive services use among a variety of population subgroups. This dissertation addressed policy influences on screenings and provided information on the impact of policies on use of preventive services and disparities among subpopulations. Improved access to health insurance and better coverage of preventive services are necessary, but may not be sufficient to actually realize optimal utilization of preventive services.

# PREVENTIVE SERVICES USE - DISPARITIES AND CHANGES FOLLOWING HEALTH CARE REFORM

by

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# Chapter 1

## Introduction

### The Importance of Preventive Services

Since the beginning of the 20th century, the leading causes of death in the United States have shifted from contagious illnesses to chronic diseases as the health system and public health effectiveness have improved (Guyer, Freedman, Strobino, & Sondik, 2000). In fact, 7 of the top 10 leading causes of death in the United States in 2010 were chronic diseases; many of which are preventable or, at least, manageable (Heron, 2013). The top two causes of death – cardiovascular disease and cancer – accounted for nearly half of all deaths (Heron, 2013). Table 1 lists the top 10 causes of death in the U.S. for 2010 and the associated number of people who died. As of 2012, the date for which the most recent chronic disease figures are available, approximately 117 million people had at least one chronic disease or health condition (Hoyert & Xu, 2012). Clearly, preventing chronic diseases or the costly sequelae would be beneficial to the United States health care system.

**Table 1. Chronic Disease Burden in the United States, 2013**

| Chronic disease | Number of deaths | % |
|---|---|---|
| Cardiovascular disease | 596,577 | 24% |
| Cancer | 576,691 | 23% |
| Chronic lower respiratory diseases | 142,943 | 6% |
| Stroke (cerebrovascular diseases) | 128,932 | 5% |
| Accidents (unintentional injuries) | 126,438 | 5% |
| Alzheimer's disease | 84,974 | 3% |
| Diabetes | 73,831 | 3% |
| Influenza and pneumonia | 53,826 | 2% |
| Kidney disease | 45,591 | 2% |
| Intentional self-harm | 39,518 | 2% |
| **Total** | **2,515,458** | **100%** |

Source: Centers for Disease Control and Prevention, http://www.cdc.gov/nchs/data/nvsr/nvsr63/nvsr63_03.pdf

The effective use of preventive services serves as a primary driver in the reduction of major health problems affecting the U.S. population such as cancer mortality, cardiovascular disease, and other chronic diseases (Franks, Gold, & Clancy, 1996). Preventive care services include primary prevention methods to prevent disease from occurring, secondary prevention methods to discover and treat disease early, and tertiary prevention methods that aim to lessen the impact of already present disease and inhibit related complications (USPSTF, 2013). Preventive services have the potential to enable U.S. adults to live longer, healthier lives by reducing illness and/or disability (USPSTF, 2013; Vaidya, Partha, & Howe, 2011).

**The Affordable Care Act and Coverage of Preventive Health Services**

The federal Patient Protection and Affordable Care Act (ACA), signed into law on March 23, 2010, changes the landscape of U.S. health care through expanded insurance access, enhanced consumer protections, emphasis on wellness and disease prevention, and cost control. To bring about these changes, the ACA mandated all persons carry health insurance coverage and created a marketplace for all to purchase insurance; including both individuals and small employers (Kaiser Family Foundation, 2010). The ACA set new requirements for coverage by large employers as well as individuals and sought to expand safety net coverage by expanding the Medicaid program (Kaiser Family Foundation, 2010; National Conference of State Legislatures, 2011).

The ACA places new emphasis on disease prevention and public health instead of only treatment as part of the broader aim to bend the health care cost curve.

The law provides grants for public health programs in an effort to unify prevention efforts and establish a national public health strategy (Shearer, 2010). The ACA requires private health insurance plans as well as Medicare and Medicaid to cover United States Preventive Service Task Force (USPSTF) recommended preventive services without added cost sharing (Shearer, 2010). Beginning September 23, 2010, health plans must cover preventive services highly recommended by the USPSTF.

The USPSTF produces and maintains primary and secondary prevention recommendations that aim to guide clinical and preventive care and are employed by numerous federal and private agencies as they are widely considered the top choice for preventive services guidance (Moyer, LeFevre, & Siu, 2011; USPSTF, 2013). With the passage of the ACA, all people are required to have health insurance coverage and insurance plans must cover many preventive care services without cost sharing (Sommers, Tomasi, Swartz, & Epstein, 2012).

**Disparities in Preventive Care Utilization**

Improving preventive services access is a key objective set by *Healthy People 2020* (Office of Disease Prevention and Health Promotion, 2013). The Healthy People initiative tracks national objectives for improving the health of Americans. It is set up as a set of objectives or targets for public and private health service entities, as well as the general public, to access and take action and incrementally improve a variety of health indicators (Office of Disease Prevention and Health Promotion, 2013). Preventive services, including colorectal cancer screening and regular blood pressure checks, are key to reducing premature death and disability as well as improving the health of the population. Leading Healthy People 2020 health

indicators cover a range of health issues, including cancer, cardiovascular disease, infectious diseases, and diabetes due to the large impact these issues have on the U.S. population.

The literature has documented disparities by race/ethnicity, demographics, socio-economic status, and health insurance in the use of preventive services. Studies have shown that minorities are generally less likely than whites to receive services such as blood pressure checks, cervical cancer screening, and cholesterol screening (Gornick, 2000). Age has been shown to be negatively associated with mammograms and positively associated with Pap tests, cholesterol, and blood pressure screenings (Abdus & Selden, 2013; Allen, Stoddard, Mays, & Sorensen, 2001; Hewitt, Devesa, & Breen, 2002; Saraiya et al., 2012; Vaidya et al., 2011). Higher income and being married are associated with increased preventive service use (Cornelius, Smith, & Simpson, 2002; Gornick et al., 1996; Makuc, Breen, & Freid, 1999; Yi, 1994). Higher levels of education, having a usual source of care, and having insurance are associated with greater utilization of preventive services (Abdus & Selden, 2013; Bandi, Cokkinides, Virgo, & Ward, 2012; Bednarek & Schone, 2003; Benjamins, Kirby, & Bond Huie, 2004; Sambamoorthi & McAlpine, 2003a).

**Structure of the Dissertation**

The general format of this dissertation utilizes a three study/article structure to investigate different aspects of preventive services. The first study explores the variation by race/ethnicity and income in the use of various preventive services among the uninsured. The second article focuses on expanded access to health insurance in young adults under the Affordable Care Act (ACA) and its impact on the

use of contraception and on unintended pregnancy. The third article examines colorectal cancer screening practices in the Medicare population before and after Medicare rules changes under the ACA regarding reimbursement of screening procedures. The final chapter provides a discussion of the results and conclusions of this dissertation.

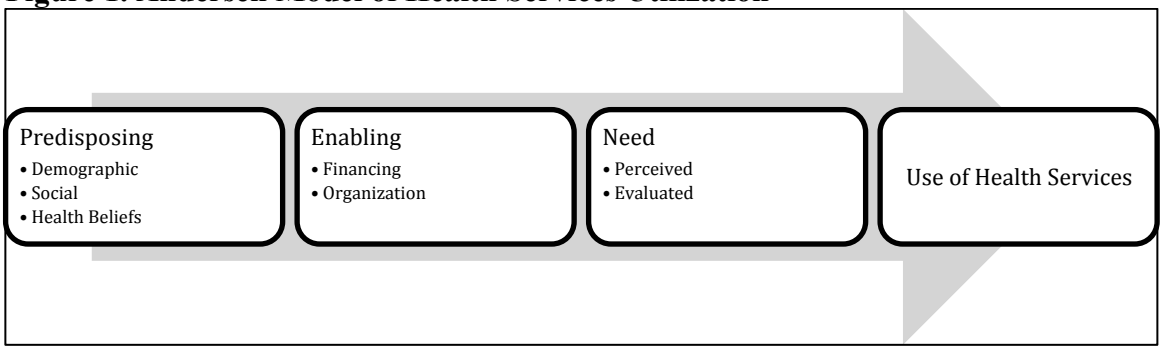
**Conceptual Model**

Theories provide the basic structure to understand behavior and to connect these behaviors to the contexts in which they occur. Health care utilization patterns have been explained by a multitude of theories and models. The Andersen model of health service utilization is one of these theoretical models that describes how the use of health services is explained by personal and environmental factors (R. M. Andersen, 1995). The Andersen model has proven useful in describing the utilization of care across a wide range of health service types including dental care, hospital based services, and basic medical care among diverse populations of varied backgrounds and financial means (Aday & Andersen, 1974; R. Andersen et al., 2000; R. M. Andersen & Davidson, 1997; Coulter et al., 2000; Davidson, Rams, & Andersen, 1997; Gelberg, Andersen, & Leake, 2000; Stein, Andersen, & Gelberg, 2007; Wolinsky & Johnson, 1991). Each of the papers in this dissertation utilizes the Andersen Model as the basis to identify the factors that explain the use of preventive services.

The Andersen model comprises three factors that contribute to health services utilization: (1) predisposing factors include factors such as demographics and socio-structural characteristics that predispose people to either use or not use health

services, (2) enabling factors include resources that either facilitate or impede the use of health services, and (3) need factors include perceived or evaluated health problems that either individuals or health care providers determine that they require medical service intervention (R. M. Andersen, 1995). Figure 1 illustrates the organization of the Andersen model and the way in which the predisposing, enabling, and need population characteristics contribute to health services utilization.

**Figure 1. Andersen Model of Health Services Utilization**




Source: R.M. Andersen. 1995. Revisiting the behavioral model and access to medical care: Does it matter? *Journal of Health and Social Behavior, 36*(1), 1-10.

**Analysis Chapters**

In chapter 2, *Preventive Care Utilization Among the Uninsured by Race/Ethnicity and Income*, a national sample of pooled 2004–2011 Medical Expenditure Panel Survey data is used to analyze the use of U.S. Preventive Services Task Force (USPSTF)-recommended preventive services among uninsured adults. The analysis conducted multivariate logistic regressions to estimate the variation in the receipt of eight preventive services and focused on variation across race, ethnicity, and household income. Chapter 3, *Impact of the Affordable Care Act on Contraceptive Use and Unintended Pregnancy among Young Adults*, utilizes data from the National Survey of Family Growth to analyze how the ACA dependent coverage expansion affected contraceptive use and unintended pregnancy in young

adults. Difference-in-difference analyses were used to estimate the effect of the ACA dependent coverage expansion on contraceptive use and unintended pregnancy. In chapter 4, *The ACA Change in Medicare Cost Sharing Policy and Colorectal Cancer Screening Rates*, the effect of Medicare rules changes stemming from preventive coverage mandates in the ACA is assessed in a population of adults between 65 and 75 years old. The study applied multivariate logistic regression analyses to estimate the probability of being current for colorectal cancer screening by way of different screening methodologies.

# Chapter 2

## Preventive Care Utilization Among the Uninsured by Race/Ethnicity and Income

### Introduction

Effective use of preventive services is a key factor in the reduction of important health concerns such as cancer mortality, cardiovascular disease, hypertension, and other chronic diseases (Allen et al., 2001; Franks et al., 1996). Preventive care services include primary prevention methods designed to prevent occurrence of disease (e.g., immunizations), secondary prevention methods to identify and treat disease early (e.g., cancer screening), and tertiary prevention methods that reduce the impact of established disease and prevent related complications (e.g., home visits to the chronically ill) (USPSTF, 2013). Preventive care services have the potential to enable U.S. adults to live longer, healthier lives by reducing the incidence and prevalence of illness or disability (USPSTF, 2013; Vaidya et al., 2011).

The literature has documented disparities by race/ethnicity and SES in use of preventive services and shown that minorities are generally less likely than whites to receive services such as blood pressure checks, cervical cancer screening, and cholesterol screening. (Gornick, 2000)Age has been shown to be negatively associated with mammograms and positively associated with Pap tests, cholesterol, and blood pressure screenings (Abdus & Selden, 2013; Allen et al., 2001; Barr et al., 2001; Breen, Gentleman, & Schiller, 2011; Hewitt et al., 2002; Saraiya et al., 2012; Vaidya et al., 2011). Higher incomes and being married are associated with increased preventive service use (Barr et al., 2001; Breen et al., 2011; Cornelius et al., 2002; Gornick et al., 1996; Makuc et al., 1999; Yi, 1994). Higher levels of education, having a usual source of

care, and having insurance are associated with greater utilization of preventive services (Abdus & Selden, 2013; Bandi et al., 2012; Bednarek & Schone, 2003; Benjamins et al., 2004; Breen & Kessler, 1994; Hewitt et al., 2002; Sambamoorthi & McAlpine, 2003). Other studies have illustrated that better health status, positive health beliefs, living in the Northeast, and residing in an urban environment are associated with more preventive service use (Benjamins et al., 2004; Cornelius et al., 2002; Sambamoorthi & McAlpine, 2003).

However, scarce literature exists on preventive service utilization among the uninsured. When medical issues are discovered in the uninsured, it is typically at more advanced disease stages and, once a diagnosis is received, they tend to receive less therapeutic care than insured people (Hadley, 2003). According to the Office of the Assistant Secretary for Planning and Evaluation (ASPE) in the USDHHS, an estimated 48.6 million people were uninsured in 2011, which equates to approximately 15.7% of the U.S. population.

Racial and ethnic minorities were more likely to be uninsured than non-Hispanic whites in 2011 (ASPE, 2011). Almost a third of Hispanics, one in five African Americans, and nearly 17% of Asians were uninsured in 2011 compared to 11.1% of non-Hispanic whites (Kaiser Family Foundation, 2013). Lack of health insurance can lead to a variety of issues—from barriers to accessing services to delayed care. Improving preventive services access is a key objective set by *Healthy People 2020* (U.S. Department of Health and Human Services, 2010). The USPSTF produces and maintains primary and secondary prevention recommendations that aim to guide clinical and preventive care and are employed by numerous federal and private agencies and are

widely considered the top choice for preventive services guidance (Moyer et al., 2011). The purpose of this study is to analyze use of USPSTF-recommended preventive services among uninsured adults and illustrate how utilization varies across race/ethnicity and income.

The findings of this study will be relevant to policy stakeholders. With passage of the Affordable Care Act (ACA), all people are required to have health insurance coverage and insurance plans must cover many preventive care services without cost sharing (National Association of City and County Health Officials, 2011). This study will shed light on preventive service utilization of the uninsured, the main target population of the ACA.

*Conceptual Model*

Andersen's behavioral model was chosen to guide independent variable selection. The model details predisposing, enabling, and need factors associated with healthcare service utilization (R. Andersen & Newman, 1973). Predisposing factors represent individuals' natural tendency to utilize healthcare services and include age, gender, and social structural characteristics (e.g., education, occupation, race/ethnicity) (R. M. Andersen, 1995). Enabling factors are resources available to individuals to utilize services (e.g., income, health insurance, regular source of care). Finally, need factors represent health status or disease and are the essential causes of health services utilization (R. M. Andersen, 1995).

## Methods

*Data and Analytic Sample*

Medical Expenditure Panel Survey (MEPS) data were used for this study. MEPS is a household survey of the civilian non-institutionalized population of the U.S.

sponsored by the Agency for Healthcare Research and Quality and the National Center for Health Statistics and provides representative estimates of healthcare utilization, insurance coverage, and sociodemographic characteristics of the population (Ezatti-Rice, Rohde, & Greenblatt, 2008). Eight years of cross-sectional household component MEPS data were pooled (2004 through 2011); analysis took place in 2013. The analytic sample included individuals aged older than 18 years without health insurance for the previous year and was limited to non-Hispanic whites, non-Hispanic African Americans, and Hispanics in order to have sufficient statistical power to compare preventive service utilization across race and ethnicity. This study employed USPSTF recommendations for preventive services to assess proportion and odds of receipt by race/ethnicity and income.

*Dependent Variables*

Eight preventive services were analyzed, including cancer screening procedures (breast, colon, and cervical), hypertension and blood cholesterol screening, routine physical checkup, receiving doctor's advice to quit smoking, and influenza vaccination. Following USPSTF guidelines, eight binary indicator variables were created to reflect whether individuals met guidelines. Table 1 summarizes the analyzed preventive services by recommended population, frequency of assessment, MEPS survey question(s), and resultant sample sizes.

**Table 1.** U.S. Preventive Services Task Force preventive service measures

| Screening | Recommended Population | Frequency | Survey Question(s) | Uninsured Sample |
|---|---|---|---|---|
| **Cervical Cancer (Pap Smear)** | Women aged 21-65 | Every 3 years | How long since last Pap smear test?<br>Had a hysterectomy? | 12,192 |
| **Breast Cancer (Mammogram)** | Women aged 40-74 | Every 2 years | How long since last mammogram? | 6,764 |
| **Colorectal Cancer** | Adults aged 50-75 | Based on screening: | 2004-2008: When was last sigmoidoscopy? | 6,355 |
| **Fecal Occult Test** | | Fecal Occult yearly, or | When was last blood stool test? | |

| | | | | |
|---|---|---|---|---|
| **Colonoscopy**<br><br>**Sigmoidoscopy** | | Colonoscopy every 10 years, or<br>Sigmoidoscopy every 5 years<br>with fecal occult every 3 years. | 2009-2011: When was last blood stool test?<br>When was last colonoscopy?<br><br>When was last sigmoidoscopy? | |
| **Cholesterol Test** | Men age 35+<br>Women age 45+ | Every 5 years | How long since last blood cholesterol check by a doctor or health professional? | 13,101 |
| **Blood Pressure** | Adults over 18 | Every 2 years | How long since last blood pressure check? | 30,242 |
| **Influenza Vaccination** | Adults over 18 | Yearly | When was last influenza vaccination? | 30,247 |
| **Routine Checkup** | Adults over 18 | Yearly | How long since last routine check-up by doctor or other health professional for assessing overall health? | 30,247 |
| **Smoking Advice** | Adult smokers over 18 | Yearly | Among current smokers:<br>Has a doctor advised you to quit smoking? | 5,089 |

Source: United States Preventive Services Task Force, Agency for Health Research and Quality (2015)

USPSTF acknowledges lack of evidence for ideal blood pressure screening intervals and recommends screening every 1–2 years depending on blood pressure level. The indicator variable shows whether screening was performed within the past 2 years.

Cholesterol screening guidelines differ between men and women by age and by risk group. Because risk cannot be assessed, men older than age 35 years and women older than age 45 years met the guideline if the test was performed within the past 5 years. Individuals met guidelines for influenza, routine physical exam, and receipt of advice to quit smoking if these services were received within the past year.

Women met Pap test screening guidelines if they fulfilled inclusion requirements and the test was performed within the past 3 years. Screening for breast cancer by mammography is recommended every 2 years for women aged between 40 and 74 years. Colorectal cancer screening is recommended for all adults aged between 50 and 75 years.

*Primary Independent Variables*

Primary independent variables were race/ethnicity and household income. Race/ethnicity was categorized as white non-Hispanic, African American non-Hispanic, and Hispanic. Categorical variables for four poverty groups were assigned corresponding to poor, low, middle, and high income according to the Federal Poverty Level (FPL): <100%, 100%–199%, 200%–399%, and ≥400% FPL, respectively.

*Other Independent Variables*

Marital status was categorized as never married, married, and divorced/separated/widowed. Education was categorized as less than high school, high school, some college, and college graduate. Primary language, based on interview language, was categorized as English or other. Age categories were: 18–26 years, 27–34 years, 35–64 years, and 65 years or older. Usual source of care was categorized as having none, physician's office, hospital, or emergency room. Urbanicity was categorized as either residing within or outside a Metropolitan Statistical Area. Health and mental health status and were categorized as excellent, very good, good, fair, or poor.

