Colorectal cancer screening in the United States: Trends from 2008 to 2015 and variation by health insurance coverage[★]

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Abstract

Regular colorectal cancer (CRC) screening is recommended for reducing CRC incidence and mortality. This paper provides an updated analysis of CRC screening in the United States (US) and examines CRC screening by several features of health insurance coverage.

Recommendation-consistent CRC screening was calculated for adults aged 50–75 in 2008, 2010, 2013 and 2015 using data from the National Health Interview Survey. CRC screening prevalence in 2015 was described overall and by sociodemographic subgroups. CRC screening by health insurance coverage was further examined using multivariable logistic regression, stratified by age (50–64 years and 65–75 years) and adjusted for age, race/ethnicity, sex, education, income, time in US, and comorbid conditions.

Recommendation-consistent screening increased from 51.6% in 2008 to 58.3% in 2010 ($p < 0.001$). Use plateaued from 2010 to 2013 but increased to 61.3% in 2015 ($p < 0.001$). In 2015, adults aged 50–64 years with traditional employer-sponsored private insurance were more likely to be screened (62.2%) than those with traditional private direct purchase plans (50.9%) and the

uninsured (24.8%) ($p < 0.01$, respectively). After multivariable adjustment, differences between traditional employer-sponsored private insurance and the uninsured remained statistically significant. Adults aged 65–75 with Medicare and private insurance were more likely to be screened (76.3%) than those with Medicare, no supplemental insurance (68.8%) or Medicare and Medicaid (65.2%) ($p < 0.001$). After multivariable adjustment, the differences between Medicare and private insurance and Medicare no supplemental insurance remained statistically significant.

CRC screening rates have increased over time, but certain segments of the population, especially the uninsured, continue to screen below recommended levels.

Keywords

Colorectal cancer; Screening; Insurance coverage

1. Introduction

Colorectal cancer (CRC) is the third most commonly diagnosed cancer in men and women and the second leading cause of death from cancers affecting both men and women in the United States (Siegel et al., 2016; U.S. Cancer Statistics Working Group, 2017). Regular screening may prevent CRC and is recommended for detecting early stage disease and reducing CRC mortality (Lin et al., 2016). Since 2008 (and through 2015), the US Preventive Services Task Force (USPSTF) has recommended that adults aged 50–75, who are not considered high risk, screen for CRC using one of three approaches: annual high-sensitivity fecal occult blood testing (FOBT), sigmoidoscopy every 5 years combined with high-sensitivity FOBT every 3 years, or colonoscopy every 10 years (Screening for colorectal cancer, 2008). The USPSTF considers CRC screening a grade "A" recommendation, indicating that the net benefit is substantial.

Recommendation-consistent CRC screening use has increased substantially over the last two decades, rising from 38.6% in 2000 to 54.6% in 2008 (Sinicrope et al., 2012; Klabunde et al., 2011; Fedewa et al., 2015). However, rates remain below the National Colorectal Cancer Roundtable goal of 80% of eligible adults having recommendation-consistent CRC screening by 2018 (80% by 2018: working toward the shared goal of 80% screened for colorectal cancer by 2018, n.d.). Likewise, for most population subgroups, screening rates are below the Healthy People 2020 target of 70.5% (Healthy people 2020 cancer objectives, n.d.). The lowest screening rates are observed among the uninsured and underinsured, people without a usual source of care, and recent immigrants, (Sinicrope et al., 2012; Klabunde et al., 2011; Fedewa et al., 2015) which suggests that screening decisions may be influenced by access to health care and cost considerations (Wools et al., 2016; Honein-AbouHaidar et al., 2016; Gupta et al., 2014).

With recent changes to health insurance coverage in the United States, evaluating the trends in CRC screening use and factors associated with recommendation-consistent use can be informative. For example, non-grandfathered health insurance plans, with plan-years beginning on or after September 23, 2010, are required to provide coverage without patient cost-sharing for preventive services that have a rating of "A" or "B" in the recommendations

of the USPSTF (Patient Protection and Affordable Care Act, 42 U.S.C. § 18001, 2010). Likewise, effective January 1, 2011, the Medicare program eliminated cost-sharing for most preventive services with a USPSTF grade of "A" or "B" (Patient Protection and Affordable Care Act, 42 U.S.C. § 18001, 2010). Changes to health insurance laws have also expanded access to health insurance options for people who were previously uninsured (Blumenthal and Collins, 2014). However, cost-sharing for adults with Medicaid coverage continues to vary by state. It is worth noting that coverage requirements apply only to preventive CRC screening. CRC tests performed for surveillance or diagnostic purposes or when a polyp is detected and removed during screening colonoscopy may have cost-sharing requirements imposed (Coverage of Colonoscopies Under the Affordable Care Act's prevention benefit, 2012). Nevertheless, despite expanded access to health insurance and the absence of cost-sharing for most health plans, many eligible adults are not screening according to USPSTF recommendations (White et al., 2017).

This paper had two main objectives. The first was to characterize national trends in recommendation-consistent CRC screening from 2008 to 2015, reflecting a time-period that encompasses changes to health care legislation in the United States. The second was to explore potential differences in the prevalence of CRC screening according to type of health insurance coverage, using data from 2015, the most recent year of cancer screening data available from the National Health Interview Survey (NHIS).

