Persistent Disparities in Colorectal Cancer Screening: A Tell-Tale Sign for Implementing New Guidelines in Younger Adults

Po-Hong Liu[1], Nina N. Sanford[2], Peter S. Liang[3,4], Amit G. Singal[1], and Caitlin C. Murphy[5]

ABSTRACT

Background: In May 2021, the U.S. Preventive Services Task Force began recommending initiating colorectal cancer screening at age 45 (vs. 50) years.

Methods: We estimated prevalence of colorectal cancer screening (by colonoscopy, sigmoidoscopy, CT colonography, or stool-based tests) in adults ages 50 to 75 years using data from the National Health Interview Survey in 2000, 2003, 2005, 2008, 2010, 2013, 2015, and 2018. For each survey year, we estimated prevalence by age, race/ethnicity, educational attainment, family income, and health insurance. We also compared increases in prevalence of screening from 2000 to 2018 in 5-year age groups (50–54, 55–59, 60–64, 65–69, and 70–75 years).

Results: Overall, prevalence of colorectal cancer screening increased from 36.7% in 2000 to 66.1% in 2018. Screening prevalence in 2018 was lowest for age 50 to 54 years (47.6%), Hispanics (56.5%), Asians (57.1%), and participants with less than a high school degree (53.6%), from low-income families (56.6%), or without insurance (39.7%). Increases in prevalence over time differed by five-year age group. For example, prevalence increased from 28.2% in 2000 to 47.6% in 2018 (+19.4%; 95% CI, 13.1–25.6) for age 50 to 54 years but from 46.4% to 78.0% (+31.6%; 95% CI, 25.4%–37.7%) for age 70 to 75 years. This pattern was consistent across race/ethnicity, educational attainment, family income, and health insurance.

Conclusions: Prevalence of colorectal cancer screening remains low in adults ages 50 to 54 years.

Impact: As new guidelines are implemented, care must be taken to ensure screening benefits are realized equally by all population groups, particularly newly eligible adults ages 45 to 49 years.

Introduction

Colorectal cancer screening with colonoscopy, sigmoidoscopy, or stool-based tests is a well-established preventive health service and can reduce colorectal cancer incidence and mortality (1–3). Overall screening participation remains below target, and screening benefits are not realized equally across populations. For example, racial and ethnic minorities and low-income persons are less likely to receive screening (4, 5), which may contribute to the higher incidence rates of colorectal cancer and worse cancer-specific survival observed in these groups (6, 7). Modeling studies similarly suggest that differences in screening between Black and White persons account for 42% and 19% of the disparity in incidence and mortality rates, respectively (8). These observations underscore the importance of optimizing screening as a critical strategy for reducing disparities in colorectal cancer outcomes (7, 9).

In May 2021, the U.S. Preventive Services Task Force (USPSTF) updated their guidelines to recommend average-risk colorectal cancer screening starting at age 45 (vs. 50; ref. 10); the American Cancer Society made a similar recommendation in May 2018 (11). These recommendations were driven by increasing colorectal cancer incidence rates in young adults (age <50 years), as well as modeling studies suggesting screening at age 45 results in more life years gained and fewer cases and deaths (12). Although updated guidelines have generally been well-received, some have raised concerns that expanding screening to age 45 to 49 years may perpetuate disparities in screening that have been overserved in older age groups (13–15). Understanding colorectal cancer screening patterns at age 50 to 54 years—adults who were once the youngest age group eligible for screening—may help us anticipate potential pitfalls and inform implementation strategies when screening is expanded to age 45 to 49 years. These age groups may face similar barriers to screening: competing demands, such as work and family responsibilities; insurance coverage on the basis of employment; and less connected to primary care given lower prevalence of chronic conditions (16–18). Therefore, we used the National Health Interview Survey (NHIS) to: (i) estimate prevalence of colorectal cancer screening, overall and by age, race and ethnicity, educational attainment, family income, and health insurance, over a 20-year time period; and (ii) examine age-related differences in prevalence of screening across these groups, particularly in newly eligible adults age 50 to 54 years.

Materials and Methods

Study population

The NHIS is an annual, cross-sectional survey of the U.S. population, covering a broad range of health topics and conducted in-person by the National Center for Health Statistics at the U.S. Centers for Disease Control and Prevention (19, 20). NHIS allows for nationally representative estimates, including underrepresented groups, by using

[1]Division of Digestive and Liver Diseases, Department of Medicine, University of Texas Southwestern Medical Center, Dallas, Texas. [2]Department of Radiation Oncology, University of Texas Southwestern Medical Center, Dallas, Texas. [3]Department of Medicine, NYU Langone Health, New York, New York. [4]Department of Medicine, VA New York Harbor Health Care System, New York, New York. [5]School of Public Health, University of Texas Health Science Center at Houston, Houston, Texas.