*Statistical Analysis*

Descriptive statistics illustrated proportion differences of uninsured individuals receiving preventive services by race/ethnicity. Linear combinations compared proportions of African Americans and Hispanics to whites by independent variable to identify significant differences. Eight logistic regression models were estimated for the analyzed preventive services and controlled using predisposing, enabling, and need factors per Andersen's model. Finally, logistic regression models were estimated that further stratified by household income to investigate direction and magnitude of race/ethnicity and use of preventive services. Statistical analyses were conducted using

Stata SE, version 13 (StataCorp LP, College Station TX) and adjusted for the complex sample design of the MEPS.

## Results

Table 2 provides summary statistics of the U.S. uninsured population aged 18 years and older by race/ethnicity. Among the uninsured, African Americans and Hispanics were significantly different from whites in nearly all independent variables. In general, uninsured African Americans and Hispanics were poorer, less educated, and fewer had a usual source of care than uninsured whites.

**Table 2.** Weighted descriptive statistics of the uninsured adult population by race/ethnicity

| | | White | Black | Hispanic |
|---|---|---|---|---|
| **Total** | ref. = White | 0.51 | **0.15***** | **0.35***** |
| **Observations** | | 10,418 | 5,789 | 17,314 |
| **Age category** | 18-26 | 0.25 | **0.28**** | **0.27**** |
| | 27-34 | 0.18 | 0.18 | **0.26***** |
| | 35-64 | 0.57 | **0.53**** | **0.45***** |
| | 65+ | 0.003 | 0.004 | **0.01***** |
| **Poverty level** | 0-100% | 0.20 | **0.33***** | **0.26***** |
| | 100-199% | 0.26 | **0.29**** | **0.36***** |
| | 200-399% | 0.33 | **0.26***** | **0.30*** |
| | 400+% | 0.21 | **0.12***** | **0.08***** |
| **Education** | less than High School | 0.22 | **0.26**** | **0.51***** |
| | High School Diploma | 0.39 | **0.42**** | **0.29***** |
| | Some college | 0.25 | 0.23 | **0.13***** |
| | College graduate | 0.14 | **0.09***** | **0.07***** |
| **Marital Status** | Single | 0.37 | **0.22***** | **0.48***** |
| | Married | 0.23 | 0.22 | **0.13***** |
| | Divorced/Widow/Separated | 0.39 | **0.56***** | 0.40 |
| **MSA** | In an MSA | 0.75 | **0.87***** | **0.93***** |
| | Not in an MSA | 0.25 | **0.13** | **0.07***** |
| **Gender** | Male | 0.57 | 0.56 | **0.59*** |
| | Female | 0.43 | 0.44 | **0.41*** |
| **Region of U.S.** | Northeast | 0.14 | 0.13 | **0.11*** |
| | Midwest | 0.24 | **0.18**** | **0.07***** |
| | South | 0.41 | **0.61***** | 0.43 |
| | West | 0.21 | **0.07***** | **0.40***** |
| **Perceived Physical Health Status** | Excellent | 0.25 | 0.27 | 0.25 |
| | Very Good | 0.32 | **0.29**** | 0.31 |
| | Good | 0.30 | 0.30 | **0.33*** |
| | Fair | 0.10 | 0.11 | 0.10 |
| | Poor | 0.03 | **0.03*** | **0.01***** |
| **Perceived Mental Health Status** | Excellent | 0.34 | **0.39***** | 0.35 |
| | Very Good | 0.29 | **0.27**** | 0.31 |

| | | | | |
|---|---|---|---|---|
| | Good | 0.28 | 0.26 | 0.29 |
| | Fair | 0.07 | 0.07 | **0.04***** |
| | Poor | 0.02 | **0.01***** | **0.01***** |
| **SF-12 - Physical Health** | Mean value | 50.73 | **50.22*** | **52.51***** |
| **SF-12 - Mental Health** | Mean value | 49.22 | **50.48***** | **51.00***** |
| **Interview Language** | English | 0.99 | 0.99 | **0.31***** |
| | Not English | 0.01 | 0.00 | **0.69***** |
| **Location of Usual Source of Care** | No USC | 0.49 | 0.57*** | **0.68***** |
| | Office | 0.42 | 0.28*** | **0.21***** |
| | Hospital | 0.08 | 0.13*** | **0.11***** |
| | Emergency Room | 0.01 | **0.02**** | **0.00*** |
| **MEPS Year of Survey** | 2004 | 0.11 | 0.12 | 0.11 |
| | 2005 | 0.12 | 0.12 | 0.11 |
| | 2006 | 0.12 | 0.12 | 0.12 |
| | 2007 | 0.13 | 0.12 | 0.12 |
| | 2008 | 0.13 | 0.13 | 0.13 |
| | 2009 | 0.14 | 0.13 | 0.13 |
| | 2010 | 0.13 | 0.13 | 0.14 |
| | 2011 | 0.12 | 0.13 | **0.14*** |

Source: Medical Expenditure Panel Survey 2004-2011
Note: Boldface indicates statistical significance (*p<0.05, **p<0.01, *** p<0.001).
MSA, Metropolitan Statistical Area; USC, Usual Source of Care; SF-12, 12-Item Short Form Health Survey; MEPS, Medical Expenditure Panel Survey

Table 3 shows bivariate relationships between use of preventive services and race/ethnicity among the uninsured and illustrates variation in meeting USPSTF guidelines. Compared to uninsured whites, a higher proportion of uninsured African Americans met utilization guidelines for cervical cancer screening, mammograms, and routine checkups, and a lower proportion met guidelines for receipt of smoking advice. By contrast, fewer uninsured Hispanics than uninsured whites met guidelines for colorectal cancer screening, routine checkups, cholesterol checks, blood pressure checks, and receipt of smoking advice, but had a higher proportion of uninsured.

**Table 3.** Weighted proportion of uninsured adults receiving selected preventive services by race/ethnicity

| | White | Black | Hispanic |
|---|---|---|---|
| Pap Test | 0.67 | **0.74***** | **0.74***** |
| Mammogram | 0.40 | **0.51***** | **0.50***** |
| Colorectal Cancer Screening | 0.24 | 0.25 | **0.15***** |
| Influenza Vaccination | 0.13 | 0.12 | 0.11 |
| Routine Physical Checkup | 0.31 | **0.41***** | 0.29 |
| Cholesterol Check | 0.73 | 0.73 | **0.70*** |

| | | | |
|---|---|---|---|
| Blood Pressure Check | 0.71 | 0.71 | **0.59*** ** |
| Smoking Advice | 0.47 | **0.42*** | **0.33*** ** |

Reference: White

Source: Medical Expenditure Panel Survey 2004-2011

Note: Boldface indicates statistical significance (*p<0.05, **p<0.01, ***p<0.001).

Results of logistic regression models are presented in Table 4, showing ORs for preventive service receipt among uninsured adults by race/ethnicity and household income. The results are from multivariate models that each included, as control variables, all predisposing, enabling, and need variables described previously. Results are shown only for race/ethnicity; comprehensive tables presenting results for sociodemographic and other control variables are available upon request.

**Table 4.** Multivariate analyses of receipt of selected preventive services stratified by household income[a]

| | | All Income Levels Odds Ratio | <100% FPL Odds Ratio | 100-199% FPL Odds Ratio | 200-399% FPL Odds Ratio | ≥400% FPL Odds Ratio |
|---|---|---|---|---|---|---|
| **Pap Test** | | | | | | |
| ref. | African American | **1.82*** ** | **2.03*** ** | **2.11*** ** | **1.57*** | 1.11 |
| White | Hispanic | **1.37**** | **1.45*** | **1.49*** | 1.41 | 0.88 |
| **Mammogram** | | | | | | |
| ref. | African American | **2.19*** ** | **2.55*** ** | **2.85*** ** | **1.87**** | 1.21 |
| White | Hispanic | **1.91*** ** | **2.42**** | **2.35*** ** | **1.97**** | 0.89 |
| **Colorectal Cancer Screening** | | | | | | |
| ref. | African American | 1.21 | 1.08 | **2.48*** ** | 1.10 | 0.61 |
| White | Hispanic | 0.89 | 1.04 | 1.59 | 0.80 | 0.53 |
| **Blood Pressure Check** | | | | | | |
| ref. | African American | **1.26*** ** | 1.17 | **1.37**** | **1.40**** | 0.89 |
| White | Hispanic | **0.85*** | **0.67*** ** | 0.92 | 0.97 | **0.71*** |
| **Cholesterol Screening** | | | | | | |
| ref. | African American | 1.13 | 0.94 | **1.36*** | 1.05 | 1.17 |
| White | Hispanic | 1.19 | 1.08 | 1.02 | 1.2483 | 1.65 |
| **Routine Physical Checkup** | | | | | | |
| ref. | African American | **1.96*** ** | **1.80*** ** | **2.30*** ** | **2.12*** ** | **1.54*** |
| White | Hispanic | **1.21**** | 1.09 | **1.49**** | **1.30*** | 0.79 |
| **Advice to Quit Smoking** | | | | | | |
| ref. | African American | 0.98 | 0.86 | 1.16 | 0.94 | 0.98 |
| White | Hispanic | **0.62**** | **0.43**** | 0.87 | **0.55*** | 0.61 |
| **Influenza Vaccination** | | | | | | |
| ref. | African American | 1.05 | 1.19 | **1.38*** | 1.04 | **0.60*** |
| White | Hispanic | **1.31**** | **1.71*** ** | **1.43**** | 1.21 | 1.07 |

Source: Medical Expenditure Panel Survey 2004-2011

Note: Boldface indicates statistical significance (*p<.005, **p<0.01, ***p<0.001).

[a] Age category, gender, education level, marital status, region of residence in U.S., perceived physical and mental health status, SF-12 assessed physical and mental health, interview language, location of usual source of care, and survey year were included in multivariate regression models.

FPL, Federal Poverty Line

As shown in Table 4 under the heading "all income levels," adherence to preventive services guidelines differed by race/ethnicity, holding other covariates constant. However, colorectal cancer and cholesterol screening did not differ significantly by race/ethnicity. African Americans had higher odds of receiving Pap tests (OR=1.82, 95% CI=1.51, 2.19), mammograms (OR=2.19, 95% CI=1.83, 2.63), routine checkups (OR=1.96, 95% CI=1.74, 2.20), and blood pressure screening (OR=1.26, 95% CI=1.11, 1.44) compared to whites. Hispanics had higher odds of receiving Pap tests (OR=1.37, 95% CI=1.11, 1.69), mammograms (OR=1.91, 95% CI=1.47, 2.19), influenza vaccinations (OR=1.31, 95% CI=1.12, 1.53), and routine checkups (OR=1.21, 95% CI=1.06, 1.38) compared to whites. Whites had greater odds of receiving blood pressure checks (OR=1.17, 95% CI=1.02, 1.34) and advice to quit smoking (OR=1.61, 95% CI=1.20, 2.15) than Hispanics.

Table 4 results stratified by household income illustrate that the odds of Pap test receipt were significantly greater in uninsured Hispanics than in uninsured whites at incomes <200% FPL and significantly greater in uninsured African Americans at incomes <400% FPL. Only at >400% FPL did differences in odds of Pap test adherence become non-significant by race/ethnicity. Similar to Pap test results, uninsured Hispanics and African Americans had greater odds of mammogram receipt compared to uninsured whites at incomes <400% FPL.

Colorectal cancer screening among the uninsured presented different results. When not stratified by household income, differences in colorectal cancer screening odds were not significantly different by race/ethnicity. However, uninsured African Americans with incomes between 100% and 200% FPL had two and a half times the odds of

uninsured whites (OR=2.56) of receiving colorectal cancer screening. Uninsured African Americans had higher odds of a routine physical examination than uninsured Whites in every income group. Uninsured African Americans in the middle of the income spectrum (100%–399% FPL) had higher odds of blood pressure checks than uninsured whites, whereas uninsured Hispanics with incomes <100% and ≥400% FPL had lower odds of blood pressure checks than uninsured whites. Uninsured African Americans in the near-poor income category (100%–199% FPL) had higher odds of meeting cholesterol screening guidelines than uninsured whites.

Stratified results revealed that uninsured Hispanics between 100% and 400% FPL had higher odds of routine checkup, whereas those with incomes <100% and ≥400% FPL were not significantly different from uninsured whites. Uninsured Hispanics had lower odds of receiving quit-smoking advice than uninsured whites. Stratifying by household income revealed that uninsured Hispanics earning <100% FPL and between 200% and 400% FPL had lower odds of receiving quit-smoking advice (OR=0.43 and 0.55, respectively) than uninsured whites.

Odds of influenza vaccination in the previous year were significantly greater in uninsured Hispanics than uninsured whites at incomes <200% FPL. Compared to uninsured whites, uninsured African Americans switched from higher odds (OR=1.38) of receiving influenza vaccination in the near-poor category (100%–199% FPL) to lower odds (OR=0.60) of vaccination in the highest income group (≥400% FPL).

**Discussion**

This study finds that preventive service utilization among the uninsured remains far below levels noted in the literature for the insured but consistent with previous levels

of uninsured preventive service utilization noted in the literature (Bandi et al., 2012; Bednarek & Schone, 2003; Benjamins et al., 2004). *Healthy People 2020* set targets for many of the analyzed preventive services (U.S. Department of Health and Human Services, 2010). The mammogram target is 81.1%, colorectal cancer screening is 70.5%, Pap test is 93%, and cholesterol is 82.1%. The percentage by which the uninsured population missed *Healthy People 2020* targets ranges widely and differs by racial/ethnic group.

The USPSTF guidelines provide a long-term goal for preventive service utilization to which the nation should aspire. This study did not include the insured population for comparison because regulatory changes to the health insurance market requiring plans to cover USPSTF-identified preventive services without cost sharing would likely render such comparisons less relevant in the coming years as utilization levels are likely to change.

Recent findings illustrate stark differences in preventive service utilization between insured and uninsured populations. Benjamins et al. (2004) found blood pressure screening for whites and African Americans approaching 90% with Hispanics at nearly 80%. Results from the present study follow a similar race/ethnicity trend but around 20 percentage points lower for each group. The trend noted by Benjamins and colleagues is consistent with that observed by Vaidya et al. (2009) generally, African Americans and whites are similar and Hispanics lag in receipt of blood pressure screening. This study illustrates not only that the uninsured population uses preventive services at much lower levels than levels seen in insured populations, as shown in the literature, but also that uninsured African Americans do significantly better than uninsured whites and Hispanics

in regard to guideline adherence for several preventive services, including Pap tests, mammograms, routine checkups, and blood pressure checks.

Among the uninsured, racial/ethnic disparities exist when compared to whites. In contrast to racial and ethnic differences in preventive service utilization among the general population, general disparities among the uninsured demonstrate that whites fare worse in preventive service utilization than Hispanics or African Americans at most income levels. Other studies have reported a few similar findings. Jones and colleagues (2003) noted racial and ethnic minorities had higher odds of receiving mammograms than whites. Cook et al. (2010) found African Americans and Hispanics more likely to receive Pap tests than whites, holding other demographic variables constant. However, the literature has generally not focused on the uninsured population when examining racial/ethnic disparities in preventive service utilization, leading to a dearth of explanations for utilization disparities. One possible explanation for differences in preventive care service utilization is the effectiveness of public health interventions. Wells and colleagues (2011) performed a systematic review of community health worker–led screening interventions and found them especially effective in improving screening rates in urban settings and also by racial/ethnic concordance with the community health worker.

Another factor potentially impacting differences observed in preventive care services between uninsured racial/ethnic groups are demographic shifts that have been ongoing in the U.S. between rural and urban places. Johnson et al. (2005) documented significant rural population decline and noted that the trend is a movement toward centers of moderate density near metropolitan areas (Johnson, Nucci, & Long, 2005). Rural

residents tend to be poorer and more likely to live below the poverty line (Gamm, Hutchison, Dabney, & Dorsey, 2010). The greater density of racial/ethnic minorities in urban areas that also have a greater concentration of healthcare services, coupled with effective interventions, provides a plausible explanation for uninsured Hispanics and African Americans having higher odds of preventive service receipt than whites. This study included whether or not a person resided in an MSA. Though not presented, removing MSA from the regression models leads to slightly larger odds of preventive service receipt among the uninsured population, suggesting that rural residence may be a factor in preventive service utilization. However, it should be noted that MSA in this study was measured as a binary variable and, therefore, does not take into account gradations of rural residence among the uninsured population.

The present findings have broad implications, especially in light of recent health insurance reform enacted in the ACA. The ACA offers potential reductions in premature mortality through broader insurance coverage and increased use of preventive services (Koh & Sebelius, 2010). Screening rates will likely improve after provisions within the ACA take effect, namely the availability of more affordable health insurance through the health insurance exchange markets and the individual mandate to carry health insurance (Martinez & Cohen, 2012). Expanded Medicaid coverage to include those up to 138% of the FPL will likely also increase the number of insured.

*Healthy People 2020* advocates reduction of out-of-pocket costs for preventive services (U.S. Department of Health and Human Services, 2010). The ACA removed cost sharing for preventive services, which may result in increased preventive screening rates. However, implications of newly enrolled individuals utilizing screening services at a

higher rate within an already strained primary care market has serious implications for local health departments. Future research should investigate the association between local health department organization and funding, and use of preventive services among the uninsured.

Study results should be interpreted in light of the limitations. First, MEPS data are self-reported and rely on respondent recall and honesty. Second, although a categorical variable representing time was created to account for changes, it remains possible for time trends to influence results. Finally, USPSTF screening guidelines do not directly align with MEPS questions, thus utilization may be slightly underestimated or overestimated.

**Conclusions/Implications**

This research adds to the literature highlighting the uninsured as at risk for lower utilization of preventive services. Although the results show that increasing income generally decreases racial/ethnic disparities, it is important to note that uninsured African Americans and Hispanics generally fare better than uninsured whites in meeting USPSTF guidelines for preventive service utilization. Future research should examine reasons behind lower rates of preventive service utilization among uninsured whites. As healthcare reform moves forward and the uninsured increasingly become insured, it will be necessary for local systems of health delivery, both private and government-based, to identify how best to meet the increased demand produced by expanding enrollment in health insurance within an already strained healthcare environment.

# Chapter 3

## Impact of the Affordable Care Act on contraceptive use and unintended pregnancy among young adults

### Introduction

The prevention of unintended pregnancies through the availability, and effective use, of contraceptives remains a high priority in the United States (HealthyPeople 2020). Nearly half of all pregnancies occurring in the U.S. are mistimed or unintended and, among women between 20 and 24 years old this rate increases to almost two of three pregnancies (Finer & Zolna, 2011). Younger women and adolescents experience a higher rate of unintended pregnancy than older women – at least 4 in 5 pregnancies among those between 15 and 20 years old are unintended (Finer & Zolna, 2014). Though progress toward lowering the unintended pregnancy rate occurred between the late 1980s and 1990s, the rate of progress slowed in the early 2000s (Finer & Zolna, 2011).

Unintended pregnancy is defined by the Centers for Disease Control and Prevention (CDC) as a pregnancy that is mistimed, unplanned, or unwanted at the time of conception (Centers for Disease Control and Prevention, 2013). Unintended pregnancy has been associated with an array of adverse health behaviors and outcomes (Santelli et al., 2003). Women not expecting or trying to become pregnant may engage in behaviors detrimental to early stages of fetal development (e.g., smoking, alcohol consumption); such behaviors occur in the highest rates among women experiencing unwanted pregnancies (D'Angelo, 2001; Dott, Rasmussen, Hogue, & Reefhuis, 2010). Women with unintended pregnancies suffer a higher rate of depression, both during and following pregnancy, than women with intended pregnancies (Leathers & Kelley, 2000). In

addition, unexpected or unwanted pregnancies are associated with inadequate or delayed prenatal care, as a woman may not realize she is pregnant in the weeks immediately following conception (Haddrill, Jones, Mitchell, & Anumba, 2014). For these reasons, the incidence of unintended pregnancy has become an essential indicator of health status in the reproductive health field (Finer & Zolna, 2011).