2. Materials and methods

2.1. Data source

Data were obtained from the 2008, 2010, 2013, and 2015 NHIS and NHIS Cancer Control Supplement. The NHIS is administered by the National Center for Health Statistics, and data are collected on a broad range of health topics through in-person household interviews. The Cancer Control Supplement is administered periodically to a single adult in each household that participated in NHIS (i.e., the sample adult) and captures information about practices, knowledge, and attitudes regarding cancer-related health behaviors, including cancer screening. The sampling plan for NHIS is a multi-stage area probability design and the survey is administered to a representative sample of the civilian, non-institutionalized population in the United States (Parsons et al., 2014). Response rates for the sample adult component ranged from a high of 62.6% in 2008 to a low of 55.2% in 2015 (National Center for Health Statistics, 2016; National Center for Health Statistics, 2009). More information about the survey can be found at https://www.cdc.gov/nchs/nhis/index.htm.

For this study, CRC screening patterns were examined for adults aged 50–75, the population for whom CRC screening is recommended by the USPSTF (Screening for colorectal cancer, 2008). Adults with missing or incomplete CRC screening data were excluded (an average of 775 people each year, representing approximately 7% of the sample) as were those with a history of CRC (an average of 95 people each year, representing < 1% of the sample).

2.2. Measures

Screening within USPSTF recommendations was defined as having one of the following: home FOBT, or fecal immunochemical test (FIT) within the past year (hereafter referred to as FOBT); sigmoidoscopy within the past 5 years and FOBT within the past 3 years; or colonoscopy within the past 10 years. Information about the main reason for having each test was also captured (i.e., test was part of a routine exam, because of a problem, follow-up test of an earlier test or screening exam, or other reason). For the purposes of this analysis, individuals were considered "screened" if they had the recommended tests for any reason. Although this approach did not exclusively capture those who were "screened" because testing could also have been performed in response to symptoms, it did identify those who had not been tested according to USPSTF recommendations and were thus due for screening. As previously noted, adults with missing or incomplete CRC screening data were excluded.

CRC screening use in 2015 was examined by age group (50–64 years and 65–75 years) to reflect differences in age eligibility for Medicare coverage. Other individual-level factors were sex, race/ethnicity (non-Hispanic white only, non-Hispanic black only, Hispanic, Non-Hispanic Asian only, non-Hispanic other including multi-race), education (less than high school graduate, high school graduate, some college/associates degree, bachelor's degree– including those with higher degrees), marital status (married, not married–including widowed, divorced, separated, never married, living with partner), family income as a percentage of the federal poverty line (FPL) (138%, > 138– 200%, > 200– 400%, > 400%), time lived in the United States (born in the US, not born in the US but lived in US for 10 + years, not born in the US but lived in US for < 10 years in the US) and number of chronic conditions (0, 1, 2+). Chronic conditions were defined as any diagnosis of cancer, hypertension, coronary heart disease, stroke, emphysema, chronic obstructive pulmonary disease, diabetes, arthritis, rheumatoid arthritis, gout, lupus, fibromyalgia, and hepatitis; a diagnosis of chronic bronchitis or weak or failing kidneys in the past 12 months; or a current diagnosis of asthma. Screening behavior was also examined separately by level of family out-of-pocket spending on medical care ($0, $1-$1999, and $2000), and access to care (usual place of care other than the emergency room and number of physician visits in the past year (0, 1, 2+)).

The percentage of the population in 2015 who had recommendation-consistent screening was also examined by type of health insurance coverage. Health insurance was categorized separately for adults aged 50–64 years and 65–75 years. For adults aged 50–64 years, health insurance coverage was categorized as traditional employer-sponsored private or high-deductible employer-sponsored private obtained through employer, workplace or union; traditional direct-purchase private or high-deductible direct purchase private obtained through the Health Insurance Marketplace, school or other means; Medicare disability; military coverage such as TRICARE, VA, and Champ-VA (restricted to civilians and includes those covered by both military coverage and Medicare disability); Medicaid or other public coverage (includes other state-sponsored or government-sponsored plans not already mentioned); and uninsured. Among adults aged 65–75 years, insurance was categorized as Medicare plus private insurance (includes those who only reported private

coverage), Medicare, no supplemental insurance (includes Medicare Advantage plans), and Medicare plus Medicaid or any public (includes state-sponsored health plans).

2.3. Statistical analysis

The percentage of the population up-to-date with CRC screening as well as the percentage of the population screened with FOBT, sigmoidoscopy plus FOBT, or colonoscopy were calculated for 2008, 2010, 2013 and 2015. Estimates were age-adjusted to the 2000 United States standard population by 5-year age groups and *t*-tests were used to compare screening prevalence for three time periods: 2008 to 2010, 2010 to 2013, and 2013 to 2015.

Associations between key sociodemographic characteristics and health insurance and CRC screening were evaluated with 2015 data. Weighted prevalence estimates and 95% confidence intervals (CI) accounting for the NHIS sampling design were calculated for the total eligible sample and according to sociodemographic characteristics, comorbidity, out-of-pocket spending, and access to care. Chi square tests were conducted to evaluate whether subgroup differences in CRC screening were statistically significant. Statistical significance was defined as a *p*-value < 0.05. Multivariable logistic regression with predicted marginal probabilities was used to further examine whether CRC recommendation-consistent screening varied by type of health insurance plan. Analyses were conducted separately for adults aged 50–64 and adults aged 65–75. To explore the independent effect of health insurance coverage, multivariable models adjusted for age, race/ethnicity, sex, education, income, time in the United States and comorbidity, variables which are associated with both health insurance coverage and CRC screening (Wools et al., 2016). All prevalence estimates and the multivariable models were weighted to account for the sampling design of NHIS and for survey nonresponse using SUDAAN® release 11.0.1 (Explore Sudaan 11: Statistical Software for Weighting, Imputing, and Analyzing Data: RTI International; 2016 [cited 2016 8/8/2016], n.d.).