Note: Supplementary data for this article are available at Cancer Epidemiology, Biomarkers & Prevention Online (http://cebp.aacrjournals.org/).

AACR members: Caitlin C. Murphy (AACR ID: 302961)

Corresponding Author: Caitlin C. Murphy, UT Health School of Public Health, 7000 Fannin Street, Suite 2618, Houston, TX 77030. E-mail: caitlin.c.murphy@uth.tmc.edu

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a multistage clustered probability design accounting for nonresponse (21, 22). Persons who are: on active military duty, incarcerated in the prison system, residents of long-term care facilities, and U.S. citizens residing abroad are excluded (23).

We used NHIS data from survey years 2000, 2003, 2005, 2008, 2010, 2013, 2015, and 2018; these survey years correspond to the years when NHIS measured colorectal cancer screening and/or administered the Cancer Control Supplement. Response rates ranged from 72% in 2000 to 53% in 2018, and the total number of participants ranged from 21,781 in 2008 to 34,557 in 2013 (22). We excluded participants with a personal history of colorectal cancer ($n = 1{,}380$) and with missing information on colorectal cancer screening (missingness ranged from 4% in 2013 to 10% in 2010). The final sample included 80,220 participants ages 50 to 75 years.

Colorectal cancer screening

Our primary outcome was colorectal cancer screening, defined as receipt of at least one recommended test within the recommended timeframe, regardless of the reason for that test. This outcome is consistent with prior studies of colorectal cancer screening that also use NHIS data (4, 24). NHIS participants were asked questions about if and when they received colorectal cancer screening tests. For each test, participants were asked about the main reason for having the test and the date of their most recent test. Screening tests assessed in questionnaires differed across survey years, reflecting changes in colorectal cancer screening practices. Sigmoidoscopy, colonoscopy, and stool-based tests (including both fecal occult blood and/or fecal immunochemical tests) were measured in all survey years. CT colonography was measured in 2010, 2015, and 2018, and FIT-DNA was measured in 2018. The USPSTF recommendations in effect at the time of each survey were used to determine whether survey participants were up-to-date with colorectal cancer screening (25, 26). For example, in 2018, colorectal cancer screening was defined as use of a stool-based test within the past year, colonoscopy within past 10 years, CT colonography or sigmoidoscopy within the past 5 years, or FIT-DNA test within the past 3 years.

Statistical analysis

For each survey year, we estimated prevalence of colorectal cancer screening, overall and by age, race, and ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, and Asian), educational attainment (below high school, high school graduate or GED, some college or associate degree, and bachelor's degree or higher), family income [≤200%, 200%–400%, and >400% of federal poverty level (FPL)], and health insurance (private, public, military, and uninsured). Race and ethnicity were on the basis of self-report and categorized according to standards of the Office of Management and Budget. Educational attainment was measured as the highest level of education achieved. Family income was measured as a percentage of the FPL; the FPL in 2018 was $12,140 for a one-person family and $25,100 for a four-person family. Health insurance was categorized as: (i) private or commercial; (ii) public only, including Medicaid, Medicare, and other government-sponsored health plans without private insurance; (iii) military only, such as TRICARE, VA, or Champ-VA without private insurance; and (iv) uninsured, including participants with only Indian Health Service coverage or a single service plan.

To better understand age-related differences, for each survey year, we also estimated prevalence of colorectal cancer screening in each 5-year age group (50–54, 55–59, 60–64, 65–69, and 70–75 years), overall and by race and ethnicity, educational attainment, family income, and health insurance. We illustrated these differences by plotting prevalence of screening for 50- to 54-year-old and 70- to 75-year-old in 2000 versus 2018, separately by each of these sociodemographic factors. Given the potential for underestimating prevalence of colorectal cancer screening in adults ages 50 to 54 years, as participants who just turned age 50 may not yet have been offered screening, we performed a sensitivity analysis of adults ages 51 to 54 years.

Weighted prevalence estimates and 95% confidence intervals (CI) were calculated accounting for the complex sampling design of NHIS. Chi-square tests were conducted to evaluate group differences. Statistical significance was set as $P < 0.05$ in two-tailed tests. Analyses were conducted using SAS version 9.4 (SAS Institute).