The CDC acknowledged contraception as one of the 10 greatest public health achievements in the U.S. during the last century (Centers for Disease Control and Prevention, 1999). Recommendations from the Institute of Medicine (IOM) report "Clinical Preventive Services for Women: Closing the Gaps", stated that preventive services for women should include an expanded scope of contraceptive education, counseling, methods, and services (Institute of Medicine, 2011). Having adequate access to effective contraception is an essential tool to plan the timing of pregnancy and prevent unwanted pregnancies. In addition to being a main goal for couples, reducing the incidence of unintended pregnancies is an important reproductive health goal identified by the federal government in Healthy People 2020 (Healthy people 2020 final review, 2012). In fact, HP 2020 identified several family planning goals aimed at preventing unintended pregnancy and increasing contraception use as shown in Table 5.

**Table 5. Healthy People 2020 Family Planning Objectives**

| Topic Area | Objective |
|---|---|
| FP-1 | Increase the proportion of pregnancies that are intended |
| FP-5 | Reduce the proportion of pregnancies conceived within 18 months of a previous birth |
| FP-6 | Increase the proportion of females at risk of unintended pregnancy or their partners who used contraception at most recent sexual intercourse |
| FP-8 | Reduce pregnancies among adolescent females |
| FP-11 | Increase the proportion of sexually active persons ages 15-19 years who use condoms and hormonal or intrauterine contraception to both effectively prevent pregnancy and provide barrier protection against disease |

Contraception is an effective method to prevent unintended pregnancy when used correctly (Sonfield, Hasstedt, Kavanaugh, & Anderson, 2013). In assessing the effectiveness of contraceptives, Sonfield and colleagues (2013) found that two-thirds of women using contraceptives consistently and correctly accounted for only 5% of unintended pregnancies, while the 18% of women who use contraceptives inconsistently accounted for more than 40% of unintended pregnancies. Given the high unintended pregnancy rate and the sizable proportion of women at risk for unintended pregnancy (either not using contraception effectively or not at all), it is important to reduce the burden of unintended pregnancy by improving access to, and use of, contraceptives (Finer & Zolna, 2011; Mosher & Jones, 2010).

Women value convenience, simplicity, and affordability above most other concerns when choosing a contraceptive method (Landau, Tapias, & McGhee, 2006). Many factors lead to reduced access and serve as barriers to contraceptive use. Factors acting as barriers include (1) a lack of awareness of contraception options; (2) insurance regulations, (3) health care provider rules; (4) cost; and (5) low health literacy, among others (Landau et al., 2006).

While Landau and colleagues (2006) found that more than 90% of women were aware of hormonal birth control methods, awareness of other types of contraceptives lags far behind. Studies by Fleming and colleagues (2010) and Whitaker and colleagues (2008) found that 55% and 60% of women, respectively, were not aware of intrauterine contraception (IUC). Of those who knew about IUCs, only two in five held a positive attitude toward them (Fleming, Sokoloff, & Raine, 2010).

Dennis and Grossman (2012) performed in-depth interviews among women to identify barriers to regular contraceptive use and found that both insurance regulations and health provider rules hindered access. Investigators discovered that many health plans only allowed women to obtain a one month worth of contraceptives at a time whereas most women felt this increased the likelihood they would miss a day of contraceptive use (and potentially risk unintended pregnancy) and preferred insurance companies to allow them 3-6 months of contraceptives at a time (Dennis & Grossman, 2012). In the same study, authors cited health care provider rules requiring women to be seen at least yearly before being able to obtain a prescription for contraception, as a barrier and possible contributor to unintended pregnancy (Dennis & Grossman, 2012). Women with health insurance reported better access to contraception but cited cost sharing as a reason contraceptive use could be interrupted (Dennis & Grossman, 2012).

In a study of contraceptive use in young adults, Bessett and colleagues (2015) found health literacy to be low and health coverage decisions largely determined by parents. Even where parents were not heavily involved in health coverage decisions, they still acted in an assisting role to adult children choosing health coverage (Bessett et al., 2015). Bender and colleagues (2013) found that a number of factors play a role in young adults' choosing and using health plans and services and that many were initially uncomfortable interacting with health care providers regarding contraceptive services and feared the embarrassment if others, such as parents, became aware of their use. Young adults valued the ability to maintain confidentiality from parents with regard to sensitive health behaviors and contraceptive use (Bender & Fulbright, 2013).

While several factors are implicated in reducing access to contraceptives, lack of health insurance serves as a barrier in all age groups, particularly among young adults (Salganicoff & Ranji, 2012). Costs of contraceptives vary widely depending on the type used with more effective methods costing more and requiring a prescription (Salganicoff & Ranji, 2012). Even with insurance coverage of contraceptives, cost-sharing policies serve as a barrier to utilization (Cassidy, 2010). In the past, coverage of a variety of contraceptive methods was not as widespread as it is currently and also varied by plan type, employment setting, as well as the state in which one was covered (Salganicoff & Ranji, 2012; Sonfield, Gold, Frost, & Darroch, 2004). Increases in private coverage of contraceptive methods were driven by government policy and judicial decisions. Absent government actions, coverage of contraceptives by private health insurance plans would likely have grown far slower and remained more limited (Sonfield et al., 2004).

Other factors contributed to insurance plan coverage of contraceptive methods. An Equal Employment Opportunity Commission (EEOC) ruling in 2000 and a federal court decision concerning the omission of contraception coverage from health insurance policies in 2001 forced insurance plans to expand contraceptive coverage. The opinion of the EEOC clarified the intent of the U.S. Congress regarding the Pregnancy Discrimination Act of 1978 (PDA) – finding that the law prevents employers from treating pregnant women differently from others and prohibits employers from singling out pregnancy or related medical conditions in their health insurance benefit plans (Equal Employment Opportunity Commission, 2000). The Federal court for the Western District of Washington reached the pioneering conclusion that, under federal law, if an employer offers a prescription drug benefit to its employees and their dependents then the benefit

must include coverage for prescription contraceptives. The federal court's decision expanded the intent of the PDA when it stated that strictly equivalent coverage between men and women does not allow exclusion of benefits uniquely designed for women (United States Court of Appeals for the Ninth Circuit, 2002).

While contraceptive coverage in health insurance plans expanded in the years leading up to the Patient Protection and Affordable Care Act of 2010 (ACA), health insurance coverage of young adults lagged behind other age groups. In 2005, the proportion of people between the ages of 19 and 25 covered by health insurance was 6% lower than for those between 26 and 34 years of age (Collins, Rasmussen, Garber, & Doty, 2013). Prior to the ACA, children covered as dependents under a parent's health insurance plan often lost coverage when they graduated from high school or following college graduation (Cantor, Monheit, Delia, & Lloyd, 2012). For children with coverage through Medicaid or the Children's Health Insurance Program (CHIP), most lost coverage at age 19 (Collins et al., 2013).

Among the first implemented provisions of the ACA was dependent coverage expansion permitting young adults (between 19 and 26 years of age) to remain on a parent's private health insurance plan. The ACA dependent coverage provision improved upon weaker insurance expansion laws passed by approximately two thirds of the states (RWJF, 2014). State level dependent coverage expansion laws were not comprehensive as many of them limited coverage eligibility to unmarried young adults and included residency requirements (RWJF, 2014). The ACA dependent coverage provision was stronger in that it required all private insurance plans to cover dependents until they reach

age 26 without restriction on marital status, residency, or other characteristics (Cantor et al., 2012).

Levine and colleagues (2011) analyzed state expansions and found that increases in young adult dependent health insurance coverage were offset by drops in other sources of coverage such as employer sponsored and self purchased private plans. Monheit and colleagues (2011) tested the impact of state insurance expansion laws on the number of uninsured young adults and found no net impact. The ACA dependent coverage expansion improved state level laws by incorporating broader eligibility requirements as well as expanding application to large self-insured group plans that were exempt from state laws. Burgdorf (2014) re-analyzed the works of Levine and colleagues (2011) and Monheit and colleagues (2011) utilizing additional insurance source granularity available in the Current Population Survey's Annual Social and Economic Supplement. Burgdorf (2014) attributed much of the increase in employer-sponsored insurance found by Monheit and colleagues (2011) to increases in spousal coverage; not parent insurance coverage. With regard to the study by Levine and colleagues (2011), Burgdorf (2011) called into question their findings due to the non-robustness to alternative model specifications.

Recent evaluations of the ACA's dependent coverage expansion have illustrated early policy success. Antwi and colleagues (2013) found the policy's benefits were greatest for people who previously had limited access to health coverage with significant increases in insurance coverage across all racial and ethnic groups - especially unmarried adults (more than married adults) and men (more than women). Sommers and colleagues

(2013) similarly found that the policy led to increased health insurance coverage for young adults as well as improved access to care.

In addition to the dependent coverage expansion, the ACA removed cost sharing from many preventive services with a resultant positive effect on utilization. Lau and colleagues (2014) found that young adults had higher rates of annual health exams, blood pressure screening, cholesterol screening, and annual dental visits following ACA implementation. Kotagal and colleagues (2014) employed a difference-in-difference evaluation of insurance coverage, access to care, and service utilization among young adults and found that health coverage increased between 2009 and 2012. The ACA's mandated removal of cost sharing for U.S. Food and Drug Administration (FDA) approved contraceptives began in August 2012 (FDA 2012). Covered contraceptives include oral contraception, long acting injectable contraceptives, contraceptive implants and inserts, diaphragms, cervical caps and permanent contraceptive methods, such as tubal ligation. Currently, there is a dearth of information regarding the effect of the dependent coverage expansion on contraceptive use and unintended pregnancy. This study adds to the literature that examines the impact of the ACA on preventive services by investigating the effects of the dependent coverage expansion and the removal of cost sharing on the use of contraceptives and the rate of unintended pregnancy in the U.S.

**Theoretical Model**

The Andersen model of health services utilization was chosen to guide independent variable selection for this study. The model acknowledges predisposing, enabling, and need factors that influence or predict utilization of healthcare services (R. M. Andersen, 1995). The Anderson model details several determinants that may work

directly or indirectly on health care utilization. The model identifies the variables working directly as enabling resources whereas variables operating indirectly are identified as predisposing characteristics. Predisposing factors represent individuals' natural tendency to utilize healthcare services and include age, gender, and social structural characteristics (e.g., education, occupation, race/ethnicity). Enabling factors are resources available to individuals to utilize services (e.g., income, health insurance, regular source of care). Finally, need factors represent health status or disease and are the essential causes of health services utilization (e.g., health status, gravidity, parity) (R. M. Andersen, 1995). In this study, the ACA dependent coverage expansion, an enabling factor, is the main explanatory variable of utilization of contraceptives. Health insurance coverage typically reduces out-of-pocket costs for care and would be expected to increase the utilization of FDA covered contraceptives. Use of contraceptives is sensitive to price as Collins and Hershbein (2013) found in a study of young adult females following the Deficit Reduction Act of 2005.

## Methods

### *Data sources*

The National Survey of Family Growth (NSFG), sponsored by the National Center for Health Statistics (NCHS), is based on personal interviews with a nationally representative sample of women and men between the ages of 15 and 44. Topics covered by the NSFG include: the number of children women have had and the number they expect to have in the future, intended and unintended births, marriage, cohabitation, health status, insurance coverage, family planning, and health behaviors. The NSFG utilizes a multistage area probability design, which includes clustering, stratification, and

the assignment of unequal selection probabilities to sample units. Two publicly available data files were used in the analysis and compared the years 2006-2010 (before implementation of the ACA) with the years 2011-2013 (after ACA implementation).

*Study Population*

In this quasi-experimental study, each model includes two population groups (treatment and control) for purposes of comparison. The same control group was utilized for both outcome variables, birth control use and unintended pregnancy. The young adult population between 19 and 25 years of age constitutes the treatment group, as this was the age range targeted by the ACA's dependent coverage expansion. Adults between the ages of 26 and 30 constitute the control group. Comparison to adjacent age groups were made because an ideal comparison group of young adults between 19 and 25 years of age who were not affected by the ACA dependent coverage expansion does not exist.

*Dependent variables*

Three preventive behaviors were analyzed: current contraceptive use, contraceptive use over the past year, and intendedness of the most recent pregnancy. To create the binary variable for current and past year contraceptive use, guidelines from the CDC and the U.S. Food and Drug Administration (FDA) were utilized (Food and Drug Administration, 2015; Centers for Disease Control and Prevention, 2015). Contraceptive use was defined as the current use (or past year use) of FDA approved birth control methods that required a prescription. Table 6 lists the contraceptive method response categories and how each was coded for development of the binary response variable.

**Table 6. Dependent variable code assignment**

| Method | Code |
|---|---|
| Contraceptive patch | 1 |
| Contraceptive ring | 1 |
| Depo-Provera injectable | 1 |

| | |
|---|---|
| Diaphragm | 1 |
| Emergency contraception | 1 |
| Female condom, vaginal pouch | 1 |
| Implant (Norplant or Implanon) | 1 |
| IUD, coil, loop | 1 |
| Lunelle injectable | 1 |
| Pill | 1 |
| Condom | 0 |
| Don't know | 0 |
| Jelly or cream | 0 |
| No method | 0 |
| Other method | 0 |
| Refused | 0 |
| Rhythm or safe period by calendar | 0 |
| Safe period by temperature or cervical mucus test, natural family planning | 0 |
| Suppository, insert | 0 |
| Withdrawal | 0 |
| Female sterilizing operation/tubal ligation[1] | n/a |
| Partner's vasectomy[1] | n/a |
| Respondent sterile (aside from sterilizing operation above)[1] | n/a |
| Respondent's partner sterile (aside from vasectomy above)[1] | n/a |

Source: National Survey of Family Growth female respondent file codebook
1: not included in analysis as respondents were not at risk of pregnancy

Table 7 summarizes the dependent variables by population and NSFG survey question. NSFG respondents were guided through questions that provided a pregnancy history – including if each pregnancy was intended or not and the pregnancy's outcome. A pregnancy was coded as unintended if it was "too soon, mistimed" or was "unwanted." A pregnancy was classified as wanted if the respondent stated that the pregnancy occurred at the "right time," was "late, overdue" or "didn't care."

**Table 7. Dependent variable definitions**

| Screening | Survey Question | Population | |
|---|---|---|---|
| | | Treatment | Control |
| **Birth control - current use** | Which methods of birth control do you currently use to prevent pregnancy or sexually transmitted disease? | Females between 19 & 25 years old. | Females between 26 & 30 years old. |
| **Birth control - past year use** | During the past 12 months, which methods of birth control did you use to prevent pregnancy or sexually transmitted disease? | Females between 19 & 25 years old. | Females between 26 & 30 years old. |
| **Unintendedness of last pregnancy** | Was your last pregnancy too soon/mistimed or unwanted? | Females between 19 & 25 years old. | Females between 26 & 30 years old. |

Source: National Survey of Family Growth female respondent file codebook

*Independent variables*

Andersen's behavioral model was used to guide selection of control variables. These variables need to be controlled for as this study utilizes a non-equivalent control group. In difference-in-differences evaluations, the statistical role of control variables further serves to improve the model's precision by explaining in the outcomes. Predisposing factors included age, race/ethnicity, marital status, and level of education. Enabling factors included income, student status, and whether or not an individual had a usual source of health care. Need factors included whether or not the respondent was limited by "physical, mental, or emotional problems." The literature has also found gravidity and parity related to choice of birth control method so they were included as additional need factors (Mosher et al., 2010).

*Analytic process*

All analyses were conducted using Stata, version 13.1, and incorporated the weights available in the NSFG data sets to account for the complex survey design and allow the generation of nationally representative estimates of the study variables. This study uses a difference-in-differences approach in order to identify a causal relationship between the policy and outcome. Difference-in-differences analysis attributes a change in use to the dependent coverage mandate only if the increase in contraceptive use (or decrease in unintended pregnancies) occurred over the same time interval as the policy change, and if the observed difference in the treated group differed from that in the slightly older control group not targeted by the dependent coverage expansion. The difference-in-differences approach has been used in health policy to predict what outcomes would occur if the policy were not enacted and allows for causal inference

using observational data. The underlying assumption is that the causal inference from the observational data centers on the assumption that the dependent variable in the treatment group would have followed the path of the control group in the absence of a change in policy (Lechner, 2011). Difference-in-differences models are useful in this study in that they illustrate whether increases in the use of contraceptives or the reduction in unintended pregnancy occurred as a result of the dependent coverage expansion or if there were unmeasured factors at work.

We conducted analyses to determine whether the utilization of FDA approved birth control methods and the rate of unintended pregnancy varied significantly between the time periods of 2006-2010 and 2011-2013 and between the treatment and control groups. Sensitivity analyses were conducted based on the implementation of mandates in August of 2012 stemming from the ACA's requirement that health insurance policies cover FDA approved contraceptives without cost sharing. Linear combinations compared proportions of treatment and control populations to identify statistically significant differences.

To examine whether the ACA had an effect on the use of birth control and unintended pregnancy, a difference-in-differences approach was employed to help account for secular trends (Lechner, 2011). The basic logic behind the difference-in-differences approach is to model the effect of a treatment by estimating the difference between outcomes at two time points for two populations (those affected by a policy and those not) followed by comparing the difference between the groups (Lechner, 2011). By identifying two populations in such a way, the difference-in-differences strategy guards against variables that may affect both populations but are unobserved.

The difference-in-differences approach facilitated analysis of whether changes between treatment and control groups occurred over time and if this change was more evident for one group or the other. Logistic regression models, adjusted for independent covariates based on Andersen Behavioral Model factors, were estimated for the current use of contraception, past year use of contraception, and occurrence of unintended pregnancy. In this paper, results are reported as either adjusted probabilities or marginal effects. Reporting the results in this way allowed us to sidestep interpreting interaction terms and use an easier to understand measure of effect. Methods used follow those described by Karaca-Mandic and colleagues (2012).

*Model Specification*

Difference-in-Differences = (*Preventive behavior in target population*, post-period – *Preventive behavior in target population*, pre-period) – (*Preventive behavior in control population*, post-period – *Preventive behavior in control population*, pre-period)

$$y_{iat} = \alpha + \beta_1 AGE_a + \beta_2 AGE_a * POST_t + \beta_3 X_{iat} + \delta_t + \varepsilon_{iat}$$

a – age at time of interview
t – time
i – individual
AGE – indicator equal to one for young adults and zero otherwise
POST – indicator equal to one in the post treatment period and zero otherwise
X – vector of predisposing, enabling, and need variables
$\delta_t$ – Year fixed effects

For the models estimated in this analysis, the difference-in-differences estimation is described by the coefficient on the interaction term, $\beta_2$ (the outcome of interest). AGE is an indicator equal to 1 when the individual is between 19 and 25 years of age, POST is an indicator equal to 1 in the period after the ACA was in effect, and $\delta_t$ are the year fixed effects. The coefficient of interest is $\beta_2$, which is the difference-in-differences estimator

that measures the effect of the ACA on current and past year contraception use and unintended pregnancy in the targeted population of young adults.

Three main explanatory variables were utilized in this study: a binary indicator of whether an individual was assigned to the treatment or control group based on age, a post indicator identifying the period after the ACA's dependent coverage provision went into effect, and the product (interaction) of these two indicators. For current and past year use of contraceptives, age at the time of interview was used to assign participants to treatment and control groups. For unintended pregnancy, treatment and control group assignment were based on the date at which the most recent pregnancy was completed and the age of the participant at that time. The second indicator variable, which indicated the post period, was assigned a value of 1 in the time period after the ACA's dependent coverage expansion was implemented (October 2010). Since there was no variation within the treatment or control groups on this measure, it was used only to create the interaction term. The third indicator variable was an interaction term indicating that an observation occurred in the treatment group (young adults) after the dependent coverage expansion took effect. Therefore, the interaction variable is always 0 for persons in the 26-30 year old age category. The regression coefficient on the interaction variable provided the estimated effects of the dependent coverage expansion on contraceptive use and rate of unintended pregnancy.