3. Results

3.1. Trends in CRC screening

Fig. 1 shows trends in CRC screening rates. In 2008, 51.6% of adults were up-to-date with CRC screening. From 2008 to 2010, screening rates increased by 6.7 percentage points to 58.3% (*p* < 0.05). Although CRC rates were essentially unchanged from 2010 to 2013 (58.3% to 57.3%), they increased an additional four percentage points to 61.3% between 2013 and 2015 (*p* < 0.05). Recommendation-consistent CRC screening is largely driven by colonoscopy, which was used more frequently than other screening modalities. In fact, screening with FOBT declined slightly from 2008 to 2015 (10% to 7.1%, *p* < 0.05) whereas screening using sigmoidoscopy with FOBT was unchanged. The prevalence of CRC screening in 2015 was 61.3% for overall recommendation-consistent screening, 58.3% for colonoscopy, 7.1% for FOBT, and 0.7% for sigmoidoscopy with FOBT (Table 1). Of the adults who received recommendation-consistent screening, 92.8% (95% CI: 91.9% - 93.5%) had a single test and 7.2% (95% CI: 6.5%–8.1%) had more than one test. For overall recommendation-consistent test use, 13.8% (95% CI: 12.8%–15.0%) reported testing due to

a health problem and 4.6% (95% CI: 4.0%–5.4%) reported testing as a follow-up to an earlier test.

3.2. Colorectal cancer screening in 2015 by sociodemographic characteristics

Table 1 describes the age-adjusted percentage of adults in 2015 who received recommendation-consistent CRC screening, overall and by screening modality. CRC screening use varied, with the highest use observed among adults aged 50–64 with military coverage (73.4%), adults aged 65–75 years overall (71.7%) and among those with Medicare and supplemental private insurance (76.3%). Adults with a Bachelor's degree or higher (69.5%) and those who had incomes at > 400% of the FPL (69.2%) also had relatively high rates of CRC screening. The lowest rates of CRC screening were observed among adults aged 50–64 years who were uninsured (24.8%), who lacked a usual place of care (27.6%) or who reported no physician visits in the previous year (28.6%). In general, the pattern of results by modality was similar to the results for overall screening (Table 1).

3.3. Colorectal cancer screening by type of health insurance coverage

Among adults aged 50–64 years, the percentage screened differed by type of health insurance coverage (Table 1). Compared to those with traditional employer-sponsored private health insurance, adults with traditional private direct purchase insurance, Medicaid or other public insurance, or no insurance were significantly less likely to have recommendation-consistent screening. In contrast, those with military coverage were more likely to have recommendation-consistent screening than adults with traditional employer-sponsored private health insurance (Fig. 2a).

In multivariable adjusted analyses, adults aged 50–64 years who were uninsured were less likely to receive recommendation-consistent screening than those with traditional employer-sponsored private health insurance. However, those with military coverage were more likely to have recommendation-consistent screening than adults with traditional employer-sponsored private health insurance. There were no statistically significant differences in the likelihood of screening between those with traditional employer-sponsored private health insurance and those with high-deductible employer sponsored private insurance, traditional private direct purchase, high-deductible direct purchase, Medicare disability, or Medicaid or other public insurance, respectively (Fig. 2a). As illustrated by Fig. 2a, multivariable adjustment increased the predicted probability that those with traditional private direct purchase insurance, Medicaid or other public insurance, or no insurance would have recommendation-consistent screening—thereby, attenuating differences in CRC screening as compared to those with traditional employer sponsored private insurance.

Among adults aged 65–75, in age-adjusted analyses, those with Medicare with no supplemental insurance or Medicare and Medicaid coverage were less likely to receive recommendation-consistent screening than those with Medicare and private insurance (Table 1, Fig. 2b). These associations were attenuated in the multivariable-adjusted analyses, but those with Medicare without supplemental insurance were still significantly less likely to receive recommendation-consistent screening (Fig. 2b). Among those with Medicare and Medicaid, the percentage who received recommendation-consistent screening was similar to

those with Medicare with no supplemental insurance. However, unlike Medicare with no supplemental insurance, the differences in CRC screening were not statistically significant compared to those with Medicare and private insurance.

4. Discussion

Since 2008, the proportion of the adult population aged 50–75 years in the United States who received recommendation-consistent CRC screening increased by almost 10 percentage points, to 61.3% in 2015. Concerns about a plateau in screening rates from 2010 to 2013, previously expressed in another report, were not borne out in our study, (Sabatino et al., 2015) as overall screening rates increased by four percentage points from 2013 to 2015 (White et al., 2017). Between 2008 and 2015, the percentage of adults screened according to USPSTF recommendations was driven by colonoscopy, which was used more frequently than the other screening modalities. Screening with FOBT declined during this time. The overall population screening rate of 61.3% in 2015 is below the Healthy People 2020 target for CRC screening of 70.5%. Consistent with prior research, the lowest CRC screening rates were observed for those with lower levels of education or income, those without a usual place of care or physician visits in the previous year, recent immigrants, and adults aged 50–64 who lacked health insurance (Klabunde et al., 2011; Wools et al., 2016; Honein-AbouHaidar et al., 2016; Gupta et al., 2014; Miranda et al., 2017).