Data availability

Data were obtained from the NHIS, National Center for Health Statistics, U.S. Centers for Disease Control and Prevention, and available at https://www.cdc.gov/nchs/nhis/index.htm.

Results

Prevalence of colorectal cancer screening

Overall, prevalence of colorectal cancer screening increased from 36.7% (95% CI, 35.5–37.8) in 2000 to 66.1% (95% CI, 65.0–67.3) in 2018 (**Table 1**), with increases for nearly all groups (**Fig. 1**). In 2018, prevalence of screening was highest in participants: ages 70 to 75 years (78.0%; 95% CI, 75.9–80.0), who were non-Hispanic White (68.7%; 95% CI, 67.4–70.0), with a bachelor's degree or higher (72.7%; 95% CI, 71.0–74.4), with family income at least 400% of FPL (71.7%; 95% CI, 70.0–73.4), and with military insurance (80.7%; 95% CI, 76.7–84.8). Prevalence was lowest in participants: ages 50 to 54 years (47.6%; 95% CI, 44.8–50.3), who were Hispanic (56.5%; 95% CI, 52.4–60.6) or non-Hispanic Asian (57.1%; 95% CI, 51.3–63.0), with less than high school education (53.6%; 95% CI, 50.0–57.2), with family income less than 200% of FPL (56.6%; 95% CI, 54.2–59.0), and without insurance (39.7%; 95% CI, 33.5–76.3).

Age-related differences in prevalence of colorectal cancer screening

Increases in prevalence of colorectal cancer screening over time differed by 5-year age group. For example, prevalence increased from 28.2% in 2000 to 47.6% in 2018 (+19.4%; 95% CI, 13.1–25.6) for age 50 to 54 years (**Table 2**) but from 46.4% to 78.0% (+31.6%; 95% CI, 25.4%–37.7%) for age 70 to 75 years (**Table 3**). Prevalence for ages 55 to 59, 60 to 64, and 65 to 69 years is shown in Supplementary Tables S1 to S3, respectively. Notably, we observed smaller increases in prevalence by race and ethnicity, educational attainment, family income, and health insurance for age 50 to 54 years compared with age 70 to 75 years, illustrated in **Fig. 2** and described in detail later.

Race and ethnicity

Although prevalence of colorectal cancer screening increased over time for all racial and ethnic groups (**Table 1**), increases in prevalence were smallest for age 50 to 54 years (**Fig. 2A**). For example, for Hispanic participants ages 50 to 54 years, prevalence increased from 16.7% in 2000 to 35.5% in 2018 (+18.8%; 95% CI, 9.7–27.8) compared with an increase of 54.0% (95% CI, 42.4–65.7) for Hispanic participants ages 70 to 75 years.

Table 1. Prevalence of colorectal cancer screening among participants ages 50 to 75 years, NHIS, 2000 to 2018 (n = 80,220).

