Published in final edited form as:

Cancer. 2010 October 15; 116(20): 4872–4881. doi:10.1002/cncr.25215.

Recent Data and Trends in Cancer Screening in the United States: 1992-2005 National Health Interview Surveys

Judith Swan, M.H.S.¹, Nancy Breen, Ph.D.¹, Barry I. Graubard, Ph.D.², Timothy S. McNeel, B.A.⁴, Donald Blackman, Ph.D.³, Florence K. Tangka, Ph.D.³, and Rachel Ballard-Barbash, Ph.D.¹

¹Division of Cancer Control and Population Sciences, National Cancer Institute, Bethesda, MD

²Division of Cancer Epidemiology and Genetics, National Cancer Institute, Bethesda, MD

³Division of Cancer Prevention and Control, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Atlanta, GA

⁴Information Management Services (IMS), Inc., Silver Spring, MD

Abstract

Background—This paper examines the prevalence of cancer screening use as reported in 2005 among U.S. adults, focusing on differences among historically underserved subgroups. We also examine trends from 1992 through 2005 to determine if differences in screening use are increasing, staying the same, or decreasing.

Methods—Data from the National Health Interview Surveys between 1992 and 2005 were analyzed to describe patterns and trends in cancer screening practices, including Pap test, mammography, prostate-specific antigen (PSA), and colorectal screening. Logistic regression was used to report 2005 data for population subgroups defined by a number of demographic and socioeconomic characteristics.

Results—Rates of use for cancer tests are rising only for colorectal cancer, due largely to the increase in colorectal endoscopy screening. Use of all the modalities was strongly influenced by contact with a physician and by having health insurance coverage.

Conclusions—There remain large gaps in use for all screening modalities by education, income, usual source of care, health insurance, and recent physician contact. These specific populations would benefit from interventions to overcome these barriers to screening.

Keywords

NHIS; cancer screening; mammography; Pap; PSA; colorectal screening

INTRODUCTION

The National Health Interview Survey (NHIS) has monitored the nation's progress toward Healthy People objectives in cancer screening for nearly two decades.¹ A major objective of

Correspondence to: Nancy Breen, Division of Cancer Control and Population Sciences, National Cancer Institute, National Institutes of Health, 6130 Executive Boulevard, EPN 4005, Rockville, MD 20852-7344. Telephone: 301-496-4675, BreenN@mail.nih.gov, Fax: 301-435-3710.

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention or the U.S. Census Bureau.

There are no financial disclosures from any of the authors.

the Healthy People initiative is to increase use of recommended cancer screening tests and to help reduce disparities in the use of cancer screening services. Repeated monitoring of differences among groups can inform the planning of public health strategies.

Condensed abstract

When examining cancer screening from the 2005 NHIS, large gaps in use remain among population groups with differing levels of education, income, usual source of care, health insurance, and recent physician contact. Results identify specific populations that may benefit from efforts to overcome barriers to screening.

This report examines the prevalence of cancer screening practices reported by adults in the 2005 NHIS, and trends in screening usage from 1992 through 2005. The U.S. Preventive Services Task Force (USPSTF) reviews scientific evidence on preventive services and is the basis for Healthy People cancer screening objectives. Currently, the USPSTF recommends Pap tests for cervical cancer, mammography for breast cancer, and fecal occult blood test (FOBT), sigmoidoscopy, or colonoscopy for colorectal cancer.² Although consensus has not been reached on the effectiveness of PSA testing in reducing cancer mortality, its use is widespread and increasing.³⁻⁶ Due to its widespread use, the NHIS began monitoring this screening modality in 2000.

Our previous report on trends in screening from 1987 to 2000 demonstrated progress toward Healthy People objectives for all these screening modalities.⁷ In that study, variables found to influence screening practices included age, gender, race/ethnicity, recency of immigration, income (poverty status), education, health insurance status, and having a usual source of health care. In this study, we test for associations between cancer screening and those variables again, and whether progress continued to 2005.

METHODS

National Health Interview Survey

The NHIS is a large-scale household interview survey of a statistically representative sample of the U.S. civilian non-institutionalized population (<http://www.cdc.gov/nchs/nhis.htm>). Each year a random, stratified, multistage cluster sample of U.S. households is used to obtain the data. In-person interviews yield a basic set of demographic and health items for each participating household. For each survey year included in this study, respondents were asked to report the time since their most recent cancer screening tests. In 2005, the universe of respondents who were asked to choose a category was expanded from that used in 2000 and 2003. As a result, the rates for 2005 and subsequent years can be calculated in two ways. In Tables 1 and 2, we report 2005 results using the expanded group of respondents. In Figure 1, for the sake of consistency with earlier trend analyses, we report the 2005 results limited to the type of data collected and the estimation methods used with the earlier data in 2000 and 2003. Descriptions of the 2005 NHIS and these methods are available online.⁸

Tests and Test Intervals—NHIS respondents who report having had a recent test are asked why they received the test. We included tests given that were not part of a routine exam; in short, we assumed that a person who had the test within the recommended interval had been screened. This is a reasonable assumption for mammography, Pap, PSA, and home FOBT, where 10% or less of tests are performed due to a symptom. A much larger percent of colorectal endoscopies result from symptoms,⁹ so we included only screening tests for this modality. We measured two types of colorectal cancer screening: home FOBT and endoscopy. Each modality was measured independently, so that respondents reporting both

tests are included in rates for both. We excluded office-based FOBT from our analysis because it does not have a proven benefit. Recently published American Cancer Society (ACS) guidelines endorse the full range of colorectal screening technologies already in use, emphasizing that tests be offered in the context of shared decision making,¹⁰ but do not state a preference for any single test.