Both having insurance and type of insurance were positively associated with CRC screening. In age-adjusted analyses, adults aged 50–64 with traditional employer-sponsored private health insurance had higher screening rates than those with traditional private direct purchase insurance, those with Medicaid or other public insurance, and those with no insurance. Additionally, screening rates were higher among those with military coverage as compared to adults with traditional employer-sponsored private health insurance. However, these differences were attenuated after multivariable adjustment for demographic characteristics, comorbidity and time in the US. In multivariable analyses, the likelihood of recommendation-consistent screening did not differ between those with traditional employer-sponsored private insurance and those with traditional private direct purchase insurance, Medicare disability, and Medicaid or other public insurance.

Enrollment in high-deductible health plans (HDHP) has increased over time, accounting for 39.4% of insurance-covered workers in 2016 (Cohen et al., 2017). HDHPs have lower premiums and higher deductibles than traditional health plans, and some evidence suggests that adults covered by HDHPs have fewer outpatient visits, possibly due to the greater out-of-pocket costs burden associated with these visits (Cohen et al., 2017; Reddy et al., 2014). In the current study, adults with high-deductible employer-sponsored private coverage were not less likely to be screened for CRC than those with traditional employer-sponsored private insurance coverage. Changes to healthcare policy in recent years require non-grandfathered insurance plans to cover USPSTF recommended CRC screening tests without cost-sharing. Thus, people enrolled in HDHPs would not experience more out-of-pocket costs associated with CRC screening than people enrolled in traditional (lower deductible) plans, unless a polyp was found during screening colonoscopy or screening tests were performed for surveillance or diagnostic purposes (Coverage of Colonoscopies Under the

Affordable Care Act's prevention benefit, 2012). Other research has shown that switching to a HDHP was not associated with lower CRC screening after changes in U.S. healthcare policy required the coverage of preventive services in contrast to switching to a HDHP before these requirements (Wharam et al., 2016).

Consistent with other studies, we found that adults aged 65 and older with Medicare and public insurance or Medicare, no supplemental insurance have lower screening rates than individual with Medicare and private insurance (Klabunde et al., 2011; Sabatino et al., 2016). However, in multivariable adjusted analyses, only differences between Medicare and private insurance and Medicare, no supplemental insurance were statistically significant. Although, some individuals aged 65–75 may not have been eligible for Medicare at the time of screening, particularly for adults screening with colonoscopy, these findings still suggest that up-to-date screening status varies by insurance coverage. Consistent with findings for adults aged 50–64, multivariable adjustment for demographic characteristics, comorbidity and time in the US increased the likelihood that those with Medicare and Medicaid or any public insurance would have recommendation-consistent screening, and attenuated the difference in CRC screening compared to those with Medicare and private insurance. Adults aged 65–75 and those with Medicare and private insurance are among the few US population subgroups that are screening at a rate above the Healthy People target, and only those with Medicare and private insurance are close to the National Colorectal Cancer Roundtable's goals of 80% of eligible adults having recommendation-consistent CRC screening by 2018. Screening rates are also high among adults ages 50–64 with military coverage. However, for most sociodemographic and insurance subgroups, national CRC screening rates are still lower than is recommended.

The decision to engage in cancer screening is a function of a complex interplay of factors operating at the level of the individual (e.g., knowledge, attitudes, motivation), their social network (e.g., social support), the healthcare system (e.g., provider recommendation, usual source of care), and society (e.g., cultural norms) (Wools et al., 2016; Honein-AbouHaidar et al., 2016). Thus, multiple strategies may be needed to improve CRC screening. In 2016, the USPSTF expanded its list of recommended screening modalities to include CT colonography and fecal DNA testing (Force, U.S.P.S.T., 2016), with the goal of maximizing the number of people who can find an acceptable screening test. An expanded menu of screening options may lead to increased CRC screening, and previous research has shown greater screening uptake when patients are offered a choice of test options that is consistent with their preferences (Inadomi et al., 2012; Smith et al., 2017). Additional strategies to boost CRC screening rates have also been described by others and emphasize the importance of identifying unscreened individuals in a systematic way; implementing evidence-based strategies for CRC screening; addressing barriers to screening such as cost, access to a primary care provider, and access to CRC treatment; and providing clear recommendations and guidance for screening (Gupta et al., 2014; Peterson et al., 2016; Yabroff et al., 2011; Goebel et al., 2015). In particular, others have called for targeted efforts to improve screening rates among underserved populations who may lack a usual source of care and experience unique financial barriers to screening, particularly in the case of the uninsured and individuals who live in states where colorectal cancer screening is not covered by Medicaid (Gupta et al., 2014; Goebel et al., 2015). It has been suggested that wide-spread

implementation of evidence-based interventions to promote screening with FOBT/FIT testing may be particularly important for improving CRC screening rates among underserved populations because stool testing is inexpensive and less invasive than colonoscopy, which requires time away from work and another adult to provide transportation home (Gupta et al., 2014).

5. Limitations

This study had several limitations. CRC screening was self-reported and not verified by medical records or claims data. Individuals were considered to have screened according to recommendations if they had the recommended tests for any reason. Thus, "screening" prevalence includes people who may have had the test for diagnostic purposes. Health insurance coverage was measured at the time of the interview, which may not have been the type of insurance payer at the time the person received screening. This may be particularly true for colonoscopy given the 10-year screening interval. Additionally, for some population subgroups, sample sizes were small, leading to a loss of ability to detect differences. Although our study provides information about recent CRC screening rates in the United States, further research may elucidate nuanced factors contributing to lower screening rates among certain groups. Despite these limitations, this study provides nationally representative estimates about CRC screening in the United States. These estimates can be used to track variation in screening across the population, identify groups that could benefit from more intensive targeted intervention, and evaluate progress in meeting national Healthy People objectives and the National Colorectal Cancer Roundtable 80% by 2018 initiative.