**Results**

Demographic characteristics of young adults (19-25 years) and adults (26-30 years) were compared between the two time periods (2006-2010 and 2011-2013) in the pooled survey data (Table 8). The mean age for young adults was approximately 22 years

in both time periods and the mean age for adults between 26 and 30 years was 28 years in both time periods. There was a statistically significant increase in the percentage of young adults living below the poverty line between the two time periods (percent below 100% FPL increased from 26.6% to 33.5% for young adults, between 2006-2010 and 2011-2013). For young adults, public health insurance increased from 19.1% in the 2006-2010 period to 25.4% in the 2011-2013 period. The proportion of persons with less than a high school education decreased significantly in all age groups (19-25 year olds: 14.7% to 10.0%; 26-30 year olds: 15.2% to 10.6%). There were no statistically significant differences between the two time periods for any of the cohorts in terms of mean age, race/ethnicity, marital status, gravidity, parity, or whether or not individuals had a usual source of health care.

**Table 8. Weighted descriptive statistics of the analyzed population by age range**

| Characteristics | All observations | | Age between 19 & 25 Young adults | | Age between 26 & 30 Adults | |
|---|---|---|---|---|---|---|
| | 2006-2010 | 2011-2013 | 2006-2010 | 2011-2013 | 2006-2010 | 2011-2013 |
| **Total observations** | 5425 | 2457 | 3047 | 1386 | 2378 | 1071 |
| **Age, mean** | 24.4 | 24.5 | 21.9 | 21.9 | 28.0 | 28.0 |
| **Race/Ethnicity** | | | | | | |
| Hispanic | 0.17 | 0.20 | 0.17 | 0.20 | 0.18 | 0.20 |
| White (non-hisp.) | 0.61 | 0.59 | 0.62 | 0.57 | 0.61 | 0.61 |
| African Amer. (non-hisp.) | 0.15 | 0.15 | 0.15 | 0.16 | 0.15 | 0.13 |
| Other (non-hisp.) | 0.07 | 0.06 | 0.07 | 0.07 | 0.07 | 0.06 |
| **Marital status** | | | | | | |
| Single | 0.48 | 0.46 | 0.62 | 0.61 | 0.27 | 0.25 |
| Married | 0.47 | 0.51 | 0.35 | 0.37 | 0.65 | 0.69 |
| Divorced/widow/separated | 0.05 | 0.04 | 0.03 | **0.02*** | 0.08 | 0.06 |
| **Education level** | | | | | | |
| Less than high school | 0.15 | 0.10** | 0.15 | **0.10**** | 0.15 | **0.11*** |
| High school diploma | 0.25 | 0.28 | 0.27 | 0.30 | 0.23 | 0.25 |
| Some college | 0.37 | 0.40 | 0.42 | 0.46 | 0.29 | 0.31 |
| College graduate | 0.23 | 0.22 | 0.17 | 0.14 | 0.33 | 0.34 |
| **Employment status** | | | | | | |
| Yes | 0.69 | 0.69 | 0.68 | 0.67 | 0.71 | 0.73 |
| No | 0.15 | 0.14 | 0.18 | 0.17 | 0.10 | 0.10 |
| Other | 0.16 | 0.16 | 0.14 | 0.16 | 0.19 | 0.17 |
| **Student status** | | | | | | |
| Yes | 0.31 | 0.32 | 0.42 | 0.42 | 0.16 | 0.18 |
| **Metropolitan Statistical Area** | | | | | | |
| In an MSA | 0.80 | 0.85 | 0.80 | 0.85 | 0.79 | 0.85 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Poverty level** | | | | | | |
| 0-100% | 0.25 | 0.31* | 0.27 | **0.33*** | 0.23 | 0.27 |
| 100-199% | 0.23 | 0.23 | 0.25 | 0.24 | 0.21 | 0.22 |
| 200-399% | 0.33 | 0.29** | 0.34 | **0.28*** | 0.33 | 0.30 |
| >=400% | 0.18 | 0.18 | 0.15 | 0.15 | 0.23 | 0.22 |
| **Health Insurance status** | | | | | | |
| Private | 0.56 | 0.53 | 0.56 | 0.53 | 0.57 | 0.55 |
| Public | 0.20 | 0.23 | 0.19 | **0.25*** | 0.21 | 0.21 |
| None | 0.24 | 0.23 | 0.25 | 0.22 | 0.22 | 0.24 |
| **Usual source of care** | | | | | | |
| Yes | 0.82 | 0.80 | 0.79 | 0.79 | 0.85 | 0.81 |
| **Number of Pregnancies** | | | | | | |
| none | 0.48 | 0.49 | 0.61 | 0.64 | 0.30 | 0.29 |
| 1-2 | 0.44 | 0.43 | 0.34 | 0.34 | 0.56 | 0.57 |
| 3+ | 0.08 | 0.07 | 0.04 | 0.03 | 0.14 | 0.14 |
| **Number of Children** | | | | | | |
| none | 0.57 | 0.58 | 0.69 | 0.70 | 0.40 | 0.43 |
| 1-2 | 0.34 | 0.33 | 0.26 | 0.27 | 0.44 | 0.41 |
| 3+ | 0.09 | 0.09 | 0.04 | 0.03 | 0.15 | 0.16 |

Source: National Survey of Family Growth 2006-2010 and 2011-2013
Reported proportions weighted to account for the complex sample design of the NSFG
Linear combinations compared proportions of 2011-2013 (post results) to 2006-2010 (pre results) and reported statistically significant differences as: *p<0.05, **p<0.01, ***p<0.001

Figure 2 graphically presents the unadjusted rate of current contraceptive use and unintended pregnancy for both treatment and control groups over the period of the study. Rates of unintended pregnancy have decreased for both young adults and adults while contraceptive use has increased modestly for both groups. However, the effect that we observe in the exhibit could be biased by other factors that distinguish young adults from adults and thus there is a need for adjusted analyses controlling for predisposing, enabling, and need factors that influence the use of contraceptives and occurrence of unintended pregnancy.

**Figure 2. Rate of Contraceptive Use and Unintended Pregnancy in Young Adults (19-25) and Adults (26-30), 2006-2013**

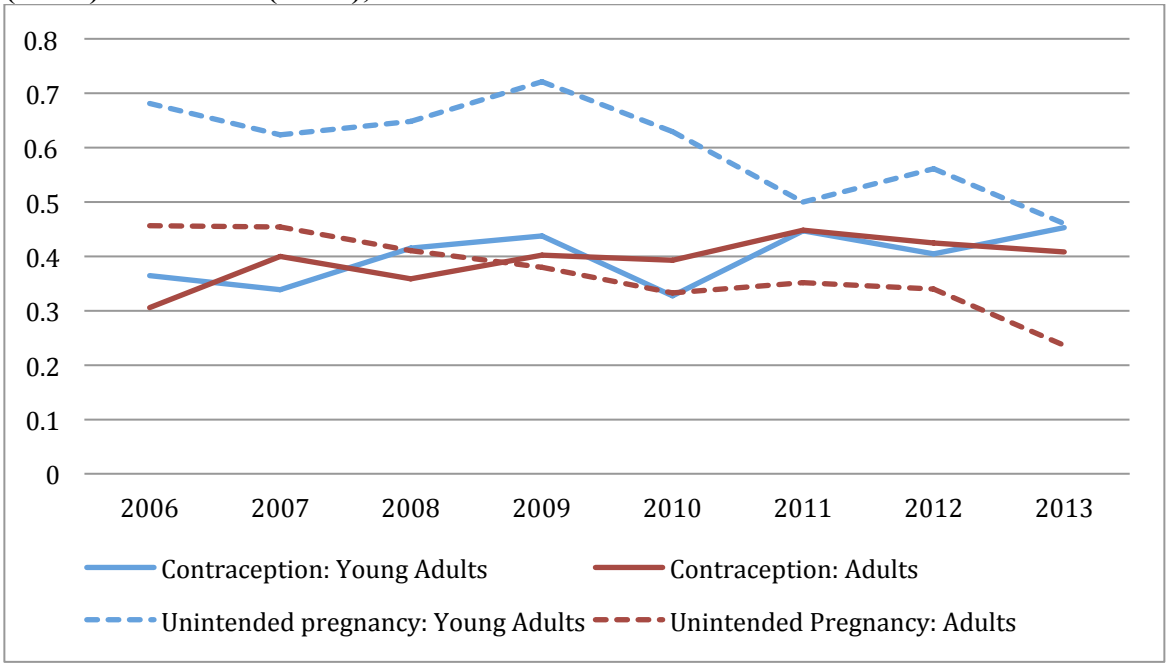



Table 9 presents analyses using a difference-in-differences approach. The analysis adjusted for Andersen behavioral model factors for health care utilization including: age, gender, race/ethnicity, marital status, employment, level of education, student status, and whether or not an individual had a usual source of care. All estimates were weighted to account for the complex survey design of the NSFG and for survey non-response.

There were no significant differences in the use of FDA approved contraceptives in either the young adult or adult populations. Further, there was no significant difference in the percentage who reported using FDA approved contraception in the past year between 2006-2010 and 2011-2013 for young adults compared to adults 26-30 years. The difference-in-differences analysis did not show that young adults significantly increased either their current or past year utilization of FDA approved contraceptives following implementation of the dependent coverage expansion. Similarly, there were no significant differences in unintended pregnancy over the years analyzed.

**Table 9. Effect of ACA dependent coverage expansion on young adults 19-25 years old: difference-in-differences findings**

| | Contraceptive use, current | Contraceptive use, past year | Unintended last pregnancy |
|---|---|---|---|
| ACA dependent coverage expansion | 0.0133 | 0.0115 | -0.0489 |
| | (0.0549) | (0.0631) | (0.0561) |
| ACA contraception cost sharing, | -0.0226 | -0.0380 | -0.0322 |
| (beginning August 2012) | (0.0754) | (0.0662) | (0.1050) |
| *Dependent variable means* | | | |
| Before dependent coverage expansion | | | |
| Treatment, pre | 0.3827 | 0.5748 | 0.5802 |
| Control, pre | 0.3786 | 0.5677 | 0.3617 |
| After dependent coverage expansion | | | |
| Treatment, after | 0.4261 | 0.6275 | 0.5247 |
| Control, after | 0.4210 | 0.6231 | 0.2979 |

Source: National Survey of Family Growth 2006-2010 & 2011-2013

1: Number of observations is 6,919 for current contraception, 4410 for past year contraception, and 2824 for unintended last pregnancy.

2: Cells of the table contain: coefficients and standard errors in parentheses. Coefficients in the first row are from the interaction of an indicator variable for the treatment group (19–25 year olds) and an indicator variable for the period after ACA dependent coverage expansion (beginning October 2010); coefficients in the second row are from the interaction of an indicator variable for the treatment group and an indicator variable for the period after removal of cost sharing for contraception (beginning August 2012).

3: Dependent variables— column 1: indicator variable that equals 1 if the individual currently uses FDA approved prescription and 0 otherwise; column 2: indicator variable that equals 1 if the individual used FDA approved prescription contraceptives in the past year and 0 otherwise; column 3: indicator variable that equals 1 if the individual was ever pregnant and that pregnancy was either unwanted or mistimed and 0 otherwise.

4: Other covariates include age, year fixed effects, race/ethnicity, marital status, student status, income as a proportion of the federal poverty line, perceived physical/emotional/mental health, gravidity, and parity.

5: Means of dependent variables are obtained for treatment and control groups before and after ACA dependent coverage expansion (October 2010).

The NSFG dataset included interview results from 2013, the period after ACA mandated removal of cost sharing for FDA approved prescription contraceptives went into effect. To capture the partial influence of elimination of cost sharing on contraceptive utilization and unintended pregnancies, an additional period variable was established and an interaction term was created to estimate this policy's influence. However, no significant differences due to the addition of the cost sharing removal mandate were found in any of the models.

To test the robustness of the findings, the study tested multiple alternative model specifications. The current results include 2010 in the pre period as new health insurance policies meeting ACA guidelines would be expected to renew with the change in calendar year. Table 10 presents two different specifications for the difference-in-

differences regressions. For each dependent variable, the first of the two models used the full sample available and assumed all effects were due to the dependent coverage expansion; the indicator variable denoting elimination of cost sharing was not included. The second of the regressions did not consider observations occurring after August 2012; the point at which removal of cost sharing began.

**Table 10. Alternate difference-in-differences model specifications, before and after ACA dependent-coverage expansion**

| | Difference in treated population, post-pre | | Difference in control population, post-pre | | Difference in differences, ((post-pre)-(post-pre)) | |
|---|---|---|---|---|---|---|
| | Estimate | SE | Estimate | SE | Estimate | SE |
| Contraception - current use | | | | | | |
| Full sample (2006 - 2013) | 0.0948 | 0.0398 | 0.0952 | 0.0434 | -0.0004 | 0.0363 |
| Restricted (2006 - 8/2012) | 0.0609 | 0.0385 | 0.0512 | 0.0520 | 0.0097 | 0.0536 |
| Contraception - past year use | | | | | | |
| Full sample (2006 - 2013) | 0.0620 | 0.0509 | 0.0720 | 0.0562 | -0.0100 | 0.0460 |
| Restricted (2006 - 8/2012) | 0.0208 | 0.0545 | 0.0095 | 0.0713 | 0.0113 | 0.0687 |
| Unintendedness - last pregnancy | | | | | | |
| Full sample (2006 - 2013) | -0.1384 | 0.0952 | -0.1059 | 0.0883 | -0.0325 | 0.0595 |
| Restricted (2006 - 8/2012) | -0.0863 | 0.0791 | -0.0652 | 0.0809 | -0.0212 | 0.0673 |

Source: National Survey of Family Growth 2006-2010 & 2011-2013
1: Number of observations was 6,919 for current contraception, 4410 for past year contraception, and 2824 for unintended last pregnancy.
2: Pre period includes observations through 2010, post period includes observations beginning in January 2011
3: Full sample through 2013 assumes all changes were due to dependent coverage; there is no indicator variable for cost sharing removal. Sample up to August 2012 removes observations occurring after removal of cost sharing for contraception began
4: Dependent variables— column 1: indicator variable that equals 1 if the individual currently uses FDA approved prescription and 0 otherwise; column 2: indicator variable that equals 1 if the individual used FDA approved prescription contraceptives in the past year and 0 otherwise; column 3: indicator variable that equals 1 if the individual was ever pregnant and that pregnancy was either unwanted or mistimed and 0 otherwise.
5: Other covariates include age, year fixed effects, race/ethnicity, marital status, student status, income as a proportion of the federal poverty line, perceived physical/emotional/mental health, gravidity, and parity.
*p<0.05, **p<0.01, ***p<0.001

Additional robustness checks (not shown) were performed. Previous studies have illustrated anticipatory effects on the part of health insurance providers prior to the October 2010 implementation of dependent coverage expansion (Antwi 2013). Alternative models for each of the dependent variables were performed that included 2010 in the post period, as well as leaving 2010 out of the analysis, also showed no significant difference between treatment and control groups in difference-in-differences

analysis. Finally, a series of analyses were conducted to account for the effect an individual's anticipation of sexual activity may have on contraceptive choice. For these additional robustness checks, subpopulations were defined by women who were sexually active in the month of the interview and in the six months prior to the interview. Analyses of contraceptive use performed as part of the robustness checks were nearly identical to those presented.

**Discussion**

This study investigated the effects that the ACA's dependent coverage expansion had on contraceptive utilization and rate of unintended pregnancy in young adults. As of September 23, 2010, the ACA extended insurance coverage to young adults through a parent's health insurance policy. The ACA also placed a new emphasis on preventive rather than curative care by removing cost sharing and co-payments from many preventive services and, later in 2012, removed cost sharing from FDA approved prescription contraceptive methods (Association of State and Territorial Health Officials, 2012). Given the decreased rate of uninsured young adults brought about by the ACA and the effect that better insurance access has historically had on contraceptive use, we expected to find marked improvement in contraceptive use and unintended pregnancy rates among young people. However, we did not detect statistically significant differences in contraceptive use or unintended pregnancy following the dependent coverage expansion.

We found no significant differences in use of FDA approved contraceptive methods or the rate of unintended pregnancy between young adults and their slightly older counterparts (adults) in difference-in-differences calculations. Current findings

differ from those of others examining the effects of the ACA on other preventive services. Lau and colleagues (2014) found significant increases in routine exams, blood pressure checks, cholesterol screening, and annual dental visits. Kotagal and colleagues (2014) found significant increases in annual exams and influenza vaccines following ACA enactment. Han and colleagues (2014) found that receipt of dental checkups, blood pressure measurement, and routine health exams significantly increased after ACA enactment compared to an earlier time period. However, each of these studies looked at services that were affected both by the dependent coverage expansion and removal of cost sharing. This study included only a short period where both the dependent coverage expansion and removal of cost sharing were in effect – likely limiting the impact on utilization of contraception methods and impact on unintended pregnancy.

A number of potential reasons may explain why no significant effect was found for the ACA dependent coverage expansion on contraceptive use and unintended pregnancy. Possible reasons include legislative and regulatory actions over recent years, broad trends in contraception and birth control education, and current behavioral habits among women. The ACA was not the first legislative foray into mandates for expanded coverage of contraceptive methods. Many of the states have sought to address the health disparities in young adults by requiring private insurers to expand dependent coverage (Monheit, Cantor, Delia, & Belloff, 2011). Prior to the implementation of the ACA, 21 states had passed legislation requiring private insurers to expand dependent coverage. However, these state laws did not expand coverage as broadly as the ACA and were less effective at reducing barriers than the ACA due to the fact that large self-insured companies were exempt from state dependent coverage mandates (Cantor et al., 2012;

Monheit et al., 2011). Coverage for prescription contraceptives by health insurance companies has improved over time driven primarily by state and federal policy and the judicial decision predating the ACA (Salganicoff & Ranji, 2012; Sonfield et al., 2004). Therefore the ACA does not represent a sudden new direction in policy but rather an incremental policy change and is a possible reason our analyses did not find significant differences in contraceptive use and unintended pregnancy rate in young adults as compared to their slightly older counterparts. Another contributing factor to the lack of statistically significant results in this study is the availability of publicly funded contraceptive services. In the four years before the ACA, a quarter of women who obtained a contraceptive service did so at a publicly funded center (Frost et al., 2013). Within this group of women, approximately one in 10 utilized a family planning center; 8% from a community clinic; 6% from the public health department; and 5% received contraceptive services from an outpatient clinic (Frost et al., 2013). However, the ACA has facilitated the continued improvements as prior health insurance coverage of contraceptives varied by plan type, employment setting, and the state in which an individual is covered (Sonfield et al., 2004).

Education of both health providers and consumers regarding the types and characteristics of available contraceptive methods facilitates improved utilization (Bader et al., 2014). Leeman and colleagues (2007) found lack of provider education to be a barrier to women obtaining a form of contraception suitable to their particular situation. Further education of providers is needed. For example, Tang and colleagues (2013) found that, in a survey of 1,922 residents across 96 training programs nationwide, a large proportion of obstetrical and gynecological residents lacked knowledge about the benefits

and drawbacks of long acting reversible contraception and did not counsel all eligible women on its use.

The particular method one chooses for birth control is associated with access to health insurance (Culwell & Feinglass, 2007). The ACA opened up coverage to young adults and reduced costs associated with various contraceptive methods and, in time, utilization patterns can be expected to change. However, detecting differences in patterns of contraceptive choice may require a greater time horizon than was possible in this study. Sundstrom and colleagues (2014) found significant resistance to changing contraceptive methods and heightened suspicions of longer lasting birth control methods in a qualitative study of women. Another barrier to change was a lack of knowledge about newer forms of birth control (Sundstrom, Baker-Whitcomb, & DeMaria, 2014). Therefore, further education about effective contraceptive methods, including updated cost concerns and misperception about side effects and risks may serve to shift contraceptive utilization toward FDA approved contraceptive methods.