We used the baseline and progress measures for the Healthy People 2010 national cancer screening objectives to determine intervals for Pap tests and mammography, 3 years and 2 years, respectively. At the time of data collection, the USPSTF had no recommendation regarding interval for sigmoidoscopy/colonoscopy/proctoscopy (hereafter collectively referred to as “endoscopy”) screening. ACS recommends annual FOBT, flexible sigmoidoscopy every 5 years, or colonoscopy every 10 years. More recently, USPSTF released new recommendations similar to those of ACS except they add an interval FOBT between flexible sigmoidoscopies.^{11,12} Historical changes in both recommendations and the way data are collected create measurement challenges related to endoscopy usage. The categories used for the time interval question in the 1992 NHIS were within the past year, 1 to 3 years ago, and over 3 years ago, so we chose 3 years as the endoscopy cut-point for all survey years.¹³⁻¹⁵ Therefore, to make our trend comparisons consistent with these earlier data, we used 3 years as our maximum. For an examination of 2005 colorectal screening that is consistent with the Healthy People 2010 guidelines, see Shapiro et al.¹⁶ Finally, for the PSA test, we used the ACS screening recommendation that the test be offered annually.¹⁷ Similar to other organizations, the ACS stresses that physicians should be prepared to discuss PSA testing so men can make an informed decision.

Age Groups—Age groups were selected with consideration of screening recommendations and other age-related influences on screening, such as Medicare benefits for those age 65 and older. Although the survey questions on Pap tests were asked of women age 18 and older, educational attainment is often not completed until age 25. Therefore, we limited our analysis to age 25 and older. Mammography analysis focused on women age 40 and older. Recommendations for mammography for women age 40-49 have varied over the years, making this a group of particular interest. PSA and colorectal screening were studied for individuals age 50 and older.

Other Population Covariates—Earlier studies have found that usual source of care (USOC), insurance, and immigration recency, are the strongest predictors of cancer screening.^{7,18-20} Other covariates included in this study are education, income (as a multiple of poverty ratio), race/ethnicity, and recent physician contact.

Statistical Analysis

We present two independent analyses. For the tables, we present multiple logistic regression analysis showing bivariate associations of selected demographic and health utilization covariates with screening. For ease of interpretation, adjusted percentages (called predicted margins) were derived from the logistic regression analyses. Since predicted margins are adjusted proportions or percentages instead of odds ratios, this makes their interpretation easier for the reader, particularly when the rates of screening are not small and the odds ratios do not approximate relative risks, as is the case for our screening rates. In addition, the values of predicted margins are independent of the reference level used in the logistic regression model, which is not the case for odds ratios.²¹ For the figure, we present predicted margins derived from logistic regression results that are adjusted for the covariates over time. These covariates, dependent variables, and samples analyzed for each screening modality are described in the *Test and Test Interval* section above.

For trends, as shown in Figure 1, several years of the NHIS were analyzed using logistic regression. The year of the survey was included as a covariate. Interactions were tested between the access to care variables (USOC and insurance) and year of survey. For each screening modality, four logistic regression analyses were conducted: (1) all the covariates and survey year were included as main effects only; (2) interactions between survey year and health insurance were added to the main effects model; (3) interactions between survey year and usual source of care were added to the main effects model; and (4) both interactions between survey year and health insurance, and survey year and usual source of care were added to the main effects model. The first model was determined to be the best model as it was the most parsimonious. Even though some of the interactions were statistically significant, including the interactions did not change the predicted margins when compared to the first model without interactions. Since the patterns across groups were consistent over time, Figure 1 presents results only from the main effects model. Vertical lines represent 95% confidence intervals.

Unknown responses were excluded from the analyses except for income where, because of the large number missing, a separate missing income category was used. Some categories of variables resulted in wide confidence intervals when the sample sizes in those categories were small, such as for the smaller racial/ethnic groups and for the age-specific estimates among recent immigrants.

The analyses were conducted using SAS version 8.2 and SUDAAN Release 9.0.2 which take into account the complex multistage sample design of the NHIS.⁸ Wald F-tests were used to obtain p-values for significance tests of the regression coefficients in the logistic regression models including interactions.²¹ All significance tests were two-tailed with level of significance set at $p < 0.05$.

RESULTS

Tables 1 and 2 present cancer screening test use among women and men, respectively, estimated from the 2005 NHIS, using all available data including the additional responses described above. We describe the statistically significant variables below. Of all the screening modalities measured in 2005, use of Pap test and mammography were highest at 78% and 67%, respectively, while use of home FOBT and endoscopy were low at 12% (men and women) and 20-24% (women-men), respectively. PSA use was intermediate at 41%.