6. Conclusions

We conducted a more detailed analysis of CRC screening use by health insurance type in 2015 than has been previously undertaken. We distinguished between employer-sponsored private insurance and direct-purchase private plans, and we further examined traditional and high-deductible options within these plans. Our findings document that CRC screening rates in the U.S. continue to increase. Although segments of the population are screening at recommended levels, screening rates among groups that experience persistent barriers to healthcare access, including the uninsured, remain lower than recommended. However, our results demonstrate relatively higher rates of screening for all insurance types compared to those with no insurance. Data from the NHIS can be used to continue to monitor the effects of health insurance coverage and changes in health insurance reform on CRC screening use.

References

80% by 2018: working toward the shared goal of 80% screened for colorectal cancer by 2018. [cited 2017 August, 30, 2017]; Available at: http://nccrt.org/tools/80-percent-by-2018/.

Blumenthal D, Collins SR, 2014 Health care coverage under the affordable care act-a progress report. N. Engl. J. Med 371 (3), 275–281. [PubMed: 24988300]

Cohen RA, Zammitti EP, Martinez ME, 5 2017 Health insurance coverage: Early release of estimates from the National Health Interview Survey, 2016 National Center for Health Statistics.

Coverage of Colonoscopies Under the Affordable Care Act's prevention benefit. Kaiser Family Foundation, American Cancer Society, and National Colorectal Cancer Roundtable.

Explore Sudaan 11: Statistical Software for Weighting, Imputing, and Analyzing Data: RTI International; 2016 [cited 2016 8/8/2016]. Available at: https://www.rti.org/impact/sudaan-statistical-software-analyzing-correlated-data.

Fedewa SA, et al., 2015 Elimination of cost-sharing and receipt of screening for colorectal and breast cancer. Cancer 121 (18), 3272–3280. [PubMed: 26042576]

Force, U.S.P.S.T, et al., 2016 Screening for colorectal Cancer: US preventive services task force recommendation statement. JAMA 315 (23), 2564–2575. [PubMed: 27304597]

Goebel M, et al., 2015 How can we boost colorectal and hepatocellular cancer screening among underserved populations? Curr. Gastroenterol. Rep 17 (6), 22.

Gupta S, et al., 2014 Challenges and possible solutions to colorectal cancer screening for the underserved. J. Natl. Cancer Inst 106 (4), dju032. [PubMed: 24681602]

Healthy people 2020 cancer objectives. [cited 2017 August 30, 2017]; Available at: https://www.healthypeople.gov/2020/topics-objectives/topic/cancer/objectives.

Honein-AbouHaidar GN, et al., 2016 Systematic review and meta-study synthesis of qualitative studies evaluating facilitators and barriers to participation in colorectal cancer screening. Cancer Epidemiol. Biomark. Prev 25 (6), 907–917.

Inadomi JM, et al., 2012 Adherence to colorectal cancer screening: a randomized clinical trial of competing strategies. Arch. Intern. Med 172 (7), 575–582. [PubMed: 22493463]

Klabunde CN, et al., 2011 Trends in colorectal cancer test use among vulnerable populations in the United States. Cancer Epidemiol. Biomark. Prev 20 (8), 1611–1621.

Lin JS, et al., 2016 Screening for colorectal cancer: updated evidence report and systematic review for the US preventive services task force. JAMA 315 (23), 2576–2594. [PubMed: 27305422]

Miranda PY, et al., 2017 Citizenship, length of stay, and screening for breast, cervical, and colorectal cancer in women, 2000–2010. Cancer Causes Control 28 (6), 589–598. [PubMed: 28364196]

National Center for Health Statistics, 2009 Survey Description, National Health Interview Survey, 2008. Hyattsville, Maryland.

National Center for Health Statistics,, 2016 Survey Description, National Health Interview Survey, 2015. Hyattsville, Maryland.

Parsons VL, et al., 2014 Design and estimation for the national health interview survey, 2006–2015. Vital Health Stat 2 (165), 1–53.

Patient Protection and Affordable Care Act, 42 U.S.C. § 18001.

Peterson EB, et al., 2016 Impact of provider-patient communication on cancer screening adherence: a systematic review. Prev. Med 93, 96–105. [PubMed: 27687535]

Reddy SR, et al., 2014 Impact of a high-deductible health plan on outpatient visits and associated diagnostic tests. Med. Care 52 (1), 86–92. [PubMed: 24322990]

Sabatino SA, et al., 2015 Cancer screening test use - United States, 2013. MMWR Morb. Mortal. Wkly Rep 64 (17), 464–468. [PubMed: 25950253]

Sabatino SA, et al., 2016 Mammography use among medicare beneficiaries after elimination of cost sharing. Med. Care 54 (4), 394–399. [PubMed: 26759983]

Screening for colorectal cancer, 2008 U.S. preventive services task force recommendation statement. Ann. Intern. Med 149 (9), 627–637. [PubMed: 18838716]

Siegel RL, Miller KD, Jemal A, 2016 Cancer statistics, 2016. CA Cancer J. Clin 66 (1), 7–30. [PubMed: 26742998]

Sinicrope PS, et al., 2012 A population-based study of prevalence and adherence trends in average risk colorectal cancer screening, 1997 to 2008. Cancer Epidemiol. Biomark. Prev 21 (2), 347–350.