*Limitations*

The results of this study must be interpreted in the context of the challenges of studying this issue in this population. First, and most importantly, the NSFG collects survey data and all outcomes are self-reported and are not objective measures of health. Merely labeling pregnancy intention using only a few categories oversimplifies a complex experience (Santelli et al., 2003). Second, while we did include survey weights in our analyses, there exists potential for nonresponse bias that could have an influence on the findings. Third, despite using a difference-in-differences approach to compare effects across two groups, it is possible that slightly older adults are not adequate

comparison groups. We attempt to account for residual differences between the populations by controlling for potential confounders. However, while a perfect counter-factual control group for young adults does not exist we believe the use of slightly older adults represents the best possible choice to represent the impact of dependent coverage expansion effects on young adults. Fourth, the analysis period covers the time of a large economic recession which could lead to countervailing trends that influence health insurance coverage and health services utilization. Finally, a longer time period may be required than was possible in this study in order to detect differences in contraceptive use and unintended pregnancy.

**Conclusion**

This study, which analyzed nationally representative data before and after the implementation of the ACA, shows that trends in contraceptive use and the rate of unintended pregnancy are headed in the right direction. However, young adults have not improved at a greater rate than their slightly older counterparts in either the use of FDA approved contraceptives or in unintended pregnancy. Our research showed that the proportion of persons between the ages of 19 and 25 showed gains in health insurance status from the pre to the post period, but this did not translate to a reduction in unintended pregnancy or an increase in contraceptive use compared to persons aged 26 to 30. Understanding the ACA's full impact on young adults' utilization of reproductive health services may require a greater time horizon or drilling down into subpopulations to identify if certain groups are benefiting more than others. Our results highlight the idea that insurance is a necessary, but not sufficient, condition to change the trajectory of contraceptive use and unintended pregnancy. Health policy stakeholders must continue to

address barriers to access and quality of care in addition to health insurance coverage in order to increase contraceptive use and reduce unintended pregnancy rates.

# Chapter 4

## The ACA change in Medicare cost sharing policy and colorectal cancer screening rates

### Background

Colorectal cancer (CRC) is the third most common cancer and cause of cancer death in the U.S. (Siegel, Naishadham, & Jemal, 2012). Detected late, treatment is a long, uncomfortable, and expensive process. When detected early and treated in a timely manner, the five-year survival rate for CRC is 90 percent (Americanc Cancer Society, 2009). Unfortunately, when not diagnosed until CRC has spread to other organs, the five-year survival rate drops to only 10 percent (Americanc Cancer Society, 2009). The American Cancer Society (ACS) has estimated CRC treatment costs at more than $12 billion annually –treatment costs at the individual level can exceed $300,000 annually in severe cases (Americanc Cancer Society, 2012).

The aim of CRC screening is the identification of polyps or suspicious tissue that can lead to cancer (USPSTF, 2013). Found early through screening, colorectal cancer can be prevented. When compared to no use of preventive screening, the early detection of CRC is cost-effective (Howard, Tangka, Seeff, Richardson, & Ekwueme, 2009). Unfortunately, despite the positive aspects and effectiveness of screening, many individuals in the recommended age range remain unscreened (Centers for Disease Control and Prevention, 2010).

The US Preventive Services Task Force (USPSTF) has given CRC screening its highest grade of A, strongly recommending screening beginning at age 50 and continuing until age 75 (USPSTF, 2013). On account of the success that CRC screening enjoys,

increasing the number and proportion of screened adults remains a goal of the federal government and is a leading indicator of health in Healthy People 2020 (HP 2010).

***History of Disparities in CRC Screening***

Historically, large disparities have existed in CRC screening among subpopulations of the U.S. (Fenton, Tancredi, Green, Franks, & Baldwin, 2009). While nearly two in three members of the recommended population are current for CRC screening, this figure is far below the proportions for other leading causes of cancer; breast cancer screening at 72%, and cervical cancer screening at 83% (Centers for Disease Control and Prevention, 2014). However, as the evidence of screening utility has become apparent over the past decades, the rate of CRC screening has increased (Levin et al., 2008; Pignone, Rich, Teutsch, Berg, & Lohr, 2002).

As found in other types of cancer screening, there are racial and ethnic disparities in CRC screening rates. African Americans both have a higher risk for developing, as well as dying from CRC than any other racial or ethnic group (Cooper & Tzuyung, 2008; Doubeni et al., 2007; Shih, Zhao, & Elting, 2006). Although the national death rate from colorectal cancer has been in decline in the US, disparities remain higher among underserved populations. According to Agrawal and colleagues (2005), the five-year survival rate for African Americans was 53% compared to 63% in whites from 1992 to 1999. In addition to the higher death rates from CRC, African Americans also suffered higher incidence rates than whites (Horner et al., 2009).

Fenton and colleagues (2009) performed a serial analysis of cross sectional 1995-2003 Medicare data in an investigation of racial/ethnic disparities in CRC screening. Authors found that in the period after Medicare established coverage for CRC screening

racial/ethnic disparities existed as 47% of Whites, 38% of Blacks, and only 33% of Hispanics were current for screening (Fenton et al., 2009). Doubeni and colleagues (2010) further investigated the effects of Medicare's CRC screening coverage expansion to include the year 2005 and found that the proportion of beneficiaries current for screening had increased in Whites to nearly 57%, 52% in African Americans, and almost 46% among Hispanics. Findings suggested that rates for CRC screening were continuing to improve but disparities, though diminished, endured(Doubeni et al., 2010). Persistent disparities in CRC screening are frequently identified as the main driver behind high incidence and mortality rates among blacks(Lansdorp-Vogelaar, Knudsen, & Brenner, 2011).

Aforementioned results indicate that the disparity in CRC screening among older African Americans and Hispanics as compared to Whites continued despite the advent of CRC screening coverage in Medicare. Shih and colleagues (2006) focused on colonoscopies among Medicare beneficiaries across the same policy expansion period as Doubeni et al. (2010) and Fenton et al. (2009) and found that disparities in preventive service receipt described in 2000 between Whites and African Americans had disappeared by 2003. However, colonoscopy screening rate disparities between Whites and Hispanics increased over the same period (Shih et al., 2006). Fisher and colleagues (2004) found older age, having a usual source of care, and obtaining regular physical examinations were associated with greater use of CRC screening. Further, overall difference in cancer survival rates between Whites and African Americans and Hispanics have increased as improved treatment has become available (Tehranifar et al., 2009).

### *Impact of CRC Screening*

By increasing the use of CRC screening tests, early detection has been a major contributor to the overall decline in new cases and deaths from CRC (American Cancer Society, 2009). CRC screening makes it possible to detect and remove precancerous polyps before they progress to cancer and to identify suspicious tissue requiring further investigation (Chen, White, Peipins, & Seeff, 2008; Zapka et al., 2012). Numerous studies have illustrated that screening for CRC is the best way to reduce colorectal cancer mortality (Agrawal & Syngal, 2005; Burgess et al., 2011; Joseph, King, Miller, Richardson, & Centers for Disease Control and Prevention (CDC), 2012; Taplin et al., 2012). Screening methods used for CRC detection and prevention can lower the rate of new cases up to 60% (Joseph et al., 2012).

Screening for colorectal cancer is accomplished using one or a combination of tests varying in specificity, sensitivity, and risk. Colonoscopy is considered to be the gold standard by which other tests are judged but also the riskiest in terms of potential adverse outcomes for the patient (USPSTF, 2008). The USPSTF recommends screening for colorectal cancer using either fecal occult blood testing, sigmoidoscopy, or colonoscopy beginning at age 50 and continuing until age 75 (USPSTF, 2008). Table 11 outlines the USPSTF recommendations on CRC screening.

**Table 11. Recommended screening tests and intervals**

| CRC Screening test | USPSTF recommended interval |
|---|---|
| Fecal occult blood test (FOBT)<br>Checks for hidden blood in three consecutive stool samples | Yearly or every three years when combined with sigmoidoscopy |
| Sigmoidoscopy<br>Uses a flexible, lighted tube to directly observe at the walls of the rectum and part of the colon | Every five years when combined with FOBT |
| Colonoscopy<br>Utilizes a flexible, lighted tube but can observe a greater proportion of the colon than sigmoidoscopy and be used to remove suspicious tissue. This is the | Every 10 years. |

| |
|---|
| preferred follow-up test when abnormal results arise from another test. |

Source: United States Preventive Service Task Force (USPSTF), (USPSTF 2008)

### *Decisions about Type of Screening*

Patients tend to heed the recommendation of their providers. Laiyemo and colleagues (2014) found that specific provider recommendations for CRC screening increased the odds of patient compliance by more than two times the odds as those not receiving recommendations. Further, authors found concordance between the recommendation and the specific test followed. Among study participants given recommendations only for FOBT, more than two in three had an FOBT, whereas only about a quarter of those receiving a colonoscopy recommendation had FOBT(Laiyemo et al., 2014). Similarly, authors found that greater than three in four participants with a colonoscopy recommendation had a colonoscopy within 10 years (Laiyemo et al., 2014).

Concordance with provider recommendations in CRC screening would have little effect on outcomes if all patients followed these recommendations at the same rate. However, for reasons likely stemming from the complexities associated with bowel preparation, screening completion is less likely for colonoscopy than other screening methods. Inadomi and colleagues (2012) performed a randomized controlled trial in which patients receiving a colonoscopy recommendation were less likely to complete screening than those either recommended FOBT or given a choice between FOBT and colonoscopy. According to the authors, findings illustrate a bias among clinicians toward colonoscopy and away from FOBT (Inadomi et al., 2012). Indeed, a majority of clinicians involved in the study voiced a preference for colonoscopy (Inadomi et al., 2012).

### *Impact of Insurance Coverage and Out of Pocket Costs*

Determining the actual costs of CRC screening to Medicare beneficiaries is more straightforward but still includes a cost range due to presence or absence of supplemental insurance and individual medical needs. Pyenson and colleagues (2014) performed an actuarial analysis on costs and found that the average allowed cost for screening colonoscopy under Medicare was $1,071. Of this figure, the average cost to the patient was $275 in the form of cost-sharing (deductible and co-insurance) (Pyenson, Scammell, & Broulette, 2014). Additional costs, including transportation and loss of work time, not captured by the authors' analysis were likely as more than 40% of colonoscopies did not include a claim for prescription bowel preparation, a necessary part of colonoscopy.

Delving further into population subgroups, the importance of insurance becomes apparent as the uninsured have the lowest rate of CRC screening of any subpopulation (Abdus & Selden, 2013; Holden, Chen, & Dagher, 2015; Vaidya et al., 2011). Further, less than a quarter of the uninsured population is current in CRC screening; 24% for Whites, 25% for African Americans, and 15% for Hispanics (Holden et al., 2015).

In a meta-evaluation of studies examining the factors associated with CRC screening, Guessous and colleagues (2010) found that private supplemental coverage, in addition to Medicare, was associated with greater screening. Having public coverage in addition to Medicare was associated with a lower probability of screening compared to Medicare with additional private coverage but both were more likely to receive CRC screening as compared to those on Medicare alone (Guessous et al., 2010). O'Malley and colleagues (2005) found that lower household income and socioeconomic status were barriers to CRC screening in the Medicare population and that, among those with a usual

source of care, these barriers explained the racial/ethnic differences observed in CRC screening. In their analysis of the literature, Guessous and colleagues (2010) venture that among those without supplemental insurance the Medicare Part B deductible and the 20% coinsurance were too expensive for those with low household incomes and negatively affected the probability of being current for CRC screening.

### *The Affordable Care Act and CRC Screening*

In 2010, the Patient Protection and Affordable Care Act (ACA) was signed into law and was predominantly targeted toward decreasing the number of uninsured persons and reducing the overall cost of health care. As of October 2010, new private insurance policies are required to cover preventive services graded A or B by the USPSTF without cost sharing (Gable, 2011). For the Medicare population, the ACA sought to address low preventive screening rates through partial elimination of Medicare beneficiary cost sharing.

The USPSTF recommendation for CRC screening recommendation states "screening for colorectal cancer reduces mortality through detection and treatment of early-stage cancer and detection and removal of adenomatous polyps" (Calonge et al., 2008). The agency further notes that polyp removal is considered a fundamental part of CRC screening (Calonge et al., 2008). According to the federal government, under the ACA, new private insurance plans are required to cover polypectomy or tissue biopsy without cost-sharing due to its essential inclusion as part of cancer screening and prevention (United States Department of Labor, 2014). Contrary to this view, Medicare regulations waive responsibility for the deductible but require beneficiaries to pay coinsurance for colonoscopies involving polypectomies (Centers for Medicare and

Medicaid Services, 2014). Under Medicare, a colonoscopy performed following an abnormal FOBT result (positive for occult blood) is a separate diagnostic procedure and not part of the CRC screening process. As such, Medicare beneficiaries receiving a follow-up colonoscopy after FOBT are responsible for both the Part B deductible and the 20 percent coinsurance associated with the colonoscopy.

The partial removal of CRC screening cost sharing created a relative cost difference among colonoscopies under different classifications and incentivized the procedure's use as a first-line screening test due to differential reimbursement (Medicare, 2015). Table 12 summarizes the reimbursement policy before and after the Affordable Care Act (ACA). The difference in the policy is ***emphasized***.

**Table 12. Medicare CRC reimbursement before and after the ACA**

| Medicare reimbursement policy before the ACA | Medicare reimbursement policy following the ACA |
|---|---|
| Beginning 1/1/2007, CRC screening by FOBT, sigmoidoscopy, or colonoscopy were covered with no cost sharing to the beneficiary | ACA reimbursement policies for Medicare went into effect on 1/1/2011. CRC screening by FOBT, sigmoidoscopy, or colonoscopy were covered with no cost sharing to the beneficiary. |
| If colonoscopy was used as the initial screening and abnormalities were found mid-test, then the beneficiary was responsible for both the Medicare Part B deductible and 20% coinsurance. | If colonoscopy was used as the initial screening and abnormalities were found mid-test, then the beneficiary was responsible for the 20% coinsurance ***but the deductible was waived***. |
| If a follow-up colonoscopy was required due to an abnormal test, the beneficiary was responsible for both the Part B deductible and 20% coinsurance. | If follow up colonoscopy was required due to an abnormal test, the beneficiary was responsible for both the deductible and 20% coinsurance. |
| Cost of a diagnostic colonoscopy was not different whether initiated as a first-line screening or following an abnormal result from a prior screening test. | In the post ACA reimbursement scheme, it is more cost effective to the beneficiary to seek colonoscopy as the initial screen due to the difference in deductible responsibility. |

Source: Medicare reimbursement policies, 2015

### *Typical Screening Scenarios and Incentives*

Consistent with the ACA, when Medicare covers CRC screening, beneficiaries are not responsible for the part B deductible or coinsurance when they have a screening colonoscopy (as the initial screening test) or fecal occult blood test (FOBT) (CMS, 2015). However, beneficiaries may be responsible for procedure costs when a polyp or other

suspicious tissue is detected and removed during a screening colonoscopy. In that case, the service ceases to be a screening and is considered a diagnostic procedure (colonoscopy with polypectomy or biopsy), and patients are billed the amount of the cost-sharing. In a two-part screening where beneficiaries utilize the far less invasive FOBT, they are responsible for the part B deductible and coinsurance when a colonoscopy follows an abnormal, positive result (Center for Medicare and Medicaid Services, 2015).

Before the ACA was enacted, when a polyp or suspicious tissue was identified and removed during a screening colonoscopy, Medicare classified the test as diagnostic and beneficiaries were responsible for both the Part B deductible and coinsurance (Center for Medicare and Medicaid Services, 2015). The ACA partially addressed cost sharing by waiving the Medicare Part B deductible, regardless of whether a polyp is removed or a biopsy is taken during the procedure (Department of Health and Human Services, 2010). However, the ACA did not eliminate the 20 percent coinsurance requirement associated with polyp removal or tissue biopsy during colonoscopy. In the case where FOBT or sigmoidoscopy was the utilized form of CRC screening, a positive, or abnormal, result would most often be followed up by a colonoscopy (Center for Medicare and Medicaid Services, 2015). The colonoscopy, occurring after the FOBT and now considered diagnostic, is subject to both the Part B deductibles and co-insurance (Center for Medicare and Medicaid Services, 2015). The relative cost difference is in the deductible and it incentivizes colonoscopy as the initial screening test.

The current structure of the Medicare rules regarding CRC screening reimbursement creates adverse and inefficient incentives. Physicians may be reluctant to recommend FOBT to their patients if cost-sharing for initial colonoscopy is removed but

continue to require cost-sharing for colonoscopies following an abnormal FOBT (Green, Coronado, Devoe, & Allison, 2014). Removing cost-sharing requirements would likely increase the use of FOBT as well as both the initial screening and follow-up colonoscopies (Lansdorp-Vogelaar et al., 2011). In this way, policies that either reduce or eliminate cost sharing may increase the proportion of those screened for CRC. Increasing CRC screening is a desired outcome that can lead to reduced CRC incidence and mortality as well as reduced overall treatment costs (Lansdorp-Vogelaar et al., 2011).

***Risks Associated with Colonoscopies***

Beyond the cost advantages of greater CRC screening and, in particular, increased utilization of FOBT as a first-line screening, colonoscopy offers numerous shortcomings as a first-line screening test. Overall, colonoscopies are a safe procedure – however, much of the literature does not focus on near-elderly and elderly populations (Day, Kwon, Inadomi, Walter, & Somsouk, 2011). Prior research looking at populations broader in age than Medicare beneficiaries typically found colonoscopies to be a relatively safe procedure with one in 30,000 resulting in death due to complications (Karajeh, Sanders, & Hurlstone, 2006). However, looking broadly across all age groups receiving colonoscopies distorts the risk incurred by Medicare beneficiaries 65 years of age and older as, in the older population, the rate of adverse colonoscopy outcomes is higher than previously reported (Day et al., 2011).

Day and colleagues (2011) reviewed studies that included adverse events stemming from colonoscopies and found that patients 65 years of age and older had a 14-fold higher risk of perforation compared with patients of the same age who did not have a colonoscopy performed (Day et al., 2011). The most common complications following

colonoscopy involved the cardiovascular or pulmonary systems with gastrointestinal complications, e.g., perforation and bleeding (Day et al., 2011). The mortality incidence following colonoscopy in the elderly was 1 per 1000 procedures (Day et al., 2011).

**Study Purpose**

The purpose of this study is to investigate the impact of the change in Medicare colorectal cancer test cost sharing policy following the ACA on CRC screening. This study fills a gap in the literature with respect to the introduction of the ACA and its effects on CRC screening rates and screening disparities by race/ethnicity and will illustrate whether there was a significant effect on the use of sigmoidoscopy or colonoscopy and FOBT.

**Research Questions and Hypotheses**

**Research question 1 –** What effect did the change in Medicare colorectal cancer (CRC) test reimbursement policy following the ACA have on both beneficiary CRC test status (current or not current) and utilization of component CRC screening tests in 65 to 75 year old beneficiaries?

- **Hypothesis 1** – The change in Medicare CRC screening test reimbursement policy following the ACA will result in a greater probability of beneficiaries being current for overall CRC screening than before the ACA was enacted.
- **Rationale** – Medicare CRC policy following the ACA partially relieves cost sharing responsibility to beneficiaries by waiving the deductible for colonoscopies if suspicious tissue is found mid-procedure. Prior Medicare preventive service coverage changes that reduced cost-sharing have resulted in increases in use of

CRC screening procedures including FOBT, flexible sigmoidoscopy, and colonoscopy(Doubeni et al., 2010).