2005 NHIS

Pap Smear—In 2005, 78.4% (CI 77.6-79.2) of women age 25 and older reported having a Pap test within the last 3 years. Among the age groups studied, a gradient of use was found, with women under 40 most likely (86.8%, CI 85.5-88.1) and those age 65 and older least likely to get a Pap test (64.7%, CI 62.8-66.5). Also less likely to have had a test were women with a family income less than 200% of the federal poverty ratio (76.0%, CI 74.5-77.5), or those who lacked a usual source of care (71.7%, CI 69.4-74.1). Screening increased as education level increased, with those with less than a high school education least likely (74.8%, CI 72.9-76.6) and college graduates most likely (82.4%, CI 80.0-84.0). Women having private or military insurance coverage were the most likely to have reported a Pap test (79.9%, CI 78.9-80.9), followed by those with public insurance only (76.7%, CI 74.9-78.5), and the uninsured (74.0%, CI 71.9-76.2). Immigrants were less likely than women born in the United States (78.9%, CI 78.0-79.8) to have had a Pap test, with those in the country less than 10 years least likely (70.8%, CI 66.2-75.4). Women who did not see or talk to a doctor (69.9%, CI 67.6-72.2) or an OB/GYN (70.3%, CI 69.0-71.5) in the past 12 months were less likely to report a Pap test than those who had (80.0%, CI 79.1-80.9 for doctor and 94.0%, CI 93.2-94.8 for OB/GYN). Except for the “non-Hispanic other” racial/

ethnic category, which is a compilation of very disparate populations, there were no significant differences among Hispanics, non-Hispanic whites, and non-Hispanic blacks after adjustment for the other factors.

Mammography—In 2005, 67.0% (CI 65.8-68.2) of women age 40 and older reported a mammogram within the past 2 years. Women 50-64 were more likely (71.7%, CI 70.1-73.3) than other age groups to report a recent mammogram, and there were positive associations in the prevalence of mammograms with education and income. Women without a usual source of care were less likely to report a mammogram (54.0%, CI 49.6-58.3) than those with a usual source of care (67.9%, CI 66.7-69.2). Those with private or military insurance were more likely (69.4%, CI 68.1-70.7) to report a recent mammogram than women without insurance (55.5%, CI 51.7-59.3), and women with public insurance only (63.8%, CI 60.8-66.8) were between the two. Women who did not see or talk to a doctor in the past year were far less likely to get a mammogram than those who did (44.4%, CI 40.1-48.8 vs 69.5%, CI 68.2-70.7), as were women who did not talk to or see an obstetrician or gynecologist (58.3%, CI 56.7-59.9 vs 82.5%, CI 80.8-84.2). Race/ethnicity and immigration status did not yield significant differences in mammography use.

Home FOBT—In 2005, 11.8% (CI 10.8-12.8) of women age 50 and older reported having a home FOBT within the last year. Among women without a usual source of care, 5.7% (CI 2.0-9.4) reported a home FOBT compared to 12.0% (CI 11.0-13.0) of women with a usual source of care.

Uninsured women were less likely to report a home FOBT (6.9%, CI 4.1-9.8) compared to those with private or military insurance (12.3%, CI 11.1-13.6). Women who did not see a physician were less likely than women who did (2.5%, CI 0.6-4.4 vs 12.4%, CI 11.3-13.4). In 2005, 12.3% (CI 11.3-13.3) of men age 50 and older reported a home FOBT within the last year. Men 65 and older were more likely to have the test (15.6%, CI 13.7-17.5). There was an increasing gradient with increasing education, and men who were uninsured (6.3%, CI 2.7-9.9) or did not see or talk to a doctor in the past year (3.2%, CI 1.2-5.2) were very unlikely to be screened. For both women and men, the adjusted analysis resulted in no significant differences for race/ethnicity or immigration status.

Screening colorectal endoscopy—In 2005, 19.8% (CI 18.5-21.0) of women age 50 and older reported having colorectal endoscopy for screening purposes within the last 3 years. Rates were positively associated with education and income. There was a large difference in screening between women who had seen or talked to a physician (20.6%, CI 19.3-21.8) and those who had not (7.3%, CI 3.9-10.6). A smaller difference was seen for those who had or had not seen or talked to an obstetrician or gynecologist in the past year (23.1%, CI 21.0-25.3 vs 18.2%, CI 16.7-19.6, respectively). In 2005, 23.7% (CI 22.3-25.0) of men age 50 and older reported a colorectal endoscopy for screening purposes within the last 3 years. More likely to be screened were men 65 and older (28.2%, CI 25.8-30.5), those with a usual source of care (24.1%, CI 22.7-25.6), and those who saw or talked to a doctor in the past year (25.5%, CI 24.0-26.9). Again there was a positive gradient with increasing education and age, and men with private or military coverage were much more likely to have the test (24.7%, CI 23.1-26.3) than those with no insurance (14.1%, CI 8.4-19.8). There were no significant differences among racial/ethnic or immigration groupings for men. There were racial-ethnic differences in colorectal endoscopy screening for women because rates were lower for non-Hispanic other women.

PSA—In 2005, 41.4% (CI 39.7-43.1) of men age 50 and older reported a PSA test within the last year. Men age 65 and older were more likely to get the test (52.3%, CI 49.8-54.8), as were those with a usual source of care (42.3%, CI 40.5-44.1). Men who saw or talked to a

physician in the past 12 months (45.0%, CI 43.2-46.9) were more likely to report screening than their counterparts (9.8%, CI 6.6-12.9). Those without insurance were less likely (32.8%, CI 25.7-39.8) to have the test, compared with men having private or military insurance (43.3%, CI 41.4-45.2). No significant differences were found among racial/ethnic or immigrant groupings after adjustment for other factors.