Smith MA, et al., 2017 Insurance coverage for CT colonography screening: impact on overall colorectal Cancer screening rates. Radiology 170924.

U.S. Cancer Statistics Working Group, 2017 United States Cancer Statistics: 1999–2014 Incidence and Mortality Web-based Report. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention and National Cancer Institute, Atlanta.

Wharam JF, et al., 2016 Colorectal Cancer screening in a Nationwide high-deductible health plan before and after the affordable care act. Med. Care 54 (5), 466–473. [PubMed: 27078821]

White A, et al., 2017 Cancer screening test use - United States, 2015. MMWR Morb. Mortal. Wkly Rep 66 (8), 201–206. [PubMed: 28253225]

Wools A, Dapper EA, de Leeuw JR, 2016 Colorectal cancer screening participation: a systematic review. Eur. J. Pub. Health 26 (1), 158–168. [PubMed: 26370437]

Yabroff KR, et al., 2011 Systems strategies to support cancer screening in U.S. primary care practice. Cancer Epidemiol. Biomark. Prev 20 (12), 2471–2479.
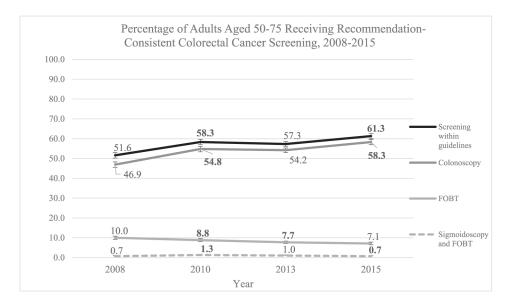
Fig. 1.

Percentage of Adults Aged 50–75 Receiving Recommendation-Consistent Colorectal Cancer Screening, 2008–2015

Estimates were age-adjusted using the 2000 U.S. standard population by 5-year age groups. Recommendation-consistent screening was defined as home FOBT within the past year, sigmoidoscopy within the past 5 years and fecal occult blood testing (FOBT) within the past 3 years, or colonoscopy within the past 10 years. Percentages were weighted to account for the complex design of NHIS. Error bars are 95% confidence intervals. Numbers in bold text are significantly different ($p < 0.05$) from the previous assessment year. Overall differences between 2008 and 2015 were statistically significant ($p < 0.05$) for screening within recommendations, colonoscopy, and FOBT.

a: Guideline recommended colorectal cancer screening in 2015 by type of health insurance among adults ages 50-64 years

b: Recommendation-consistent colorectal cancer screening in 2015 by type of health insurance among adults aged 65-75 years
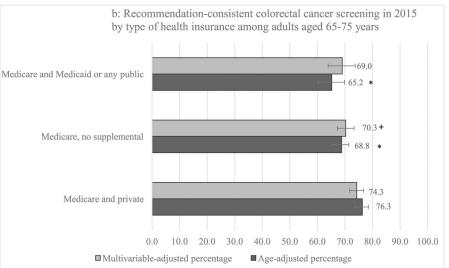
Fig. 2.
a: Recommendation-consistent colorectal cancer screening in 2015 by type of health insurance among adults ages 50–64 years.

Estimates were age adjusted to the 2000 United States standard population by 5-year age groups. Screening within recommendations was defined as home FOBT within the past year, sigmoidoscopy within the past 5 years and FOBT within the past 3 years, or colonoscopy within the past 10 years. Employer-sponsored insurance also includes insurance obtained through a union. Directly purchased private health insurance includes private plans obtained through the Health Insurance Marketplace, school, or other means. Other public plans include insurance classified as public only, other government only and SCHIP. Military coverage includes coverage through TRICARE, VA, and Champ-VA. Military coverage is restricted to civilians only and includes those with military coverage and Medicare disability.

Predicted probabilities (adjusted percentages) were derived from multivariable logistic regression analyses adjusting for age, sex, race/ethnicity, education, income as a proportion of the federal poverty line, comorbidity, and years in the US. Error bars represent 95% confidence intervals. All estimates were weighted to account for the complex survey design of NHIS.

* Statistically significant difference ($p < 0.05$) in age-adjusted analysis compared to traditional employer-sponsored private insurance.

+ Statistically significant difference ($p < 0.05$) in multivariable-adjusted analyses compared to traditional employer-sponsored private insurance.

b: Recommendation-consistent colorectal cancer screening in 2015 by type of health insurance among adults aged 65–75 years

Estimates were age adjusted to the 2000 United States standard population by 5-year age groups. Screening within recommendations was defined as home FOBT within the past year, sigmoidoscopy within the past 5 years and FOBT within the past 3 years, or colonoscopy within the past 10 years. Medicare and private includes adults with only private insurance. Medicaid or any public includes other state-sponsored health plans. Predicted probabilities (adjusted percentages) were derived from multivariate logistic regression analyses adjusting for age, sex, race/ethnicity, education, income as a proportion of the federal poverty line, comorbidity, and years in the US. Error bars represent 95% confidence intervals. All estimates were weighted to account for the complex survey design of NHIS.

*Statistically significant difference ($p < 0.05$) in age-adjusted analysis compared to Medicare and private.

+ Statistically significant difference ($p < 0.05$) in multivariable-adjusted analyses compared to Medicare and private.

Table 1

Recommendation-consistent colorectal cancer screening among adults 50–75, 2015 National Health Interview Survey.