	2000	2003	2005	2008	2010	2013	2015	2018	*P* value between groups, 2018	Difference in prevalence, 2000 vs. 2018, % (95% CI)
Overall, % (95% CI)	36.7 (35.5, 37.8)	42.5 (41.3, 43.7)	46.8 (45.4, 48.2)	51.9 (50.4, 53.4)	57.9 (56.6, 59.2)	57.0 (55.8, 58.2)	61.6 (60.3, 63.0)	66.1 (65.0, 67.3)		+29.4 (27.8–31.1)
Age									<0.001	
50–54 years	28.2	31.6	33.7	39.1	42.4	42.8	45.1	47.6		+19.4 (13.1–25.6)
55–59 years	34.6	42.1	45.4	52.6	59.1	54.4	60.9	64.6		+30.0 (23.7–36.2)
60–64 years	37.4	46.9	52.9	57.1	64.4	61.1	67.0	71.4		+34.0 (27.5–40.7)
65–69 years	44.0	49.9	55.4	59.7	66.3	67.0	69.1	73.8		+29.8 (23.1–36.5)
70–75 years	46.4	52.1	58.9	61.4	67.8	68.8	73.1	78.0		+31.6 (25.4–37.7)
Sex									0.380	
Men	36.2	43.5	46.9	51.6	57.7	55.7	60.7	66.7		+30.5 (28.2–32.9)
Women	37.2	41.6	46.7	52.2	58.2	58.2	62.4	65.7		+28.5 (26.3–30.7)
[a]Race and ethnicity									<0.001	
Non-Hispanic White	38.8	44.8	50.1	54.9	60.6	59.6	64.8	68.7		+29.9 (28.0–31.7)
Hispanic	25.9	28.8	29.0	35.6	45.4	40.5	47.6	56.5		+30.6 (25.0–36.2)
Non-Hispanic Black	30.9	37.4	40.2	48.0	54.5	56.9	58.9	64.4		+33.5 (28.9–38.2)
Non-Hispanic Asian	22.6	28.5	32.9	46.5	46.7	49.5	51.6	57.1		+34.5 (25.4–43.7)
Educational attainment									<0.001	
Less than high school degree	26.8	30.3	35.5	36.5	43.4	42.0	45.8	53.6		+26.8 (22.7–30.9)
High school degree/GED	35.3	41.3	43.9	48.9	52.7	52.6	57.2	62.6		+27.3 (24.3–30.3)
Some college/associates degree	39.5	44.0	48.0	55.1	61.4	58.4	62.5	67.1		+27.6 (24.5–30.7)
Bachelor's degree or higher	44.8	51.8	56.0	60.6	66.8	66.1	70.1	72.7		+27.9 (24.7–31.0)
Family income (% FPL)									<0.001	
≤200%	30.2	32.3	38.2	39.5	42.9	45.0	48.2	56.6		+26.4 (23.1–29.7)
200%–400%	36.3	42.7	45.4	50.6	56.4	55.1	61.2	63.6		+27.3 (23.9–30.7)
>400%	42.9	50.2	53.8	60.1	66.6	65.3	69.0	71.7		+28.8 (26.3–31.3)
Health insurance									<0.001	
Private	38.9	45.2	50.3	56.3	63.6	61.3	64.9	68.6		+29.7 (27.6–31.7)
Public only	40.9	46.4	44.1	48.7	53.7	58.7	59.3	65.7		+24.8 (21.8–27.8)
Military only	24.2	33.6	68.1	68.1	75.9	71.1	77.0	80.7		+56.5 (50.8–62.3)
Uninsured	30.2	45.8	18.0	21.5	24.3	26.3	29.9	39.7		+9.5 (−2.3–21.2)

Abbreviation: GED, general educational development.

[a]American Indian, Alaska Native, multiple race, and nonreleasable race (n = 2,057) not included in estimates by race and ethnicity.

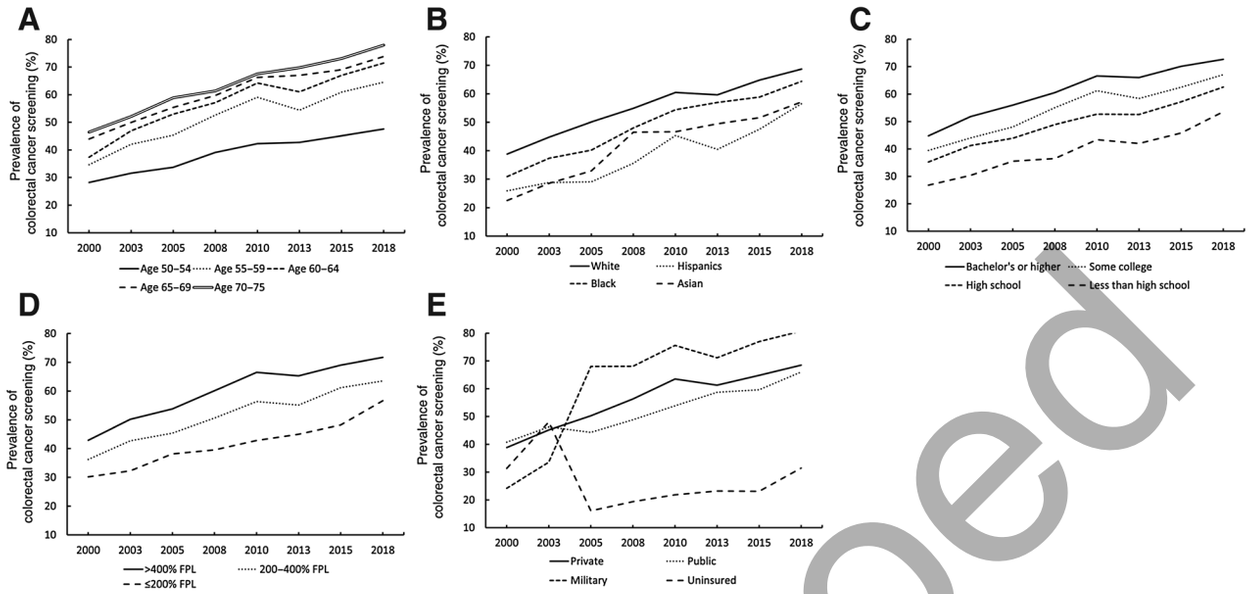

Figure 1.
Prevalence of colorectal cancer screening by age (**A**), race and ethnicity (**B**), educational attainment (**C**), family income (**D**), and health insurance (**E**), NHIS, 2000–2018.