Trends, 1992-2005

Figures 1A and 1B present trends in cancer screening among women and men, respectively, from 1992 to 2005, adjusted for all characteristics shown in the tables. The vertical lines represent 95% confidence intervals. For the sake of consistency in computing the trends, we used the 2000 and 2003 method to compute the 2005 results.

Pap test use among women remained close to 80% over the entire period, although there is a suggestion of a downward trend from 2000 to 2005. Mammography rates rose steadily from 63% in 1992 to 70% in 2000, and then began to drop to 68% in 2005. Trends among women show adjusted rates for home FOBT rose from 1992 (12%) to 2000 (18%) and then fell. In 2005, it returned to the 1992 rate (12%). Among men, the adjusted rate for home FOBT rose from 1992 (10%) to 2000 (17%), was nearly unchanged until 2003 (16%), and then dropped in 2005 (13%). Colorectal endoscopy among women increased slightly between 1992 (8%) and 1998 (10%) and then rose rapidly through 2005 (20%). Adjusted rates for endoscopy rose overall for men from 14% in 1992 to 24% in 2005. Lastly, the NHIS monitored PSA for the first time in 2000. Looking at the adjusted trends, PSA use rose from 2000 (42%) to 2003 (45%), then dropped in 2005 (42%).

DISCUSSION

We found that screening rates have changed over time. Between 2003 and 2005, colorectal endoscopy screening rose, Pap testing was stable, PSA testing dropped, and as previously reported, mammography dropped.²² The lowest screening rates were found for persons without a usual source of care, those who had no physician contact in the past year, and the uninsured. The patterns of disparities we found in 2005 were consistent with those found in previous years of the NHIS.¹⁸ A review of other studies shows that factors associated with disparities have remained similar over recent years.^{7,18,23-25} However, it is important to note that, after adjustment for the other variables studied, race/ethnicity and immigration status did not yield significant differences in test usage for distinct racial-ethnic groups. It was the factors more directly related to the individual's interaction with the health care system that resulted in significant disparities.

The only cancer site for which screening increased in 2005 was colorectal, and this was due to an increase in use of endoscopy. Even when test rates increased, people without insurance or physician contact were not screened. These patterns of disparities are most clearly illustrated by colorectal endoscopy use in 2005, after the period of rapid uptake (Figure 1). The tables show that, among the uninsured, 2005 endoscopy rates were 6.5% for women and 14.1% for men. Rates were similarly low for those who did not see or talk to a physician within the past year. Even for women and men who saw a doctor within the past year, screening rates were conspicuously low, 7.3% and 8.0%, respectively.

Though use of all the modalities was strongly influenced by contact with a physician, its effect on PSA use was particularly striking. Forty-five percent of men who saw or talked to a doctor in the past 12 months reported a PSA test; in contrast, among men who did not report physician contact, only 9.8% reported the test.

As the nation considers changes to health care, it is critical to rely on scientific evidence of the effectiveness of clinical guideline dissemination. There are three essential components to the successful delivery of cancer screening: coverage, guidelines, and tracking systems.²⁶ Few health plans in the United States had all three in place in 2000. Group and staff model HMO plans were far more likely than other types of plans to have any system at all for screening delivery.²⁶ Successful cancer screening systems require the alignment of plans and clinician efforts at the practice level.²⁷ By accomplishing that, and by adhering to cancer screening guidelines and a tracking system, Veterans Affairs medical centers had higher screening rates than surrounding communities in 2004.²⁸ The greatest benefit from screening would come from extending such a delivery system to people who have never been screened for cancer according to the guidelines. Now, more than ever, we need to bring proven delivery strategies to those individuals.²⁹ Two large public health efforts are doing that. CDC's Breast and Cervical Cancer Program has increased mammography and Pap testing rates, but it appears to be underfunded.^{30,31} NCI's Cancer Collaborative Project with the Health Resources Services Administration (HRSA) is enhancing primary care services in underserved areas to include cancer screening referrals, follow-up, and treatment.³² Even so, evidence-based cancer screening coverage of underserved populations remains incomplete.

Study limitations include the use of self-reported data and exclusion of institutionalized and non-civilian populations. In addition, American Indian, Alaska Native, Asian American and Pacific Islander samples were too small to analyze separately and were included in a "non-Hispanic other" group. We report on receipt of endoscopy within 3 years, but screening guidelines indicate an interval of 5 years for sigmoidoscopy and 10 years for screening colonoscopy. Therefore, we underestimate the percentage of the population that is "up to date" for colorectal screening using current guidelines. Other studies have suggested that about 50% of the eligible population is currently in compliance with colorectal screening guidelines.^{12,16,33-35} Survey questions are not always identical from year to year, a limitation that was especially problematic for our analysis of endoscopy. Another change in data collection in 2005 reduced the number of missing responses and slightly altered recent screening rates.

CONCLUSION

Reducing late-stage cancers is a top public health priority. High rates of screening throughout the population are necessary to accomplish this goal because routine screening is important for identifying cancer at an early stage, when it is most treatable. Studies in breast²⁹ and cervical³⁶ cancer screening in organized screening programs have found that the majority of late-stage disease occurred among women never screened. So, there is a critical need to identify effective approaches to increase use among those never screened to reduce the incidence of late-stage cancers. It is equally critical that suspicious tests receive timely follow up. Ensuring health insurance coverage and a usual source of care are the factors most likely to increase use among those never screened. Because trends for most screening modalities are stable or falling and disparities have remained large, we need to continue to carefully monitor rates.