Demographics	Total un-weighted sample size	Recommendation-consistent screening (1) Weighted % (95% CI)	Colonoscopy within the past 10 years (2) Weighted % (95% CI)	FOBT within the past year (3) Weighted % (95% CI)	Sigmoidoscopy within the past 5 years & FOBT within the past 3 years (4) Weighted % (95% CI)	p-Value for demographic subgroup differences <.05 [h]	p-Value for demographic subgroup differences <.001 [h]
Overall	12,541	61.3 (60.0–62.6)	58.3 (57.0–59.6)	7.1 (6.5–7.8)	0.7 (0.5–0.9)		
Age							
50–64	7889	56.4 (54.7–58.0)	53.4 (51.8–55.1)	5.9 (5.2–6.7)	0.6 (0.4–0.9)	1,2,3	1,2,3
65–75	4652	71.7 (69.9–73.5)	68.5 (66.7–70.3)	9.6 (8.4–11.0)	0.9 (0.6–1.3)		
Sex							
Male	5703	60.7 (58.9–62.5)	57.6 (55.8–59.3)	7.5 (6.6–8.6)	1.0 (0.7–1.5)	4	
Female	6838	62.0 (60.3–63.6)	59.1 (57.4–60.7)	6.8 (6.0–7.6)	0.3[5] (0.2–0.5)		
Race/ethnicity							
Non-Hispanic white	8557	64.2 (62.6–65.7)	61.5 (59.9–63.0)	6.8 (6.1–7.6)	0.7 (0.5–1.0)	1,2,4	1,2,4
Non-Hispanic black	1683	60.0 (56.9–63.1)	56.7 (53.5–59.8)	7.9 (6.3–9.8)	0.6[g] (0.3–1.3)		
Hispanic	1477	48.3 (45.1–51.5)	44.9 (41.7–48.2)	7.4 (5.8–9.3)	0.9[g] (0.5–1.7)		
Non-Hispanic Asian	552	52.5 (47.0–57.9)	46.3 (40.9–51.8)	9.6 (6.8–13.4)	0.2[g] (0.1–0.7)		
Non-Hispanic other	272	55.6 (46.9–63.9)	52.5 (43.7–61.0)	6.4 (3.7–10.7)	0.0 (0.0–0.1)		
Education							
Less than high school graduate	1674	45.0 (41.9–48.1)	42.3 (39.2–45.4)	6.4 (5.0–8.2)	0.6[g] (0.3–1.2)	1,2	1,2
High school graduate	3243	56.8 (54.4–59.2)	53.8 (51.5–56.1)	7.0 (5.9–8.4)	0.4 (0.2–0.8)		
Some college/associates degree	3860	62.8 (60.6–64.9)	59.6 (57.5–61.7)	7.1 (6.0–8.4)	0.5[g] (0.3–0.9)		
Bachelor's degree or higher	3720	69.5 (67.4–71.5)	66.4 (64.3–68.5)	7.6 (6.6–8.7)	1.0 (0.6–1.6)		
Marital status							
Married	6246	65.0 (63.3–66.6)	61.8 (60.1–63.4)	7.7 (6.8–8.6)	0.8 (0.5–1.1)	1,2,3	1,2
Not married	6267	54.9 (53.1–56.7)	52.2 (50.4–54.0)	6.2 (5.5–7.1)	0.5 (0.3–0.7)		
Family income (% federal poverty level)							
138%	2664	46.1 (43.5–48.7)	60.6 (59.1–62.0)	6.1 (4.9–7.6)	0.6[g] (0.3–1.3)	1,2,3,4	1,2

Demographics	Total un-weighted sample size	Recommendation-consistent screening (1) Weighted % (95% CI)	Colonoscopy within the past 10 years (2) Weighted % (95% CI)	FOBT within the past year (3) Weighted % (95% CI)	Sigmoidoscopy within the past 5 years & FOBT within the past 3 years (4) Weighted % (95% CI)	p-Value for demographic subgroup differences <.05[h]	p-Value for demographic subgroup differences <.001[h]
> 138– 200%	1358	51.7 (47.7–55.6)	47.8 (43.9–51.8)	8.2 (6.4–10.5)	0.3[g] (0.1–0.7)		
> 200– 400%	3503	59.5 (57.1–62.0)	57.0 (54.4–59.4)	5.9 (4.8–7.1)	0.4 (0.2–0.7)		
> 400%	5016	69.2 (67.5–71.0)	66.1 (64.3–67.8)	8.0 (7.0–9.1)	0.9 (0.6–1.4)		
Time in the United States (US)							
Born in the US	10,618	63.3 (61.9–64.8)	60.6 (59.1–62.0)	6.9 (6.3–7.7)	0.7 (0.5–0.9)	1,2,4	1,2,4
Not born in the US, but lived in US for 10+ years	1766	52.2 (49.3–55.2)	48.2 (45.2–51.1)	7.9 (6.6–9.5)	0.6[g] (0.3–1.2)		
Not born in the US, but lived in US for < 10 years	132	35.8 (26.4–46.4)	28.6 (20.0–39.1)	10.0[g] (5.0 – 19.1)	–		
Family out-of-pocket spending on medical care in the past 12 months							
$0	1548	42.4 (39.0–45.8)	40.0 (36.6–43.4)	3.7 (2.7–5.1)	0.2[g] (0.1–0.4)	1,2,3,4	1,2,3
$1–$1999	7938	61.8 (60.2–63.4)	58.5 (56.9–60.1)	7.5 (6.7–8.4)	0.7 (0.5–1.0)		
$2000	2884	67.1 (64.5–69.6)	64.6 (61.9–67.1)	7.4 (6.3–8.6)	0.9 (0.5–1.5)		
Usual place of care							
Yes	11,542	63.9 (62.5–65.3)	60.7 (59.4–62.0)	7.5 (6.9–8.2)	0.7 (0.5–0.9)	1,2,3	1,2,3
No	995	27.6 (23.4–32.1)	26.7 (22.5–31.2)	1.9 (0.9–3.8)	0.2[g] (0.1–0.8)		
# of physician visits in the past year							
0	1463	28.6 (25.3–32.1)	27.6 (24.4–31.1)	1.6[g] (0.8 – 2.9)	–	1,2,3	1,2,3
1	1845	55.5 (52.3–58.7)	51.6 (48.3–54.9)	6.1 (4.9–7.6)	0.4[g] (0.2–0.9)		
2+	9207	67.4 (65.9–68.9)	64.2 (62.7–65.6)	8.1 (7.4–9.0)	0.7 (0.5–1.1)		
Chronic conditions[a]							
0	3159	51.7 (49.4–54.1)	48.3 (46.0–50.5)	5.8 (4.6–7.2)	1.1 (0.6–1.9)	1,2,3	1,2,3
1	3588	62.0 (59.9–64.1)	59.2 (57.0–61.3)	6.3 (5.3–7.5)	0.4 (0.2–0.8)		
2+	5794	66.9 (65.0–68.8)	64.0 (62.1–65.9)	8.5 (7.5–9.6)	0.7 (0.4–1.0)		
Health insurance (age 50–64)							
Traditional employer sponsored private	2923	62.2 (59.7–64.5)	58.4 (55.9–60.8)	6.7 (5.6–8.0)	0.8[g] (0.4–1.6)	1,2	1,2