Educational attainment

Across all ages, prevalence of colorectal cancer screening increased over time by about 25% for each education group (**Table 1**); however, increases in prevalence were smaller for age 50 to 54 years (**Fig. 2B**). For those ages 50 to 54 years with less than a high school degree, prevalence increased from 16.1% in 2000 to 30.7% in 2018 (+14.6%; 95% CI, 6.1–23.1): smaller than their age 70- to 75-year counterparts (+34.2%; 95% CI, 26.6–41.8).

Family income

Similarly, by family income, there were smaller increases in prevalence of colorectal cancer screening over time for participants ages 50 to 54 years compared with the 70- to 75-year age group (**Fig. 2C**). For example, among those with family income ≤200% FPL, prevalence increased modestly for age 50 to 54 years (+15.7%; 95% CI, 8.2–23.0) but by 32.2% (95% CI, 25.6–38.7) for age 70 to 75 years.

Health insurance

Finally, across all ages, prevalence of colorectal cancer screening increased from 2000 to 2018 for those with private (+29.7%; 95% CI, 27.6–31.7), public (+24.8%; 95% CI, 21.8–27.8), and military insurance (+56.5%; 95% CI, 50.8–62.3) but fluctuated between 18.0% and 45.8% for those without insurance (**Table 1**). Increases in prevalence by health insurance were smallest for participants ages 50 to 54 years compared with older adults (**Fig. 2D**). Specifically, among those with private insurance, prevalence increased from 30.7% to 51.7% in the 50- to 54-year age group (+21.0%; 95% CI, 16.9–25.2) but from 50.4% to 80.8% in the 70- to 75-year age group (+34.0%; 95% CI, 27.5–40.7).

We observed a similar pattern in a sensitivity analysis limited to adults ages 51 to 54 years (Supplementary Table S4).

Discussion

In this analysis of population-based data from the NHIS, we found that, although prevalence of colorectal cancer screening increased over time for nearly all groups, prevalence remained lowest for age 50 to 54 years—during the study period and until recently, those newly eligible for screening. Further, differences in prevalence of screening by race and ethnicity, educational attainment, household income, and health insurance were most pronounced for those ages 50 to 54 years, whereas older adults experienced larger increases in prevalence across these groups. Our findings are especially relevant to the new USPSTF guidelines that recommend average-risk screening to begin at age 45 years. The persistent and worsening disparities we observed in adults 50 to 54 years may extend to those ages 45 to 49 years as they become eligible for screening.

The individual and societal burden of colorectal cancer is especially great among younger adults. Person-years of life lost due to colorectal cancer is higher for younger compared with older adults (11), and cancer deaths in young adults also result in more lost earnings (27). Despite this high burden, prevalence of screening was lowest for age 50 to 54 years: fewer than half were up-to-date with screening in 2018. Younger adults also experienced the smallest increase in screening prevalence over time, and these small increases were persistent across racial and ethnic, education, income, and insurance groups. For example, prevalence of screening increased from only about 17% to 35% for young Hispanics and Asians ages 50 to 54 years, although notably there was no difference in prevalence between younger Blacks and Whites. Prevalence remained well below 40% among younger adults with less than a high school degree, low family income, and no insurance. There are likely several explanations for these findings: (i) cancer and cancer screening are not typically a major concern of younger adults and their providers (28); (ii) younger adults may have limited access to medical care and may be under- or uninsured (29); and (iii)

Table 2. Prevalence of colorectal cancer screening among participants ages 50 to 54 years, NHIS, 2000–2018 (n = 18,948).