- **Hypothesis 2 -** The change in Medicare CRC screening test reimbursement policy following the ACA will result in a greater probability of beneficiaries being current for CRC screening using colonoscopy or sigmoidoscopy than before the ACA was enacted.
- **Rationale** – Medicare CRC policy following the ACA encourages the use of colonoscopy as a first-line screening test due to the responsibility of the beneficiary for both the deductible and the coinsurance should it be used as a follow up test. Shih and colleagues (2006) found increases in colonoscopy following Medicare coverage of the procedure due to policy changes in 2001.
- **Hypothesis 3** – The change in Medicare CRC screening test reimbursement policy following the ACA will result in a lower probability of beneficiaries being current for CRC screening using FOBT than before the ACA was enacted.
- **Rationale** – Medicare CRC policy following the ACA discourages the use of FOBT as a first-line screening test. Fenton and colleagues (2009) analyzed CRC screening testing use over the period when Medicare established CRC screening coverage. Prior to the coverage of CRC screenings, colonoscopies cost significantly more to the beneficiary than the FOBT test. As a result of coverage changes, Fenton and colleagues (2009) found the use of FOBT decreased relative to colonoscopy.

**Research question 2 –** Does the effect of the Medicare CRC test reimbursement policy on CRC test status (current or not current) vary by race/ethnicity in beneficiaries 65 to 75 years old?

- **Hypothesis 4** – The change in Medicare CRC screening test reimbursement policy following the ACA will result in narrowing racial/ethnic disparities in overall and component CRC screening status (current or not current).
- **Rationale** – The disparities in CRC screening between non-Hispanic Whites, non-Hispanic blacks, and Hispanics have continually narrowed in the Medicare population since the late nineties (Doubeni et al., 2010; Fenton et al., 2009; Shih et al., 2006). This trend is expected to continue in light of the partial cost sharing relief provided to Medicare beneficiaries in the recent ACA policy change.

**Theoretical Model**

The Andersen model of health services utilization was chosen to guide independent variable selection for this study. The model details predisposing, enabling, and need factors associated with healthcare service utilization (R. Andersen & Newman, 1973). Predisposing factors represent individuals' natural tendency to utilize healthcare services and include age, gender, and social structural characteristics (e.g., education, occupation, race/ethnicity) (R. M. Andersen, 1995). Enabling factors are resources available to individuals to utilize services (e.g., income, health insurance, regular source of care). Finally, need factors represent health status or disease and are the essential causes of health services utilization (R. M. Andersen, 1995). In this study, Medicare CRC screening reimbursement, an enabling factor, is the main explanatory variable of the use of screening procedures.

## Methods

### *Study Participants and Data Collection*

Data for this study were obtained from the Medical Expenditure Panel Survey (MEPS), a household survey of the civilian non-institutionalized population of the U.S. sponsored by the Agency for Healthcare Research and Quality and the National Center for Health Statistics. The sampling scheme and methods for data collection in the MEPS have been described in detail (Ezatti-Rice et al., 2008). MEPS provides representative estimates of health care utilization, insurance coverage, and sociodemographic characteristics of the population. Six years of cross-sectional household component MEPS data were pooled and grouped into pre-period (2007 to 2010) and post-period (2011 to 2012) in relation to the implementation of the ACA.

The sample was restricted to non-Hispanic Whites (Whites), non-Hispanic African Americans (African Americans), and Hispanics in order to have sufficient statistical power to compare preventive service utilization across race and ethnicity. The analyses were further restricted to those aged 65–75 years to include Medicare enrollees likely to benefit most from CRC screening.

### *Measures of CRC Screening*

Data on the use of CRC screening originated from several items in the MEPS, including questions asking when the "most recent sigmoidoscopy or colonoscopy" or FOBT occurred. The times of the most recent sigmoidoscopy or colonoscopy and/or FOBT were detailed by the survey as 1 year ago or less, between 1 and 2 years ago, 2 to 3 years ago, between 3 and 5 years ago, more than 5 years ago, more than 10 years ago

(2009-2012), or never. Table 13 summarizes questions used in the MEPS to assess CRC screening.

**Table 13. CRC screening questions from the MEPS**

| Screening | Medicare population | Survey questions | |
|---|---|---|---|
| **Colorectal cancer** | Men and women 65-75 | 2007-2008 | 2009-2012 |
| Fecal occult blood test | | When was the last blood stool test? | When was the last blood stool test? |
| Colonoscopy | | When was the last colonoscopy or sigmoidoscopy? | When was the last colonoscopy? |
| Sigmoidoscopy | | | When was the last sigmoidoscopy? |

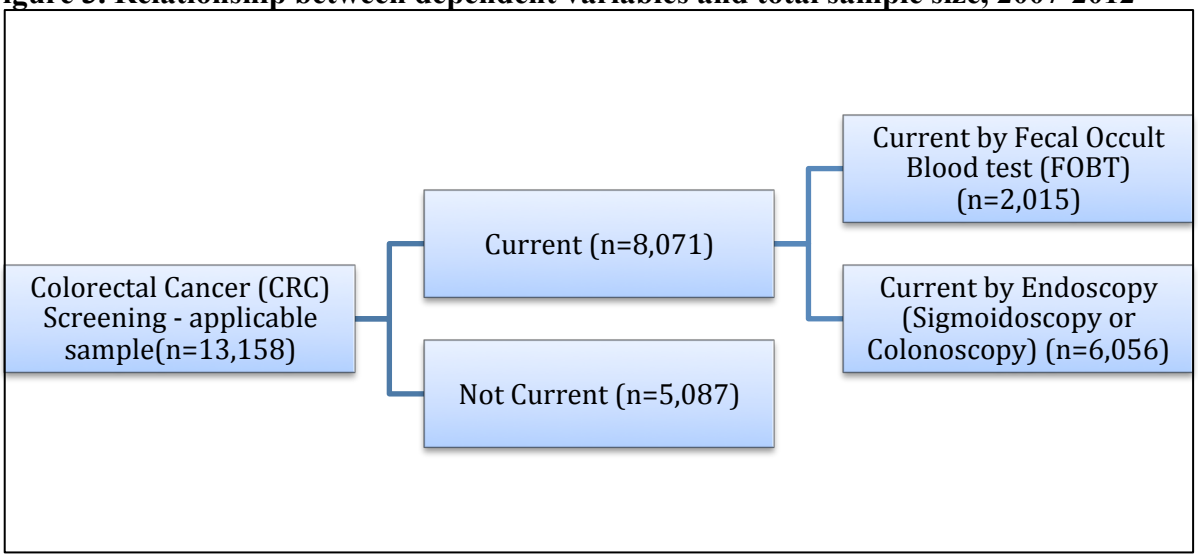
Source: Medical Expenditure Panel Survey (MEPS), 2015

### *Dependent Variables*

Screening for colorectal cancer is accomplished using one or a combination of tests varying in specificity, sensitivity, and risk. The USPSTF recommends screening for colorectal cancer using fecal occult blood testing, sigmoidoscopy, or colonoscopy. CRC screening was defined as endoscopy (either sigmoidoscopy or colonoscopy) within 5 years and/or FOBT within 1 year as has been described previously (O'Malley, Forrest, Feng, & Mandelblatt, 2005). The MEPS did not distinguish between sigmoidoscopy and colonoscopy in either 2007 or 2008. To analyze whether individuals were current for CRC screening, three variables were created to describe whether one was current for CRC screening overall (using either FOBT or sigmoidoscopy/colonoscopy), current for CRC screening using FOBT, and current for CRC screening using sigmoidoscopy/colonoscopy. Current overall CRC screening was defined as FOBT within 1 year and/or sigmoidoscopy/colonoscopy within 5 years. Current CRC screening using FOBT was defined as FOBT screening within 1 year. Current CRC screening using sigmoidoscopy/colonoscopy was defined as having had a sigmoidoscopy or colonoscopy procedure within the past 5 years.

Given that colonoscopy is used as a follow up for abnormal FOBT findings, it was possible for an individual to be current for CRC screening using both FOBT and sigmoidoscopy/colonoscopy. In these cases, the individual was coded as current for CRC screening using FOBT to reflect their initial approach to CRC screening. Figure 3 illustrates the relationship between the dependent variables and provides the associated sample size for each.

**Figure 3. Relationship between dependent variables and total sample size, 2007-2012**




Source: Medical Expenditure Panel Survey (MEPS), 2007-2012

***Independent variables***

Covariates (age, sex, residence location, household income, education, usual source of care, supplemental insurance, and health status) were also included. Race/ethnicity was categorized as White non-Hispanic, African American non-Hispanic, and Hispanic and followed previous literature on race/ethnicity disparities among the Medicare population (Doubeni 2012; Shih 2009; Fenton 2009). Categorical variables for four poverty groups were assigned corresponding to poor, low, middle, and high income according to the Federal Poverty Level (FPL): <100%, 100%–199%, 200%–399%, and >400% FPL, respectively. Marital status was categorized as never married, married, and

divorced/separated/widowed. Education was categorized as less than high school, high school, some college, and college graduate. Primary language, based on interview language, was categorized as English or other. Age categories were 65-70 and 71-75 years of age. Usual source of care was categorized as having none, physician's office, or hospital. Urbanicity was categorized as either residing within or outside a Metropolitan Statistical Area (MSA). Health status was categorized as excellent, very good, good, fair, or poor.

***Data Analyses***

Descriptive statistics illustrated proportion differences of individuals in 2007-2010 as compared to 2011-2012 by race/ethnicity. Linear combinations compared proportions to identify significant differences in the post-ACA period as compared to the pre-ACA period among Whites, African Americans, and Hispanics by independent variable. Multivariate and single difference multivariate logistic regression models were used to examine trends and racial/ethnic differences in CRC screening over the 2007 to 2012 period.

Trends in CRC screening were derived using pooled MEPS data from 2007-2010 and 2011-2012. The significance of changes over time was tested through the inclusion of a POST variable in the regressions indicating the interview occurred after January 1, 2011. Multivariate logistic models with time-trend variables in the models were used to estimate the effect of ACA and Medicare policy changes on CRC screenings. Time-trend variables were used to account for general trends in colorectal cancer screening compliance that occurred independently of the policy changes.

To identify predicted proportions for screening, covariates were fixed at the mean values observed across the entire sample. Similar models were fit to estimate trends in being up to date with using specific CRC tests (FOBT, sigmoidoscopy or colonoscopy). These models allow one to judge whether differential use of specific CRC tests according to race or ethnicity may explain changes in overall up-to-date status or illustrate differential incentives due to Medicare policy changes following the ACA. Cross-sectional survey weights and variance estimation procedures for complex survey design were used in the analysis; analyses were performed using Stata version 13.

**Results**

Table 14 provides summary statistics of the U.S. Medicare population aged 65 to 75 years pooled into 2007-2010 and 2011-2012 groups by race/ethnicity. Among the included Medicare population, a greater proportion of African Americans were single and a greater proportion of Whites were divorced, widowed, or separated in the 2011-2012 period. Significantly fewer persons in all racial/ethnic groups had less than a high school education in the 2011-2012 period while a significantly greater proportion of Whites were college graduates. A larger proportion of African Americans were located in a Metropolitan Statistical Area in the 2011-2012 period and a lower proportion had household income below the federal poverty line compared to the earlier period. A greater proportion of all racial/ethnic groups identified hospitals and fewer identified doctors' offices as their location of usual source of care in the 2011-2012 period compared to the earlier period. A significantly greater proportion of Whites categorized themselves as having excellent physical health in the 2011-2012 time period while fewer

Whites and Hispanics categorized themselves as having poor physical health compared to the earlier period.

**Table 14. Weighted Descriptive Statistics of the Medicare Population by Race/Ethnicity**

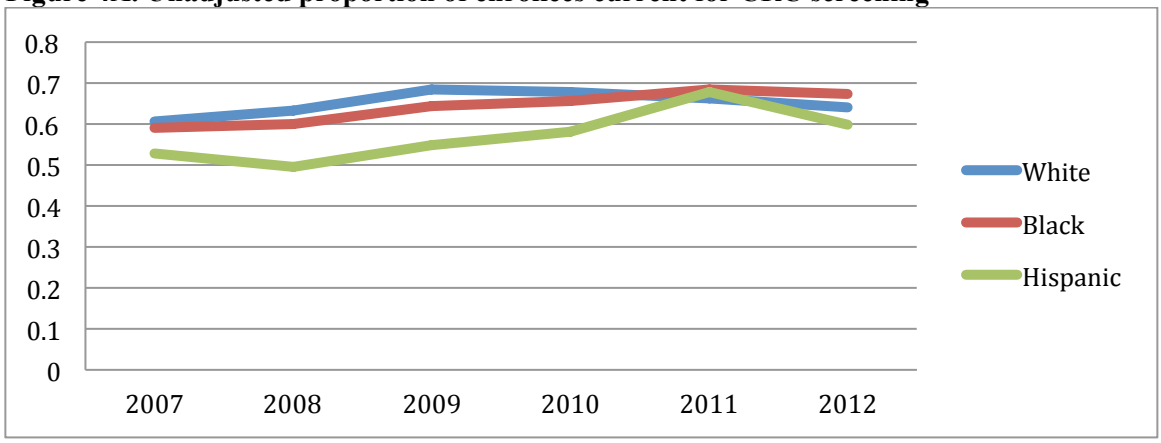
| | All | | White, non-Hisp. | | Black, non-Hisp. | | Hispanic | |
|---|---|---|---|---|---|---|---|---|
| **Characteristics** | 2007-2010 | 2011-2012 | 2007-2010 | 2011-2012 | 2007-2010 | 2011-2012 | 2007-2010 | 2011-2012 |
| Ref = 2007-2010 | | | | | | | | |
| **Total observations, n** | 7870 | 4739 | 5177 | 2939 | 1547 | 1012 | 1146 | 788 |
| **Age category** | | | | | | | | |
| 65-70 | 0.62 | 0.63 | 0.63 | 0.62 | 0.62 | **0.68** * | 0.58 | 0.59 |
| 71-75 | 0.38 | 0.37 | 0.37 | 0.38 | 0.38 | **0.32** * | 0.42 | 0.41 |
| **Gender** | | | | | | | | |
| Male | 0.46 | 0.47 | 0.47 | 0.48 | 0.41 | 0.44 | 0.43 | 0.45 |
| Female | 0.54 | 0.53 | 0.53 | 0.52 | 0.59 | 0.56 | 0.57 | 0.55 |
| **Marital status** | | | | | | | | |
| Single | 0.63 | 0.64 | 0.67 | 0.67 | 0.41 | **0.48** * | 0.55 | 0.52 |
| Married | 0.33 | 0.31 | 0.30 | 0.29 | 0.50 | 0.45 | 0.38 | 0.41 |
| Div/wid/sep | 0.04 | 0.05 | 0.03 | **0.04** * | 0.08 | 0.07 | 0.07 | 0.07 |
| **Education** | | | | | | | | |
| Less than HS | 0.20 | **0.15** *** | 0.14 | **0.11** *** | 0.35 | **0.26** ** | 0.55 | **0.46** * |
| High school diploma | 0.34 | 0.32 | 0.36 | 0.33 | 0.35 | 0.35 | 0.19 | 0.25 |
| Some college | 0.21 | 0.23 | 0.22 | 0.24 | 0.16 | 0.20 | 0.13 | 0.17 |
| College grad | 0.26 | **0.30** ** | 0.27 | **0.32** ** | 0.14 | 0.19 | 0.13 | 0.12 |
| **Region of U.S.** | | | | | | | | |
| Northeast | 0.19 | 0.19 | 0.20 | 0.20 | 0.18 | 0.15 | 0.15 | 0.17 |
| Midwest | 0.22 | 0.23 | 0.24 | 0.25 | 0.16 | 0.20 | 0.07 | 0.08 |
| South | 0.38 | 0.38 | 0.36 | 0.36 | 0.56 | 0.56 | 0.41 | 0.38 |
| West | 0.21 | 0.21 | 0.20 | 0.19 | 0.09 | 0.09 | 0.37 | 0.37 |
| **MSA** | | | | | | | | |
| Not in an MSA | 0.19 | 0.18 | 0.22 | 0.21 | 0.13 | **0.10** * | 0.08 | 0.09 |
| In an MSA | 0.81 | 0.82 | 0.78 | 0.79 | 0.87 | **0.90** * | 0.92 | 0.91 |
| **Interview language** | | | | | | | | |
| English | 0.95 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 0.48 | 0.44 |
| Not English | 0.05 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.52 | 0.56 |
| **Poverty level** | | | | | | | | |
| 0-100% | 0.08 | 0.08 | 0.06 | 0.06 | 0.17 | **0.14** * | 0.16 | 0.16 |
| 100-199% | 0.21 | 0.21 | 0.19 | 0.18 | 0.33 | 0.29 | 0.34 | 0.36 |
| 200-399% | 0.28 | 0.28 | 0.28 | 0.27 | 0.28 | 0.33 | 0.29 | 0.30 |
| <=400% | 0.42 | 0.44 | 0.47 | 0.49 | 0.22 | 0.25 | 0.21 | 0.18 |
| **Insurance type** | | | | | | | | |
| Medicare only | 0.03 | 0.03 | 0.02 | 0.02 | 0.04 | 0.03 | 0.06 | 0.06 |
| Medicare + private | 0.88 | 0.88 | 0.93 | 0.92 | 0.75 | 0.78 | 0.65 | 0.66 |
| Medicare + public | 0.09 | 0.09 | 0.05 | 0.06 | 0.21 | 0.19 | 0.29 | 0.28 |
| **Location of usual source of care** | | | | | | | | |
| No USC | 0.08 | 0.07 | 0.07 | 0.07 | 0.09 | 0.09 | 0.12 | 0.11 |
| Office | 0.80 | **0.75** * | 0.83 | **0.78** ** | 0.74 | **0.68** * | 0.61 | **0.52** * |
| Hospital | 0.12 | **0.18** *** | 0.10 | **0.15** *** | 0.17 | **0.23** * | 0.27 | **0.37** ** |
| **Perceived physical health status** | | | | | | | | |
| Excellent | 0.17 | **0.19** * | 0.19 | **0.21** * | 0.11 | 0.13 | 0.09 | 0.12 |
| Very good | 0.31 | 0.33 | 0.33 | 0.35 | 0.26 | 0.25 | 0.23 | 0.21 |
| Good | 0.32 | 0.31 | 0.31 | 0.30 | 0.35 | 0.37 | 0.33 | 0.36 |
| Fair | 0.14 | 0.13 | 0.12 | 0.11 | 0.22 | 0.19 | 0.27 | 0.26 |
| Poor | 0.05 | **0.04** ** | 0.05 | **0.04** * | 0.05 | 0.05 | 0.08 | **0.05** * |

Source: Medical Expenditure Panel Survey 2007-2012
Note: Boldface indicates statistical significance

Linear combinations compare the pre to the post periods and report as: * - p<.05, ** - p<.01, *** - p<.001
MSA, Metropolitan Statistical Area; USC, Usual Source of Care; MEPS, Medical Expenditure Panel Survey

Figures 4A, 4B, and 4C graphically present unadjusted proportions of individuals current for CRC screening by any method, FOBT, and sigmoidoscopy/colonoscopy across racial/ethnic groups. Figure 4A shows that for overall CRC screening, the proportion considered current has remained relatively stable over the study period for Whites and African Americans while the proportion considered current among Hispanics has increased and largely closed the gap with the other two groups by 2011.

**Figure 4A. Unadjusted proportion of enrollees current for CRC screening**




Source: Medical Expenditure Panel Survey (MEPS), 2007-2012

Figure 4B presents unadjusted trend information for FOBT screening and shows that while slightly decreasing over the course of the study period, each of the groups is relatively close in terms of the proportion screened by this method.

Figure 4C appears to show a generally stable to positive trajectory of FOBT use for Whites and African Americans. For Hispanics, Figure 4C reveals very little change until 2010 when sigmoidoscopy/colonoscopy appear to increase in use and in 2011 when there appears to be a decreasing trend in use.