References

1. U.S. Department of Health and Human Services. Healthy People 2010: Understanding and Improving Health. 2nd ed.. U.S. Government Printing Office; Washington, DC: 2000.
2. U.S. Preventive Services Task Force. Guide to Clinical Preventive Services, Third Edition: Periodic Updates. Agency for Healthcare Research and Quality; Rockville: 2002.
3. Potosky AL, Miller BA, Albertsen PC, Kramer BS. The role of increasing detection in the rising incidence of prostate cancer. JAMA. 1995; 273:548-552. [PubMed: 7530782]

4. Legler JM, Feuer EJ, Potosky AL, Merrill RM, Kramer BS. The role of prostate-specific antigen (PSA) testing patterns in the recent prostate cancer incidence decline in the United States. *Cancer Causes Control*. 1998; 9:519–527. [PubMed: 9934717]
5. Ross LE, Berkowitz Z, Ekwueme DU. Use of the prostate-specific antigen test among U.S. men: findings from the 2005 National Health Interview Survey. *Cancer Epidemiol Biomarkers Prev*. 2008; 17:636–644. [PubMed: 18349281]
6. Ross LE, Coates RJ, Breen N, Uhler RJ, Potosky AL, Blackman D. Prostate-specific antigen test use reported in the 2000 National Health Interview Survey. *Prev Med*. 2004; 38:732–744. [PubMed: 15193893]
7. Swan J, Breen N, Coates RJ, Rimer BK, Lee NC. Progress in cancer screening practices in the United States: results from the 2000 National Health Interview Survey. *Cancer*. 2003; 97:1528–1540. [PubMed: 12627518]
8. National Center for Health Statistics. 2005 National Health Interview Survey (NHIS) public use data release (machine readable data file and documentation). June 2006 [June 24, 2008]. Available at: ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Dataset_Documentation/NHIS/2005/srvydesc.pdf
9. Lieberman DA, Holub J, Eisen G, Kraemer D, Morris CD. Utilization of colonoscopy in the United States: results from a national consortium. *Gastrointest Endosc*. 2005; 62:875–883. [PubMed: 16301030]
10. Smith RA, Cokkinides V, Brawley OW. Cancer screening in the United States, 2008: a review of current American Cancer Society guidelines and cancer screening issues. *CA Cancer J Clin*. 2008; 58:161–179. [PubMed: 18443206]
11. U.S. Preventive Services Task Force. Screening for colorectal cancer: U.S. Preventive Services Task Force recommendation statement. *Ann Intern Med*. 2008; 149:627–637. [PubMed: 18838716]
12. Pignone M, Sox HC. Screening guidelines for colorectal cancer: a twice-told tale. *Ann Intern Med*. 2008; 149:680–682. [PubMed: 18840787]
13. Byers T, Levin B, Rothenberger D, Dodd GD, Smith RA. American Cancer Society guidelines for screening and surveillance for early detection of colorectal polyps and cancer: update 1997. American Cancer Society Detection and Treatment Advisory Group on Colorectal Cancer. *CA Cancer J Clin*. 1997; 47:154–160. [PubMed: 9152173]
14. Winawer SJ, Fletcher RH, Miller L, et al. Colorectal cancer screening: clinical guidelines and rationale. *Gastroenterology*. 1997; 112:594–642. [PubMed: 9024315]
15. Rimer, BK.; Schildkraut, J.; Hiatt, RA. Cancer screening.. In: DeVita, VT.; Hellman, S.; Rosenberg, SA., editors. *Cancer: Principles & Practice of Oncology*. Lippincott; Philadelphia: 2001. p. 627–640.
16. Shapiro JA, Seeff LC, Thompson TD, Nadel MR, Klabunde CN, Vernon SW. Colorectal cancer test use from the 2005 National Health Interview Survey. *Cancer Epidemiol Biomarkers Prev*. 2008; 17:1623–1630. [PubMed: 18628413]
17. Smith RA, Cokkinides V, von Eschenbach AC, et al. American Cancer Society guidelines for the early detection of cancer. *CA Cancer J Clin*. 2002; 52:8–22. [PubMed: 11814067]
18. Hiatt RA, Klabunde C, Breen N, Swan J, Ballard-Barbash R. Cancer screening practices from National Health Interview Surveys: past, present, and future. *J Natl Cancer Inst*. 2002; 94:1837–1846. [PubMed: 12488477]
19. Breen N, Meissner HI. Toward a system of cancer screening in the United States: trends and opportunities. *Annu Rev Public Health*. 2005; 26:561–582. [PubMed: 15760301]
20. Breen N, Wagener DK, Brown ML, Davis WW, Ballard-Barbash R. Progress in cancer screening over a decade: results of cancer screening from the 1987, 1992, and 1998 National Health Interview Surveys. *J Natl Cancer Inst*. 2001; 93:1704–1713. [PubMed: 11717331]
21. Graubard BI, Korn EL. Predictive margins with survey data. *Biometrics*. 1999; 55:652–659. [PubMed: 11318229]
22. Breen N, Cronin A, Meissner HI, et al. Reported drop in mammography: is this cause for concern? *Cancer*. 2007; 109:2405–2409. [PubMed: 17503429]
23. Cardarelli R, Thomas JE. Having a personal health care provider and receipt of colorectal cancer testing. *Ann Fam Med*. 2009; 7:5–10. [PubMed: 19139443]