	2000	2003	2005	2008	2010	2013	2015	2018	*P* value between groups, 2018	Difference in prevalence, 2000 vs. 2018, % (95% CI)
Overall % (95% CI)	28.2 (26.1–30.3)	31.5 (29.1–34.0)	33.7 (31.4–35.9)	39.1 (36.3–41.9)	42.3 (39.7–44.8)	42.8 (40.2–45.3)	45.1 (42.6–47.7)	47.6 (44.8–50.3)		+19.4 (13.1–25.6)
Sex									0.921	
Men	26.9	30.8	31.6	39.0	40.5	39.6	42.4	47.7		+20.8 (15.7–25.9)
Women	29.4	32.2	35.7	39.2	44.0	45.9	47.7	47.4		+18.0 (13.4–22.6)
[a]Race and ethnicity									<0.001	
Non-Hispanic White	30.3	33.5	36.3	41.6	44.0	45.1	49.0	51.0		+20.7 (16.6–24.8)
Hispanic	16.7	18.9	20.5	24.9	35.5	25.5	31.7	35.5		+18.8 (9.7–27.8)
Non-Hispanic Black	23.4	33.7	26.7	37.5	38.8	49.5	40.4	50.0		+26.6 (16.7–36.4)
Non-Hispanic Asian	17.3	13.7	29.8	39.0	32.5	32.2	38.5	32.3		+15.0 (0.8–29.1)
Educational attainment									<0.001	
Less than high school degree	16.1	16.9	19.5	21.3	24.5	28.2	30.7	30.7		+14.6 (6.1–23.1)
High school degree/GED	25.1	29.0	32.4	35.1	36.7	38.1	38.9	43.9		+18.8 (12.2–25.5)
Some college/associates degree	30.8	30.8	30.8	43.7	45.1	43.5	48.3	48.6		+17.8 (11.1–24.6)
Bachelor's degree or higher	34.0	42.4	43.0	45.3	51.9	51.8	52.0	54.7		+20.7 (14.6–26.6)
Family income (% FPL)									<0.001	
≤200%	19.3	20.2	24.0	26.6	28.9	32.3	35.8	35.0		+15.7 (8.2–23.0)
200%–400%	24.5	25.6	26.9	38.8	38.7	40.5	45.5	45.9		+21.4 (14.2–28.7)
>400%	33.5	39.1	40.5	46.4	50.7	51.0	51.3	53.8		+20.3 (15.2–25.4)
Health insurance									<0.001	
Private	30.7	35.5	36.9	43.6	47.5	47.0	48.2	51.7		+21.0 (16.9–25.2)
Public only	27.8	33.3	33.1	30.9	36.3	46.8	43.4	43.1		+15.3 (5.6–25.0)
Military only	23.7	31.6	57.1	57.6	70.4	62.9	65.1	64.6		+40.9 (24.3–57.4)
Uninsured	28.2	26.3	12.4	16.8	18.3	20.1	19.9	21.2		−7.0 (−30.8–16.7)

Abbreviation: GED, general educational development.

[a]American Indian, Alaska Native, multiple race, and nonreleasable race (n = 2,057) not included in estimates by race and ethnicity.

Table 3. Prevalence of colorectal cancer screening among participants ages 70 to 75 years, NHIS, 2000–2018 ($n = 13,431$).

	2000	2003	2005	2008	2010	2013	2015	2018	***P* value between groups, 2018**	**Difference in prevalence, 2000 vs. 2018, % (95% CI)**
Overall % (95% CI)	46.4 (43.8–49.1)	52.1 (49.0–55.2)	58.9 (56.1–61.7)	61.4 (58.1–64.6)	67.6 (64.7–70.5)	69.8 (67.3–72.3)	73.1 (70.5–75.8)	78.0 (75.9–80.0)		+31.6 (25.4–37.7)
Sex									0.725	
Men	47.9	54.0	62.7	64.4	68.5	72.0	76.2	78.4		+30.5 (25.4–35.5)
Women	45.2	50.6	55.6	59.2	66.8	68.0	70.4	77.7		+32.5 (28.0–36.8)
[a]Race and ethnicity									0.453	
Non-Hispanic White	49.0	54.1	62.7	63.7	68.8	71.7	74.9	78.4		+29.4 (25.7–33.2)
Hispanic	24.1	40.6	35.7	44.7	59.1	62.3	67.4	78.1		+54.0 (42.4–65.7)
Non-Hispanic Black	39.9	40.7	42.8	56.0	68.0	67.3	70.1	78.1		+38.2 (28.2–48.4)
Non-Hispanic Asian	33.8	49.3	47.9	54.5	59.6	62.0	68.9	69.0		+35.2 (13.8–56.6)
Educational attainment									<0.001	
Less than high school graduate	33.7	40.5	45.9	46.8	58.8	58.2	64.8	67.9		+34.2 (26.6–41.8)
High school graduate/GED	51.6	51.1	58.6	60.6	65.8	66.0	69.8	75.7		+24.1 (17.9–30.4)
Some college/associates degree	48.0	59.9	64.6	68.5	71.3	75.5	73.3	81.3		+33.3 (26.6–40.0)
Bachelor's degree or higher	58.2	63.7	70.1	70.8	78.1	77.5	80.1	81.8		+23.6 (15.6–31.6)
Family income (% FPL)									<0.001	
≤200%	38.2	45.6	49.0	51.1	56.3	57.0	58.9	70.4		+32.2 (25.6–38.7)
200%–400%	45.8	60.5	63.3	65.3	70.3	72.4	74.9	76.0		+30.2 (23.2–37.2)
>400%	60.0	64.8	70.3	73.4	78.6	79.8	81.3	84.5		+24.5 (16.9–32.1)
Health insurance									<0.001	
Private	50.4	53.3	64.6	67.0	73.5	74.6	77.8	80.8		+30.4 (24.9–35.9)
Public only	46.7	53.0	47.9	52.8	59.2	63.7	67.0	73.7		+27.0 (22.0–31.9)
Military only	22.5	36.5	78.0	76.3	82.3	84.9	82.6	84.9		+62.4 (52.0–72.9)
Uninsured	36.7	57.3	28.4	34.3	52.1	61.0	62.6	83.7		+47.0 (22.9–71.0)