Demographics	Total un-weighted sample size	Recommendation-consistent screening (1) Weighted % (95% CI)	Colonoscopy within the past 10 years (2) Weighted % (95% CI)	FOBT within the past year (3) Weighted % (95% CI)	Sigmoidoscopy within the past 5 years & FOBT within the past 3 years (4) Weighted % (95% CI)	p-Value for demographic subgroup differences <.05 [h]	p-Value for demographic subgroup differences <.001 [h]
High deductible employer sponsored plan	1375	61.5 (57.9–65.0)	58.8 (55.2–62.3)	5.7 (4.1–7.9)	0.5[g] (0.2–1.3)		
Traditional directly purchased private [b]	420	50.9 (44.1–57.6)	48.2 (41.5–55.0)	4.9 (2.9–8.2)	–		
High deductible directly purchased plan	362	55.9 (48.7–62.9)	54.7 (47.4–61.8)	4.3[g] (2.2–8.2)	0.2[g] (0.0–0.7)		
Medicaid or other Public [c]	1081	47.4 (43.3–51.6)	45.5 (41.4–49.7)	4.6 (3.2–6.5)	–		
Medicare disability	374	64.2 (56.2–71.4)	61.6 (53.5–69.2)	8.8 (4.9–15.1)	–		
Military coverage [d]	313	73.4 (65.4–80.1)	68.9 (61.0–75.9)	9 (5.7–14.0)	–		
Uninsured	750	24.8 (20.7–29.5)	23.2 (19.1–27.9)	4.0 (2.4–6.7)	–		
Health insurance (age 65–75)	2233	76.3 (73.7–78.6)	73.5 (70.9–76.0)	9.1 (7.5–10.9)	0.6[g] (0.3–1.2)	1,2	
Medicare and private [e]							1,2
Medicare only	1573	68.8 (65.7–71.8)	65.0 (61.9–67.9)	10.8 (8.8–13.2)	1.2[g] (0.6–2.4)		
Medicare and Medicaid [f]	720	65.2 (60.2–69.9)	62.4 (57.4–67.1)	9.1 (6.4–12.6)	1.2[g] (0.5–2.8)		

Estimates were age adjusted to the 2000 United States standard population by 5-year age groups. Screening within recommendations was defined as home FOBT within the past year, sigmoidoscopy within the past 5 years and FOBT within the past 3 years, or colonoscopy within the past 10 years. Percentages were weighted to account for the complex design of NHIS. Estimates with relative standard errors > 50% were suppressed and are indicated by "–". Analyses were not adjusted for multiple comparisons. CI=confidence interval, FOBT=fecal occult blood test.

[a] Chronic conditions were defined as any diagnosis of cancer, hypertension, coronary heart disease, stroke, emphysema, chronic obstructive pulmonary disease, diabetes, arthritis, rheumatoid arthritis, gout, lupus, fibromyalgia, and hepatitis; a diagnosis of chronic bronchitis or weak or failing kidneys in the past 12 months; or a current diagnosis of asthma.

[b] Includes private plans obtained through the health insurance marketplace, school, or means other than employment.

[c] Include insurance classified as public only, other government only and SCHIP.

[d] Includes coverage through TRICARE, VA, and champ-VA. Military coverage is restricted to civilians only and includes those with military coverage and Medicare disability.

[e] Includes those who have only private coverage.

[f] Includes other state-sponsored health plans.

[g] Estimates are based on small sample size and relative standard errors ranging from 30 to 50%.

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[h]Screening within recommendations and the individual screening modalities were compared for demographic subgroups. Statistically significant subgroup differences for screening within recommendations, colonoscopy within the past 10 years, FOBT within the past year and sigmoidoscopy within the past 5 years and FOBT within the past 3 years are denoted 1, 2, 3, and 4 respectively.