24. Brawarsky P, Brooks DR, Mucci LA, Wood PA. Effect of physician recommendation and patient adherence on rates of colorectal cancer testing. *Cancer Detect Prev.* 2004; 28:260–268. [PubMed: 15350629]
25. Schootman M, Jeffe DB, Reschke AH, Aft RL. Disparities related to socioeconomic status and access to medical care remain in the United States among women who never had a mammogram. *Cancer Causes Control.* 2003; 14:419–425. [PubMed: 12946036]
26. Klabunde CN, Riley GF, Mandelson MT, Frame PS, Brown ML. Health plan policies and programs for colorectal cancer screening: a national profile. *Am J Manag Care.* 2004; 10:273–279. [PubMed: 15124504]
27. Zapka JG, Puleo E, Taplin S, et al. Breast and cervical cancer screening: clinicians' views on health plan guidelines and implementation efforts. *J Natl Cancer Inst Monogr.* 2005:46–54. [PubMed: 16287885]
28. Ross JS, Keyhani S, Keenan PS, et al. Use of recommended ambulatory care services: is the Veterans Affairs quality gap narrowing? *Arch Intern Med.* 2008; 168:950–958. [PubMed: 18474759]
29. Taplin SH, Ichikawa L, Yood MU, et al. Reason for late-stage breast cancer: absence of screening or detection, or breakdown in follow-up? *J Natl Cancer Inst.* 2004; 96:1518–1527. [PubMed: 15494602]
30. Tangka FK, Dalaker J, Chattopadhyay SK, et al. Meeting the mammography screening needs of underserved women: the performance of the National Breast and Cervical Cancer Early Detection Program in 2002-2003 (United States). *Cancer Causes Control.* 2006; 17:1145–1154. [PubMed: 17006720]
31. Adams EK, Florence CS, Thorpe KE, Becker ER, Joski PJ. Preventive care: female cancer screening, 1996-2000. *Am J Prev Med.* 2003; 25:301–307. [PubMed: 14580631]
32. Taplin SH, Haggstrom D, Jacobs T, et al. Implementing colorectal cancer screening in community health centers: addressing cancer health disparities through a regional cancer collaborative. *Med Care.* 2008; 46:S74–S83. [PubMed: 18725837]
33. Ross JS, Bradley EH, Busch SH. Use of health care services by lower-income and higher-income uninsured adults. *JAMA.* 2006; 295:2027–2036. [PubMed: 16670411]
34. Cokkinides VE, Chao A, Smith RA, Vernon SW, Thun MJ. Correlates of underutilization of colorectal cancer screening among U.S. adults, age 50 years and older. *Prev Med.* 2003; 36:85–91. [PubMed: 12473428]
35. Institute of Medicine. *Access to Health Care in America.* National Academy Press; Washington, DC: 1993.
36. Leyden WA, Manos MM, Geiger AM, et al. Cervical cancer in women with comprehensive health care access: attributable factors in the screening process. *J Natl Cancer Inst.* 2005; 97:675–683. [PubMed: 15870438]

Figure 1.

Cancer tests among women and men: 1992, 1998, 2000, 2003, and 2005

Source: National Health Interview Survey

Predicted marginals from Model 1b. Data are adjusted for age, education, family income/poverty ratio, usual source of care, health insurance, race/ethnicity, immigration, and saw/talked to doctor past 12 months. Pap test and mammogram data are also adjusted by saw/talked to OB/GYN past 12 months.