Abbreviation: GED, general educational development.
[a]American Indian, Alaska Native, multiple race, and nonreleasable race ($n = 2,057$) not included in estimates by race and ethnicity.

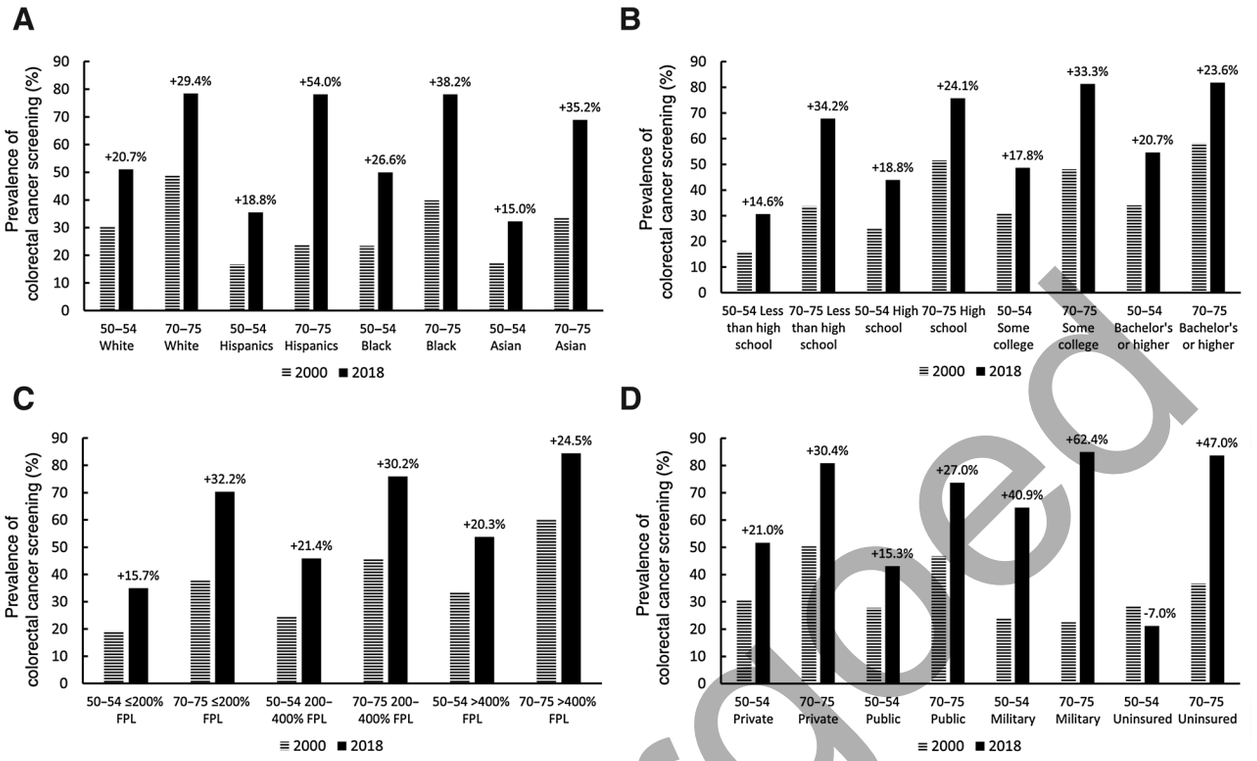

Figure 2.
Prevalence of colorectal cancer screening for age 50 to 54 years vs. 70 to 75 years by race and ethnicity (**A**), educational attainment (**B**), family income (**C**), and health insurance (**D**), NHIS, 2000 and 2018. NOTE: Percentages above black bars correspond to the difference in prevalence between 2000 and 2018.

competing priorities, such as time off work and family and caregiving responsibilities, create barriers to screening for young adults, especially in underserved populations (9, 30, 31). Public awareness campaigns may encourage screening participation among younger adults, and ongoing efforts are needed to identify and address barriers to screening that are unique to this age group.