**Figure 4B. Unadjusted proportion of enrollees current for CRC screening by FOBT**

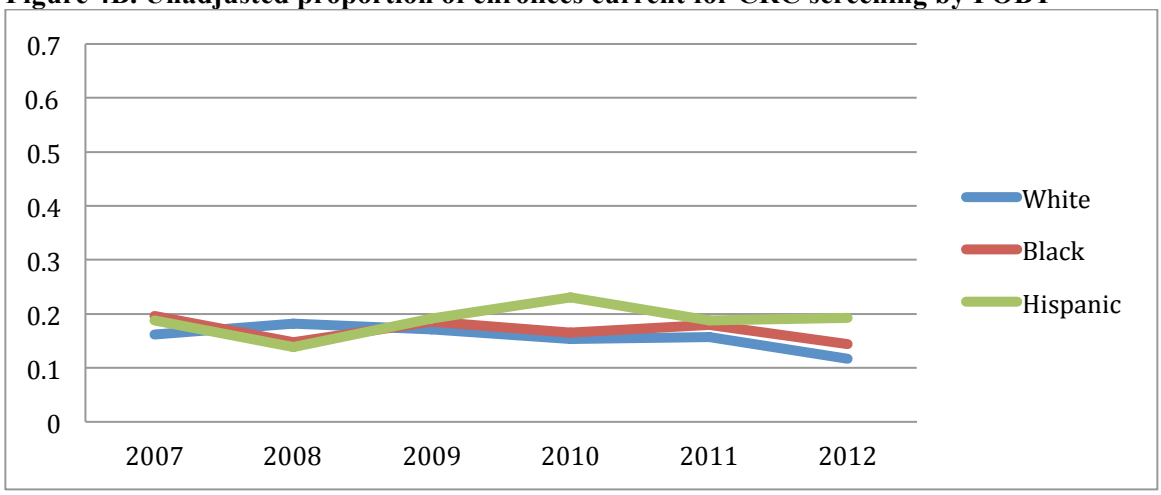
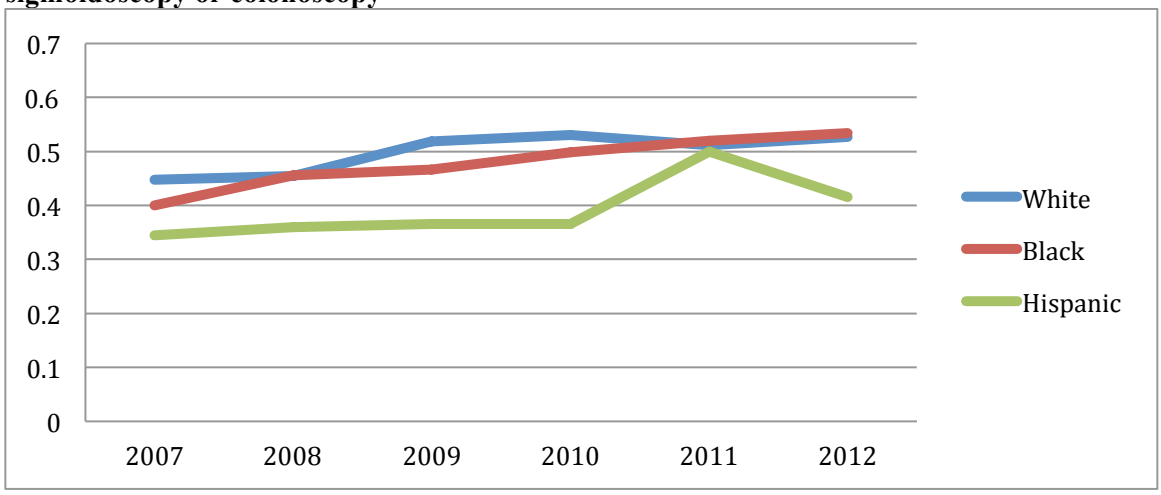



**Figure 4C. Unadjusted proportion of enrollees current for CRC screening by sigmoidoscopy or colonoscopy**




Source: Medical Expenditure Panel Survey, 2007-2012

After other covariates were controlled for in each of the time periods under study, there were no statistically significant differences between racial/ethnic groups in current overall CRC screening status as shown in Table 15. The analysis revealed that some associations seemed to have grown stronger between the earlier and later periods, while most other relationships have weakened.

**Table 15. Multivariate Logistic Models for Factors Associated with Current Overall Colorectal Cancer Screening**

| | | 2007-2010 | | | 2011-2012 | | |
|---|---|---|---|---|---|---|---|
| | | Odds Ratio | | 95% CI | Odds Ratio | | 95% CI |
| **Race/Ethnicity** | | | | | | | |
| ref. White | Black | 1.16 | | (0.95, 1.40) | 1.19 | | (0.89, 1.60) |
| | Hispanic | 1.01 | | (0.79, 1.30) | 1.21 | | (0.78, 1.86) |
| **Age** ref. 65-70 | 71-75 | **1.17** | * | (1.02, 1.33) | 1.00 | | (0.80, 1.24) |
| **Gender** ref. Male | Female | **0.87** | * | (0.77, 0.99) | 0.89 | | (0.72, 1.11) |
| **Marital Status** | | | | | | | |
| ref. Never married | Married | 0.92 | | (0.78, 1.08) | 0.84 | | (0.65, 1.08) |
| | Div/Sep/Wid | **0.61** | ** | (0.44, 0.83) | 0.86 | | (0.55, 1.36) |
| **Education** | | | | | | | |
| ref. < HS | HS Diploma | 1.10 | | (0.90, 1.35) | 1.17 | | (0.87, 1.57) |
| | Some College | **1.55** | *** | (1.26, 1.90) | 1.15 | | (0.81, 1.64) |
| | College Grad. | **1.79** | *** | (1.39, 2.31) | 1.10 | | (0.79, 1.52) |
| **Region** | | | | | | | |
| ref. Northeast | Midwest | **0.77** | * | (0.62, 0.94) | 1.26 | | (0.85, 1.87) |
| | South | 0.87 | | (0.70, 1.08) | 1.27 | | (0.87, 1.87) |
| | West | 0.98 | | (0.78, 1.23) | 1.21 | | (0.80, 1.84) |
| **MSA** | In an MSA | 1.20 | | (0.99, 1.46) | 1.18 | | (0.85, 1.63) |
| **Interview Language** | Not English | **0.70** | * | (0.51, 0.95) | 0.93 | | (0.54, 1.60) |
| **Poverty Category** | | | | | | | |
| ref. <100% | 100-199% | 1.04 | | (0.86, 1.25) | 1.09 | | (0.79, 1.49) |
| | 200-399% | **1.23** | * | (1.01, 1.49) | 1.20 | | (0 87, 1.66) |
| | 400%+ | **1.39** | ** | (1.13, 1.71) | **1.62** | * | (1.13, 2.32) |
| **Insurance** | | | | | | | |
| ref. Medicare only | Medicare+private | **2.15** | *** | (1.43, 3.23) | 1.43 | | (0.78, 2.62) |
| | Medicare+public | **1.84** | ** | (1.19. 2.83) | 1.69 | | (0.83, 3.44) |
| **Usual Source of Care** | | | | | | | |
| ref. None | Dr. Office | **3.70** | *** | (2.96, 4.62) | **2.98** | *** | (1.97, 4.50) |
| | Hospital | **3.35** | *** | (2.55, 4.41) | **4.17** | *** | (2.60, 6.68) |
| **Perceived Health Status** | | | | | | | |
| ref. Excellent | Very Good | 0.99 | | (0.81, 1.21) | 1.02 | | (0.73, 1.43) |
| | Good | 1.03 | | (0.85, 1.26) | 1.23 | | (0.88, 1.72) |
| | Fair | 1.02 | | (0.81, 1.28) | 1.18 | | (0.82, 1.69) |
| | Poor | 1.08 | | (0.77, 1.53) | 0.94 | | (0.53, 1.65) |
| **MEPS Year** | | | | | | | |
| ref. 2007 | 2008 | 1.12 | | (0.97, 1.30) | n/a | | n/a |
| | 2009 | **1.39** | *** | (1.18, 1.64) | n/a | | n/a |
| | 2010 | **1.31** | ** | (1.10, 1.57) | n/a | | n/a |
| ref. 2011 | 2012 | n/a | | n/a | 0.90 | | (0.76, 1.07) |

Source: Medical Expenditure Panel Survey 2007-2012

Note: Boldface indicates statistical significance

* - p<.05, ** - p<.01, *** - p<.001

MSA, Metropolitan Statistical Area; USC, Usual Source of Care; MEPS, Medical Expenditure Panel Survey

Most noticeably, differences in screening by household income increased in the later period. Between 2007 and 2010, households with income greater than 200% FPL had between 1.23 and 1.39 times the odds (95% CI: 1.01-1.49 and 1.13-1.71, respectively) of being current for CRC screening than those under the poverty line. In the later time period, those in the highest household income category had more than 1.6 times the odds (95% CI: 1.13-2.32) of current CRC screening than those in the lowest income category.

In an example of a relationship that has weakened over time, being in the older age category was more strongly associated with current CRC screening in the 2007-2010 period (OR=1.17, 95% CI: 1.02-1.33) than in the 2011-2012 period where results were not statistically significant. Similarly, females had significantly lower odds of current CRC screening than males in the 2007-2010 period (OR=0.87, 95% CI: 0.77-0.99) whereas in the later period gender differences in CRC screening were not statistically significant. Greater levels of education were more strongly associated with CRC screening in the earlier period as compared to the later period with people who have some college and college graduates having 1.55 to 1.79 times the odds of screening compared to those without a high school diploma (95% CI: 1.26-1.90 and 1.39-2.31, respectively). Education was not significantly associated with CRC screening in the later period.

The relationship of a usual source of care was strongly significant in both the 2007-2010 and 2011-2012 time periods. However, whether or not a respondent had supplemental insurance was positive, but not statistically significant in the later time period. Whereas, in the 2007-2010 period, supplemental insurance was both strongly, and

positively associated with current CRC screening. The relationship between the other covariates and current CRC screening was similar over the time periods under study.

***Differences between racial/ethnic groups***

Table 16 shows sequentially adjusted marginal probability of being current for CRC screening over the pre to post periods in the study by racial/ethnic group. This probability is shown for overall screening, screening by sigmoidoscopy or colonoscopy, and screening by way of FOBT. The models add additional covariates according to predisposing, enabling, and need classifications of the Andersen model. The results show that while Whites did not significantly increase in overall CRC screening, African Americans and Hispanics did (AME: 6.8% and 14.7%, respectively). Increases in CRC screening for African Americans and Hispanics were driven entirely by increases in the use of endoscopic methods (sigmoidoscopy or colonoscopy) as each group showed a statistically non-significant decrease in the probability of being current by FOBT.

Whites also showed a statistically significant increase in screening by either sigmoidoscopy or colonoscopy but also experiences a significant decline in the probability of current screening by FOBT (AME: -5.0%). Average marginal effects for each racial/ethnic group were robust to adjustment for predisposing, enabling, and need factors. Medicare policy change with regard to CRC screening has potentially had no effect on overall CRC screening while simultaneously increasing screening by way of endoscopic methods and decreasing screening by way of FOBT.

**Table 16. Unadjusted and adjusted average marginal effects of Medicare CRC reimbursement rules on probability of current screening by race/ethnicity in Medicare enrollees age 65-75**

| | White | | African American | | Hispanic | |
|---|---|---|---|---|---|---|
| | AME | SE | AME | SE | AME | SE |
| **Base model[1]** | | | | | | |
| Overall | 0.0268 | (0.0198) | 0.0814 ** | (0.0814) | 0.1264 *** | (0.1264) |
| Endoscopy | 0.0745 *** | (0.0213) | 0.1143 *** | (0.0313) | 0.1408 *** | (0.0332) |
| FOBT | -0.0477 ** | (0.0169) | -0.0303 | (0.0280) | -0.0187 | (0.0285) |
| **Adjusted for predisposing variables[2]** | | | | | | |
| Overall | 0.0263 | (0.0262) | 0.0666 * | (0.0308) | 0.1477 *** | (0.0361) |
| Endoscopy | 0.0737 ** | (0.0250) | 0.1115 ** | (0.0337) | 0.1655 *** | (0.0396) |
| FOBT | -0.0469 * | (0.0188) | -0.0404 | (0.0290) | -0.0235 | (0.0339) |
| **Adjusted for predisposing and enabling variables[3]** | | | | | | |
| Overall | 0.0222 | (0.0255) | 0.0677 * | (0.0291) | 0.1459 *** | (0.0350) |
| Endoscopy | 0.0735 ** | (0.0246) | 0.1192 ** | (0.0330) | 0.1708 *** | (0.0388) |
| FOBT | -0.0501 ** | (0.0185) | -0.0466 | (0.0286) | -0.0278 | (0.0335) |
| **Full model - predisposing, enabling, and need variables[4]** | | | | | | |
| Overall | 0.0233 | (0.0255) | 0.0683 * | (0.0292) | 0.1468 *** | (0.0350) |
| Endoscopy | 0.0746 ** | (0.0246) | 0.1195 *** | (0.0332) | 0.1710 *** | (0.0387) |
| FOBT | -0.0500 ** | (0.0186) | -0.0467 | (0.0288) | -0.0266 | (0.0334) |

Source: Medical Expenditure Panel Survey (2007-2010 & 2011-2012)
AME: Average Marginal Effect, SE: standard error
1: Base model includes Post, race/ethnicity, and year covariates
2: Includes Base model covariates plus age category, gender, marital status, education, region, and metropolitan statistical area
3: To model 3 adds interview language, household income, health insurance, and usual source of care as covariates
4: Full model adds perceived health status to model 3
Significant difference between the pre and post periods represented as: *-p<0.05, **-p<0.01, ***-p<0.001

Tables 17, 18, and 19 further examine results presented in table 16 over racial/ethnic groups and compare differences between the groups in the periods before and after Medicare rules changes regarding CRC screening. Figures 5, 6, and 7 complement the tables by showing graphically the racial/ethnic group differences between 2007 and 2012. Table 17 examines the probability of being up-to-date for CRC screening using either testing methodology while table 8 focuses on sigmoidoscopy/colonoscopy and table 19 looks exclusively at FOBT. Results from these three tables were generated using results from the multivariate analyses of CRC screening before and after the Medicare reimbursement policy change. Presenting findings as average adjusted predictions and differences between racial/ethnic groups from a multivariate logistic regression provides an intuitive measure of screening utilization.

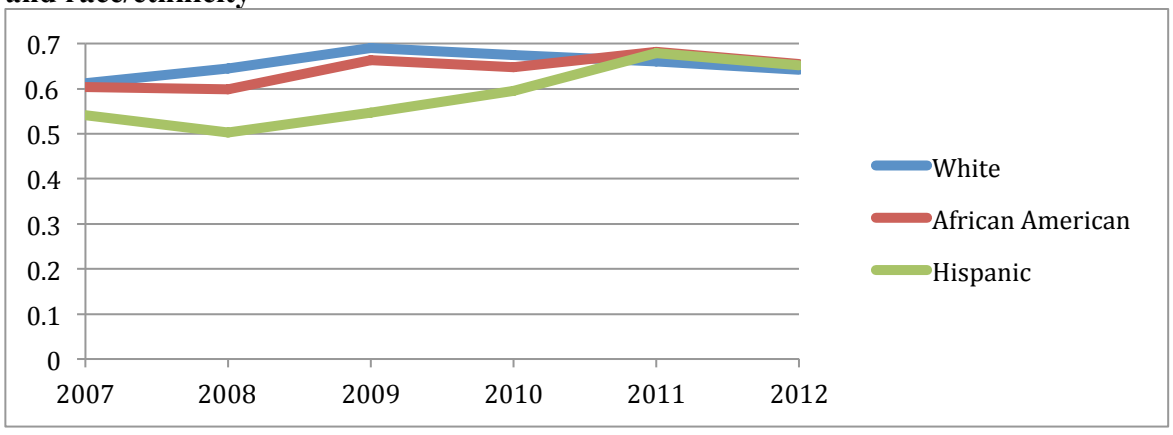
Table 17 presents the results for overall CRC screening. African Americans and Whites both showed non-significant differences in both the pre and post periods indicating little to no disparity in overall screening in either period. Hispanics were significantly less likely to be current for CRC screening than Whites in the pre period. However, by the post period Hispanics have closed the gap in the screening disparity with Whites and were not significantly different in terms of being up-to-date for CRC screening. Figure 5 further illustrates the progress made by Hispanic groups. The large disparity in screening shown graphically between 2007 and 2010 disappears in both 2011 and 2012 as the predicted probabilities of each racial/ethnic group converge.

**Table 17. Predicted probability of current overall CRC screening by race/ethnicity in Medicare enrollees age 65-75**

| | Average Adjusted Predictions | | | | | |
|---|---|---|---|---|---|---|
| | **All** | **White** | **African American** | | **Hispanic** | |
| **Overall CRC screening** | Prob. | Prob. | Prob. | Difference from white | Prob. | Difference from white |
| **2007-2010 (pre)** | 0.6373 | 0.6485 | 0.6209 | 0.0276 | 0.5391 | **0.1094*****|
| (SE) | (0.0098) | (0.0108) | (0.0184) | (0.0194) | (0.0203) | (0.0214) |
| **2011-2012 (post)** | 0.6746 | 0.6718 | 0.6892 | -0.0174 | 0.6859 | -0.0141 |
| (SE) | (0.0187) | (0.0207) | (0.0247) | (0.0279) | (0.0274) | (0.0287) |

Source: Medical Expenditure Panel Survey (2007-2010 & 2011-2012)
Stata's margins command used to produce the Average Adjusted Predictions (AAP) and lincom command to test for differences.
Models were adjusted for predisposing, enabling, and need variables
Statistical significance for differences in predictions shown by: *-p<0.05, **-p<0.01, ***-p<0.001

**Figure 5. Adjusted predicted probability of current overall CRC screening by year and race/ethnicity**




Source: Medical Expenditure Panel Survey (2007-2010 & 2011-2012)
Stata's margins command used to produce the Average Adjusted Predictions (AAP) and lincom command to test for differences.
Models were adjusted for predisposing, enabling, and need variables

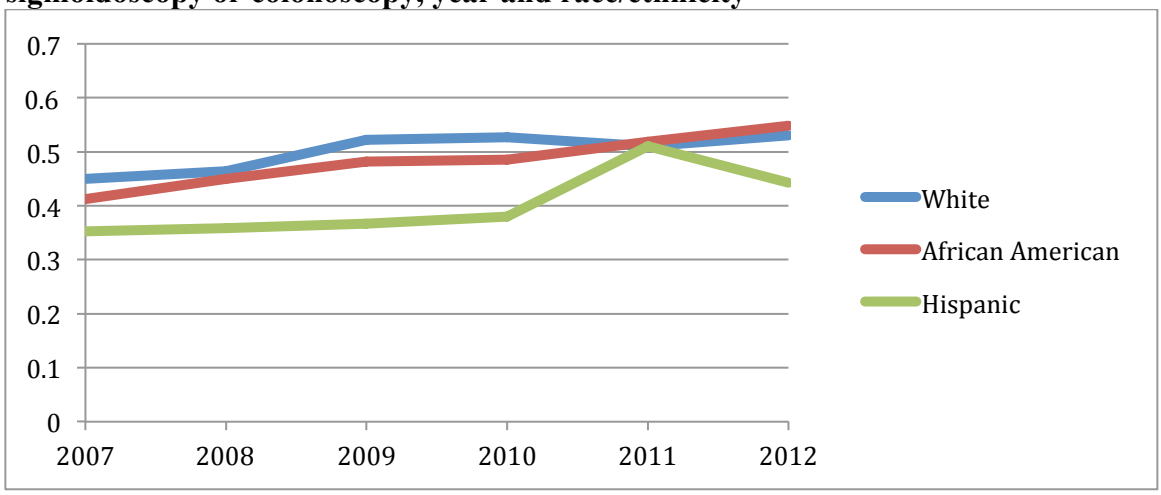
Table 18 is set up in the same way as table 17 but looks only at the probability of being current for CRC screening by way of sigmoidoscopy or colonoscopy. Findings, likewise, are similar to those for table 17; there were no significant differences between Whites and African Americans in either the pre or post periods. This finding is further reiterated in figure 6 with predicted probabilities staying very close together throughout the range of dates included in the analysis. Hispanics, on the other hand, were significantly less likely to be current for CRC screening by way of sigmoidoscopy or colonoscopy in the pre period than Whites. In the post period, Hispanics were not significantly different from Whites in being current for screening using these endoscopic methods. Of note in figure 6, however, is the recent volatility shown in the Hispanic group and the decrease from 2011 to 2012. Determining whether this is a trend was beyond the scope of this study. Figure 6 illustrates the narrowing of disparities in CRC screening sigmoidoscopy or colonoscopy in the Hispanic group as compared to African Americans and Whites.