Table 1

Cancer tests among women, 2005 National Health Interview Survey

Characteristic	Pap test within the last 3 years, age ≥ 25				Mammogram within the last 2 years, age ≥ 40				Home FOBT within the last year, age ≥ 50				Screening colorectal endoscopy within the last 3 years, age ≥ 50			
	N	PM ^a	(CI) ^b	p	N	PM ^a	(CI) ^b	p	N	PM ^a	(CI) ^b	p	N	PM ^a	(CI) ^b	p
Total	14194	78.4	(77.6-79.2)		9908	67.0	(65.8-68.2)		6798	11.8	(10.8-12.8)		6884	19.8	(18.5-21.0)	
Age				<0.001				<0.001				0.32				<0.001
25-39	4364	86.8	(85.5-88.1)		---	---	---		---	---	---		---	---	---	
40-49	3034	83.5	(82.0-85.0)		3047	60.0	(57.8-62.2)		---	---	---		---	---	---	
50-64	3667	78.9	(77.5-80.2)		3675	71.7	(70.1-73.3)		3648	11.3	(10.0-12.6)		3681	17.6	(16.1-19.0)	
≥ 65	3129	64.7	(62.8-66.5)		3186	68.3	(66.4-70.1)		3150	12.4	(10.8-14.0)		3203	22.8	(21.0-24.6)	
Education				<0.001				<0.001				0.15				0.001
Less than high school	2616	74.8	(72.9-76.6)		1900	61.3	(58.6-64.0)		1489	9.7	(7.5-12.0)		1501	17.2	(14.6-19.9)	
High school graduate	4055	77.7	(76.2-79.1)		3050	66.8	(64.9-68.7)		2201	11.1	(9.4-12.7)		2234	18.4	(16.4-20.3)	
Some college or AA degree	3982	78.9	(77.5-80.3)		2681	67.5	(65.5-69.6)		1708	12.7	(11.0-14.4)		1735	19.2	(17.3-21.2)	
College graduate (BA/BS)	3541	82.4	(80.8-84.0)		2277	71.4	(69.3-73.4)		1400	13.4	(11.3-15.4)		1414	24.2	(21.5-27.0)	
Family income/poverty ratio				<0.001				<0.001				0.50				0.022
<200%	4098	76.0	(74.5-77.5)		2639	61.9	(59.6-64.2)		1897	12.7	(10.7-14.7)		1917	17.4	(15.0-19.7)	
200-299%	1910	78.8	(77.0-80.6)		1292	68.5	(65.8-71.1)		897	12.6	(9.8-15.4)		910	21.4	(18.1-24.7)	
300-399%	1554	77.2	(74.9-79.5)		1048	69.0	(66.0-72.0)		670	12.2	(9.2-15.1)		670	16.6	(13.6-19.7)	
400-499%	1006	79.0	(76.3-81.6)		692	67.9	(64.4-71.3)		412	8.5	(5.4-11.6)		414	20.1	(16.0-24.3)	
$\geq 500\%$	2664	82.2	(80.3-84.0)		1919	71.5	(68.9-74.0)		1181	12.0	(9.8-14.2)		1193	23.0	(20.0-25.9)	
Unknown	2962	78.7	(77.2-80.2)		2318	66.1	(63.9-68.2)		1741	11.3	(9.4-13.1)		1780	19.1	(16.8-21.4)	
Usual source of care				<0.001				<0.001				0.023				0.57
None or hospital ER	1462	71.7	(69.4-74.1)		746	54.0	(49.6-58.3)		390	5.7	(2.0-9.4)		395	21.7	(14.4-29.1)	
Has usual source	12732	79.3	(78.4-80.2)		9162	67.9	(66.7-69.2)		6408	12.0	(11.0-13.0)		6489	19.7	(18.5-20.9)	
Health insurance				<0.001				<0.001				0.015				<0.001
Private / military	9580	79.9	(78.9-80.9)		6875	69.4	(68.1-70.7)		4595	12.3	(11.1-13.6)		4657	21.3	(20.0-22.7)	
Public only	2583	76.7	(74.9-78.5)		1991	63.8	(60.8-66.8)		1666	10.9	(9.0-12.9)		1683	17.3	(14.1-20.4)	
Uninsured	2031	74.0	(71.9-76.2)		1042	55.5	(51.7-59.3)		537	6.9	(4.1-9.8)		544	6.5	(3.7-9.2)	
Race/ethnicity				<0.001				0.038				0.98				0.007
Hispanic	2301	82.8	(80.6-85.0)		1229	67.2	(63.5-71.0)		722	11.8	(7.2-16.5)		726	16.7	(12.3-21.2)	

Characteristic	Pap test within the last 3 years, age ≥ 25				Mammogram within the last 2 years, age ≥ 40				Home FOBT within the last year, age ≥ 50				Screening colorectal endoscopy within the last 3 years, age ≥ 50			
	N	PM ^a	(CI) ^b	p	N	PM ^a	(CI) ^b	p	N	PM ^a	(CI) ^b	p	N	PM ^a	(CI) ^b	p
Non-Hispanic white	9339	77.7	(76.7-78.8)		7028	67.2	(65.8-68.6)		5044	11.8	(10.7-12.9)		5126	19.8	(18.5-21.2)	
Non-Hispanic black	2087	80.6	(78.6-82.7)		1353	68.7	(65.9-71.5)		840	11.3	(8.6-13.9)		842	23.3	(19.4-27.3)	
Non-Hispanic other	467	70.5	(66.4-74.5)		298	57.6	(50.5-64.8)		192	12.3	(5.9-18.7)		190	13.2	(9.0-17.4)	
Immigration				0.001				0.35				0.86				0.73
In U.S. < 10 years	567	70.8	(66.2-75.4)		160	72.6	(64.0-81.1)		59	8.5	(0.0-18.9)		58	14.0	(0.0-28.3)	
In U.S. $\geq 10+$ years	1767	76.7	(74.3-79.2)		1240	68.6	(65.2-72.1)		798	12.0	(8.1-15.9)		806	19.1	(15.2-23.0)	
Born in U.S.	11860	78.9	(78.0-79.8)		8508	66.7	(65.5-68.0)		5941	11.8	(10.7-12.9)		6020	19.8	(18.6-21.1)	
Saw/talked to doctor past 12 months				<0.001				<0.001				<0.001				<0.001
Yes	12539	80.0	(79.1-80.9)		8911	69.5	(68.2-70.7)		6231	12.4	(11.3-13.4)		6319	20.6	(19.3-21.8)	
No	1655	69.9	(67.6-72.2)		997	44.4	(40.1-48.8)		567	2.5	(0.6-4.4)		565	7.3	(3.9-10.6)	
Saw/talked to OB/GYN past 12 months				<0.001				<0.001				0.043				<0.001
Yes	5907	94.0	(93.2-94.8)		3453	82.5	(80.8-84.2)		1941	13.2	(11.4-15.1)		1966	23.1	(21.0-25.3)	
No	8287	70.3	(69.0-71.5)		6455	58.3	(56.7-59.9)		4857	11.1	(9.9-12.2)		4918	18.2	(16.7-19.6)	

^aPM = Predicted marginal from logistic regression model using all variables shown in the table.