Clinicians and researchers have debated the benefits and consequences of new USPSTF recommendations to extend colorectal cancer screening to age 45 to 49 years (13–15, 32, 33). Some of the major concerns include diverting endoscopic resources away from higher-risk and older persons, exacerbating health disparities. As described by Liang and colleagues, low-income persons are least likely to benefit from new health interventions (34), made apparent by the fact that low socioeconomic status shifted from a protective to risk factor for colorectal cancer, only after average-risk screening at age 50 years began to increase in the population (35). Adults ages 45 to 49 years who participate in screening may be less likely to belong to groups at higher risk of colorectal cancer or groups of low socioeconomic status, mirroring the disparities we observed at age 50 to 54 years. Although extending screening to age 45 to 49 years is likely cost-effective, greater benefits can be achieved at lower costs when older, unscreened adults initiate screening (13). Specifically, extending screening to age 45 to 49 years can avert 11,100 colorectal cancer deaths with an incremental cost of $10.4 billion, compared with 31,800 deaths averted at an incremental cost of $3.4 billion by achieving 80% screening participation in adults ages 50 to 75 years (13). Extra care must be taken to ensure that expanding screening to younger ages does not negatively impact efforts to eliminate disparities in colorectal cancer screening and outcomes, nor jeopardize efforts to increase screening initiation among those who remain unscreened.

On the other hand, an unintended benefit of extending colorectal cancer screening to age 45 to 49 years may be that screening participation increases in older age groups. Public health messaging about screening may be delivered earlier, and newly eligible adults will consequently have more time to delay their first screening test. Indeed, we observed larger increases in prevalence of screening over time for adults ages 55 to 59 years compared with those ages 50 to 54 years, supporting this hypothesis. Conversely, a prior study of screening using NHIS data showed no changes in screening for ages 50 to 54 years in the third and fourth quarters of 2018 (36), after the ACS recommended lowering the screening age to 45 years in May of that year (11). Given that the USPSTF's effect on insurance coverage will not happen until mid-2022, the effects of extending screening to age 45 to 49 years, both on disparities and participation of older adults, may take several years to be fully realized.

There are several strengths of our analysis. We used nationally representative data from the NHIS, and the large sample allowed us to estimate prevalence of colorectal cancer screening within and across population groups. We were also able to estimate increases in prevalence of screening over time for these groups. We acknowledge certain limitations inherent to cross-sectional survey data. With the exception of the latter half of 2018, survey data correspond to the period when the ACS and USPSTF recommended colorectal cancer screening begin at age 50 years. Information available in the NHIS is participant-reported and not validated by medical records, though prior studies support the validity of self-reported colorectal cancer screening (37). Although we

excluded participants with a personal history of colorectal cancer, NHIS does not provide information to identify other high risk or predisposing conditions, such as inflammatory bowel disease, family history of colorectal cancer, and personal or family history of advanced adenomas. We also lacked information on repeat or longitudinal screening. Finally, survey response was somewhat low (53%) in 2018, although results were weighted to account for nonresponse bias.

In summary, our study provides important insight into recent changes to and forthcoming implementation of guidelines to initiate average-risk colorectal cancer screening at age 45 years. Although the prevalence of screening has overall increased from 2000 to 2018, disparities remain, especially in the youngest age group. Adults ages 50 to 54 years, who were newly eligible for screening at the time of data collection, experienced the smallest gains in screening over time. These disparities may extend to adults aged 45 to 49 years as the new USPSTF recommendations are implemented. Screening programs must consider the barriers unique to younger adults, ensuring the benefits of screening are equally realized by all population groups.

Authors' Disclosures

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Disclaimer

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Authors' Contributions

P.-H. Liu: Conceptualization, data curation, formal analysis, writing–original draft. **N.N. Sanford:** Conceptualization, methodology, writing–review and editing. **P.S. Liang:** Conceptualization, writing–review and editing. **A.G. Singal:** Supervision, funding acquisition, writing–review and editing. **C.C. Murphy:** Conceptualization, supervision, funding acquisition, writing–review and editing.

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