**Table 18. Predicted probability of current CRC screening by endoscopy and race/ethnicity in Medicare enrollees age 65-75**

| | Average Adjusted Predictions | | | | | |
|---|---|---|---|---|---|---|
| | **All** | **White** | **African American** | | **Hispanic** | |
| **Sigmoidoscopy or Colonoscopy** | Prob. | Prob. | Prob. | Difference from white | Prob. | Difference from white |
| **2007-2010 (pre)** | 0.4639 | 0.4771 | 0.4432 | 0.0338 | 0.3509 | **0.1262*****|
| (SE) | (0.0103) | (0.0117) | (0.0187) | (0.0209) | (0.0204) | (0.0229) |
| **2011-2012 (post)** | 0.5503 | 0.5516 | 0.5627 | -0.0111 | 0.5219 | 0.0298 |
| (SE) | (0.0187) | (0.0206) | (0.0280) | (0.0300) | (0.0340) | (0.0362) |

Source: Medical Expenditure Panel Survey (2007-2010 & 2011-2012)
Stata's margins command used to produce the Average Adjusted Predictions (AAP) and lincom command to test for differences
Models were adjusted for predisposing, enabling, and need variables
Statistical significance for differences in predictions shown by: *-p<0.05, **-p<0.01, ***-p<0.001

**Figure 6. Adjusted predicted probability of current CRC screening by sigmoidoscopy or colonoscopy, year and race/ethnicity**




Source: Medical Expenditure Panel Survey (2007-2010 & 2011-2012)
Stata's margins command used to produce the Average Adjusted Predictions (AAP) and lincom command to test for differences.
Models were adjusted for predisposing, enabling, and need variables

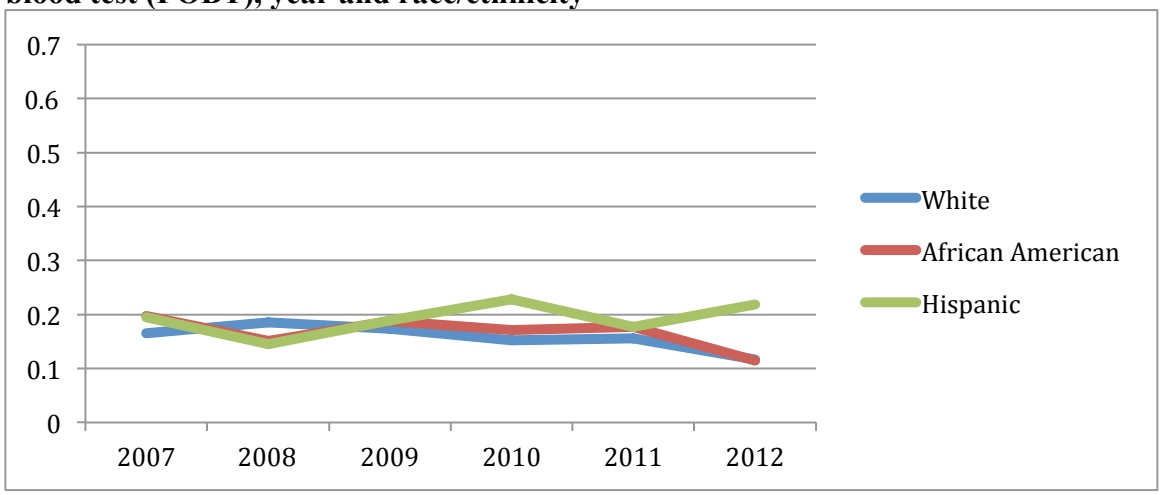
Table 19 and figure 7 round out the analysis of CRC screening differences by race/ethnicity by looking at the probability of being up-to-date for CRC screening using FOBT. No statistically significant differences were found between any of the racial/ethnic groups in either the pre or post periods (Table 19). As noted previously, Figure 7 shows the use of FOBT in decline in each of the racial/ethnic groups. However, despite declines, we noted no significant differences between Whites and either African Americans or Hispanics in the use of FOBT as an initial CRC screening method.

**Table 19. Predicted probability of current CRC screening by FOBT and race/ethnicity in Medicare enrollees age 65-75**

| | Average Adjusted Predictions | | | | | |
|---|---|---|---|---|---|---|
| | **All** | **White** | **African American** | | **Hispanic** | |
| **Fecal occult blood test (FOBT)** | Prob. | Prob. | Prob. | Difference from white | Prob. | Difference from white |
| **2007-2010 (pre)** | 0.1799 | 0.1774 | 0.1856 | -0.0082 | 0.1991 | -0.0216 |
| (SE) | (0.0100) | (0.0112) | (0.0176) | (0.0197) | (0.0200) | (0.0215) |
| **2011-2012 (post)** | 0.1321 | 0.1275 | 0.1389 | -0.0115 | 0.1725 | -0.0450 |
| (SE) | (0.0125) | (0.0131) | (0.0219) | (0.0221) | (0.0285) | (0.0273) |

Source: Medical Expenditure Panel Survey (2007-2010 & 2011-2012)
Stata's margins command used to produce the Average Adjusted Predictions (AAP) and lincom command to test for differences
Models were adjusted for predisposing, enabling, and need variables
Statistical significance for differences in predictions shown by: *-p<0.05, **-p<0.01, ***-p<0.001

**Figure 7. Adjusted predicted probability of current CRC screening by fecal occult blood test (FOBT), year and race/ethnicity**




Source: Medical Expenditure Panel Survey (2007-2010 & 2011-2012)
Stata's margins command used to produce the Average Adjusted Predictions (AAP) and lincom command to test for differences.
Models were adjusted for predisposing, enabling, and need variables

## Discussion

This study sought to identify trends in CRC screening – both overall and by FOBT and sigmoidoscopy/colonoscopy before and after the ACA changes in Medicare cost sharing policies. The partial elimination of cost-sharing resulting from the ACA and Medicare rule changes implemented on January 1, 2011 was intended to reduce CRC screening barriers, increase the proportion of 65 to 75 year olds current for screening, and ultimately reduce colorectal cancer related morbidity and mortality. We conclude that these rule changes have had no overall effect; however, they have incentivised the Medicare population to pursue colonoscopy as a first-line CRC screening tool.

The first hypothesis set out in this study was that the partial elimination of beneficiary cost-sharing would result in a greater probability of beneficiaries being current for overall CRC screening than before the ACA was enacted. The reasoning behind this hypothesis was that, despite the incentives toward colonoscopy and away from FOBT, the removal of beneficiary responsibility for the deductible would lead to

increased CRC screening. Past research had illustrated increases in CRC screening when cost barriers were reduced and the same effect was anticipated following changes brought on by the ACA (Doubeni et al., 2010). However, despite a positive change in overall CRC screening, no statistically significant effect occurred over the time period studied. A possible explanation for the non-significant increase in CRC screening could be due to the reluctance of individuals to undergo colonoscopy. Inadomi and colleagues (2012) showed that, when given a choice, people prefer the less invasive FOBT to colonoscopy. Further, these authors illustrated the lower rates of patient follow through in those where colonoscopy was recommended.

Our second hypothesis stated that the proportion of the Medicare population current for CRC screening using colonoscopy would increase. This hypothesis was supported and we think that multiple parts of the policy change contributed to it. First, the change in Medicare CRC screening reimbursement policy partially eliminated cost-sharing to the beneficiary. This change reduced the expense of screening colonoscopies when abnormal or suspicious tissue was found during the procedure. Second, the relative cost difference of first-line colonoscopy screening versus two-part screening utilizing FOBT and follow-up colonoscopy likely contributed to the increased use of endoscopic methods.

The third hypothesis represents the other side of the second hypothesis – fewer members of the Medicare population would opt for FOBT following the change to Medicare CRC screening reimbursement. The same factors that helped increase colonoscopy use likely decreased FOBT use. Therefore, the statistically significant reduction in FOBT was expected given the significant increase in screening colonoscopy.

The primary focus of this study was the effect that relative cost differences in colonoscopy reimbursement may have had on patterns of screening use. Though Medicare CRC screening reimbursement rules were relatively new when the latest data available was collected, our findings show a potential pattern where FOBT use is further discouraged and the use of colonoscopy for first-line CRC screening is incentivized. Few studies have looked at the effect of relative cost differences in CRC screening. Khatami and colleagues (2012) examined the effect that removal of cost-sharing for CRC screening had on utilization and found a resultant increase in colonoscopy screening. Outside the health care field, shifting behavior patterns also result from relative cost differences.

Finally, the fourth hypothesis posited a decrease in racial/ethnic disparities that have long been observed with CRC screening in the Medicare population between 65 and 75 years of age. Previous studies have found CRC screening disparities by race, socioeconomic status, and health care access (O'Malley et al., 2005; Centers for Disease Control and Prevention, 2008). Other studies have found that racial/ethnic disparities in CRC screening have changed over time with much of the differences explained by demographic, socioeconomic, and health care access variables (Doubeni et al., 2010; Fenton et al., 2009; Shih et al., 2006).

We found that historical disparities in current CRC screening based on racial/ethnic differences have largely been alleviated. However, this does not mean disparities do not exist as differences by household income and whether or not an individual has supplemental insurance are still significant. Further, there is certainly room for screening improvement as more than 30% of Medicare recipients included in this

study were found to not be current for CRC screening. The reduction in racial/ethnic disparities could be due, at least in part, to demographic and socioeconomic shifts in the African American and Hispanic populations. Results showed that a lower proportion of African Americans and Hispanics had less than a high school education in 2011-2012 as opposed to 2007-2010. Additionally, fewer African Americans had household incomes below the poverty line in the later compared to the earlier period.

With the introduction of the Affordable Care Act, the U.S. health system requires strategies to identify the most effective policy, system, and administrative strategies for improving health outcomes and reducing disparities. This study addressed the policy influences of the change in Medicare CRC screening reimbursement on screening and assessed the impact of this policy change on reducing the disparity between racial/ethnic groups. The literature has shown that preventive service coverage mandates are effective mechanisms to increase screenings (citation). However, the effect on colorectal cancer screening utilization is not clear. Further research is necessary to understand how variations in reimbursement policy affect CRC screening rates over time.

Study results should be interpreted in light of the limitations. MEPS data are self-reported and rely on respondent recall and honesty. This study looked at the impact of ACA mandates and Medicare rule changes on CRC screening and compared the probability before and after changes took effect. Because other time related factors may have been at play, e.g., greater awareness of CRC screening importance, findings should be viewed as an estimate of the differential effects of reduced cost-sharing and incentives resulting from relative price differences. Without an unaffected control group, it is difficult to attribute all of the observed change to the policy alone. Further, this analysis

assumed that Medicare covered all those included in the study. In addition, USPSTF screening guidelines do not directly align with MEPS questions; thus, utilization may be slightly underestimated or overestimated. Finally, we only had two years of data following the Medicare rule change which may have not been enough to detect a significant change in overall CRC screening rates.

**Conclusions**

This study found that the partial elimination of cost-sharing due to ACA mandates and Medicare rule changes has only partially impacted CRC screening in the Medicare population. The policies, implemented on January 1, 2011, were intended to reduce CRC screening barriers, result in a greater number and proportion of those at greatest risk for CRC to be current for screening, and lead to a reduction in colorectal cancer morbidity and mortality. While the effect on mobidity and mortality will require more time to assess, we conclude that CRC screening reimbursement rule changes have not had a statistically significant effect on whether the Medicare population is up-to-date in regards to overall CRC screening. However, the policy change incentivizing colonoscopy as an initial screening test appears to have decreased FOBT utilization among Medicare beneficiaries. Future research should assess whether this incentivized increase in colonoscopies have a positive impact on colorectal cancer morbidity and mortality. Finally, while overall screening has not changed significantly, the disparities between White, African American, and Hispanic populations have decreased to the point of becoming non-statistically significant. Researchers should monitor this decrease in racial/ethnic disparities over time and assess its sustainability and whether it translates to a decrease in racial/ethnic disparities in colorectal cancer morbidity and mortality.

# Chapter 5

## Conclusion

The purpose of this dissertation was to conduct three empirical analyses 1) to analyze the use of U.S. Preventive Services Task Force (USPSTF)-recommended preventive services among uninsured adults, with a focus on variation across race, ethnicity, and household income, 2) to examine the impact of the ACA on preventive services by investigating the effects of the dependent coverage expansion on the use of contraceptives and the rate of unintended pregnancy in the U.S., and 3) to illustrate the impact both ACA and Medicare cost sharing policies have had on colorectal cancer screening. This dissertation was organized into a three-paper format with results provided in chapters 2, 3, and 4.

Health care reform provides an avenue to improve the use of preventive services such as blood pressure checks, contraceptives, and colorectal cancer screening. This dissertation examined the use of preventive services in three different populations targeted by the Affordable Care Act (ACA); the uninsured, young adults between 19 and 25 years of age, and Medicare beneficiaries. The ACA brings a new emphasis on public health and the value of prevention. The ACA provides funding to further the development of a broad national prevention and health promotion strategy (Shearer, 2010). In a solid step toward prevention, the law requires coverage of preventive care services in government subsidized and private health plans without additional cost sharing (Shearer, 2010).

Despite the positive steps under the ACA to improve access to health coverage, a large segment of the population remains uninsured due to the reluctance of many states to

expand Medicaid. Additionally, foisting change laid out in the ACA on reluctant states is unlikely to reap the same benefits realized in cooperative states. Understanding the determinants of access to preventive services among a variety of population subgroups can inform implementation of the ACA in its attempt to reduce the number of the uninsured and improve health outcomes. Under the ACA, all insurers must provide first-dollar coverage for highly valued preventive services.

**Results**

***Chapter 2***

Uninsured adults received preventive services far below *Healthy People 2020* targets. Among the uninsured, African Americans had higher odds of receiving Pap tests, mammograms, routine physical checkups, and blood pressure checks according to guidelines than Whites. Moreover, compared to Whites, Hispanics had higher odds of receiving Pap tests, mammograms, influenza vaccinations, and routine physical checkups and lower odds of receiving blood pressure screening and advice to quit smoking. When results were stratified by household income, racial/ethnic differences persisted except for the highest income levels (≥400% Federal Poverty Level), where they were largely non-significant. Generally, uninsured African American and Hispanic populations fare better than uninsured Whites in preventive service utilization.

***Chapter 3***

The second study showed that trends in contraceptive use and the rate of unintended pregnancy are headed in the right direction. However, young adults have not improved at a greater rate than their slightly older counterparts in either the use of FDA approved contraceptives or in unintended pregnancy. Persons aged 19 to 25 years showed

greater gains in health insurance status, but this did not translate to a differential reduction in unintended pregnancy or contraceptive use compared to persons aged 26 to 30. Understanding the ACA's full impact on young adults' utilization of reproductive health services may require a greater time horizon or drilling down into subpopulations to identify if certain groups are benefiting more than others. Our results highlight the idea that insurance is a necessary, but not sufficient, condition to change the trajectory of contraceptive use and unintended pregnancy. Health policy stakeholders must continue to address barriers to access and quality of care in addition to health insurance coverage.

***Chapter 4***

Finally, the third study found that the partial elimination of cost-sharing due to ACA mandates and Medicare rule changes has only partially impacted CRC screening in the Medicare population. The policies, implemented on January 1, 2011, were supposed to reduce CRC screening barriers, result in a greater number and proportion of those at greatest risk for CRC to be current for screening, and lead to a reduction in colorectal cancer morbidity and mortality. While the latter will require more time to assess, we conclude that rule changes have had no overall effect and, potentially may have put the Medicare population at an increased risk to adverse health outcomes due to the greater incentive for colonoscopy. The increased CRC risk may result from both the higher risks associated with the colonoscopy procedure itself as well as the lower rate of completion due to the nature and preparation requirements of colonoscopy. While our results show that overall screening has not changed significantly, the disparities in CRC screening between White, African American, and Hispanic populations have decreased to the point

of non-statistical significance and future research should examine whether this decrease in disparities continues over time.

### *Policy Implications*

With the introduction of the *Affordable Care Act*, health systems require strategies to determine what policy, system, and administrative methods are most effective in improving the uptake of preventive services and reducing disparities. This dissertation addressed policy influences on screenings and provided information on the impact of policies on use of preventive services as well as on reducing the disparities among subpopulations. Improved access to health insurance and better coverage of preventive services are necessary mechanisms to increase service utilization in the United States, but these may not be sufficient to actually realize optimal utilization. However, with the ACA's health insurance mandate for all U.S. citizens to have health coverage, in addition to improved access and reduced cost barriers, policy makers should expect an increase in the demand for preventive services.

### *Limitations*

Limitations of the studies in this dissertation revolve mainly around the type of data employed and the lack of a true counterfactual population. Although telephone surveys allow researchers to collect data from large nationally representative samples, there are limitations to conducting a telephone survey. Findings should be interpreted with caution. Survey data are self-reported and rely on respondent recall and honesty. Further, sampling bias in telephone surveys may lead to underrepresentation of those with lower socioeconomic status, as these persons may be less likely to have a telephone. Next, although categorical variables representing time were included in each study to

account for unmeasured secular changes, it remains possible for time trends to influence results. Finally, USPSTF screening and FDA contraceptive guidelines do not directly align with the survey questions, thus utilization may be slightly underestimated or overestimated.

***Conclusions***

The articles making up this dissertation employ a variety of research designs to accomplish a few specific aims. The first study used multivariate analyses of pooled cross-sectional data to describe the factors associated with preventive service utilization among the uninsured, a widely varied population experiencing some of the worst health care access and outcome issues. The second study utilized a quasi-experimental design that incorporated a non-equivalent control group in a difference-in-differences analysis of contraception use and unintended pregnancy. Finally, the third study looked at the difference in probability that the Medicare population was up to date for colorectal cancer screening before and after ACA and Medicare reimbursement rules changes and whether there were changes in racial/ethnic disparities in screening.

With the introduction of the Affordable Care Act, the U.S. health system requires strategies to identify the most effective policy, system, and administrative strategies for improving health outcomes and reducing disparities. The analysis included in this dissertation generally supports the implementation of health care reform and policies that increase preventive screenings. The literature has shown that preventive service coverage mandates are effective mechanisms to increase screenings. Policies that reduce or eliminate the amount of cost sharing have historically been used to increase service utilization, and by extension, improve health outcomes. Implemented at the national

level, these policy changes can impact preventive services use as a strategy to improve the nation's health. Further research is necessary to understand how expanded availability of insurance coverage and variations in preventive service reimbursement policy affect utilization rates over time. However, it is important to note that policy change can have unexpected results and that, without continuous evaluation of outcomes, adverse behaviors and health outcomes can be manifested.

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