^bCI: 95% confidence interval, calculated from standard errors using the normal approximation

Table 2

Cancer tests among men, 2005 National Health Interview Survey

Characteristic	PSA test within the last year, age ≥ 50				Home FOBT within the last year, age ≥ 50				Screening colorectal endoscopy within the last 3 years, age ≥ 50			
	N	PM ^a	(CI) ^b	p	N	PM ^a	(CI) ^b	p	N	PM ^a	(CI) ^b	p
Total	4952	41.4	(39.7-43.1)		5092	12.3	(11.3-13.3)		5132	23.7	(22.3-25.0)	
Age				<0.001				<0.001				<0.001
50-64	2912	34.3	(32.2-36.5)		2988	10.2	(9.0-11.5)		3009	20.8	(18.9-22.7)	
≥ 65	2040	52.3	(49.8-54.8)		2104	15.6	(13.7-17.5)		2123	28.2	(25.8-30.5)	
Education				<0.001				0.002				0.001
Less than high school	987	34.5	(30.2-38.9)		1039	8.8	(6.8-10.8)		1039	20.7	(17.7-23.7)	
High school graduate	1408	38.3	(35.5-41.1)		1456	11.3	(9.4-13.2)		1467	20.7	(18.3-23.0)	
Some college or AA degree	1175	42.9	(39.8-46.0)		1202	13.4	(11.2-15.7)		1218	24.4	(21.9-26.9)	
College graduate (BA/BS)	1382	46.8	(44.2-49.5)		1395	14.7	(12.6-16.8)		1408	27.4	(24.8-30.1)	
Family income/poverty ratio				0.012				0.11				0.002
<200%	1059	36.7	(33.1-40.2)		1107	14.5	(11.6-17.4)		1111	19.1	(16.0-22.2)	
200-299%	613	37.9	(33.9-42.0)		632	13.9	(10.6-17.1)		641	19.7	(16.3-23.0)	
300-399%	516	42.1	(37.6-46.6)		532	14.0	(10.6-17.3)		537	21.5	(17.7-25.4)	
400-499%	396	44.0	(38.7-49.4)		401	10.4	(7.1-13.7)		406	24.1	(19.2-28.9)	
$\geq 500\%$	1221	44.3	(41.2-47.5)		1247	12.0	(10.2-13.9)		1257	27.1	(24.3-29.9)	
Unknown	1147	41.5	(38.3-44.6)		1173	10.7	(8.7-12.6)		1180	25.3	(22.6-28.0)	
Usual source of care				<0.001				0.017				0.002
None or hospital ER	487	25.0	(18.9-31.0)		489	6.4	(2.8-10.1)		488	14.4	(9.4-19.4)	
Has usual source	4465	42.3	(40.5-44.1)		4603	12.6	(11.6-13.6)		4644	24.1	(22.7-25.6)	
Health insurance				<0.001				0.030				0.005
Private / military	3589	43.3	(41.4-45.2)		3682	12.9	(11.8-14.1)		3716	24.7	(23.1-26.3)	
Public only	929	34.6	(31.0-38.1)		969	11.0	(8.4-13.6)		973	21.1	(17.9-24.3)	
Uninsured	434	32.8	(25.7-39.8)		441	6.3	(2.7-9.9)		443	14.1	(8.4-19.8)	
Race/ethnicity				0.63				0.66				0.30
Hispanic	520	43.0	(36.6-49.5)		530	14.6	(9.9-19.3)		529	22.6	(16.9-28.3)	
Non-Hispanic white	3671	41.4	(39.5-43.4)		3787	12.4	(11.3-13.4)		3821	23.5	(21.9-25.0)	
Non-Hispanic black	605	42.2	(37.3-47.2)		612	11.4	(8.3-14.5)		620	27.7	(23.0-32.4)	

Characteristic	PSA test within the last year, age ≥ 50				Home FOBT within the last year, age ≥ 50				Screening colorectal endoscopy within the last 3 years, age ≥ 50			
	N	PM ^a	(CI) ^b	p	N	PM ^a	(CI) ^b	p	N	PM ^a	(CI) ^b	p
Non-Hispanic other	156	35.8	(25.5-46.0)		163	11.0	(3.6-18.3)		162	21.2	(12.3-30.2)	
Immigration				0.041				0.040				0.90
In U.S. < 10 years	65	36.6	(16.3-56.8)		70	2.5	(0.0-6.8)		69	27.3	(11.3-43.3)	
In U.S. $\geq 10+$ years	560	34.5	(28.9-40.0)		570	8.6	(5.0-12.1)		568	24.0	(18.5-29.4)	
Born in U.S.	4327	42.2	(40.3-44.0)		4452	12.8	(11.7-14.0)		4495	23.6	(22.2-25.0)	
Saw/talked to doctor past 12 months				<0.001				<0.001				<0.001
Yes	4253	45.0	(43.2-46.9)		4376	13.3	(12.2-14.4)		4415	25.5	(24.0-26.9)	
No	699	9.8	(6.6-12.9)		716	3.2	(1.2-5.2)		717	8.0	(5.4-10.5)	

^aPM = Predicted marginal from logistic regression model using all variables shown in the table.

^bCI: 95% confidence interval, calculated from standard errors using the normal approximation