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# Awareness of Cancer Susceptibility Genetic Testing:

## The 2000, 2005, and 2010 National Health Interview Surveys

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## Abstract

**Background—**Genetic testing for several cancer susceptibility syndromes is clinically available; however, existing data suggest limited population awareness of such tests.

**Purpose—**To examine awareness regarding cancer genetic testing in the U.S. population aged ≥25 years in the 2000, 2005, and 2010 National Health Interview Surveys.

**Methods—**The weighted percentages of respondents aware of cancer genetic tests, and percent changes from 2000–2005 and 2005–2010, overall and by demographic, family history, and healthcare factors were calculated. Interactions were used to evaluate the patterns of change in awareness between 2005 and 2010 among subgroups within each factor. To evaluate associations with awareness in 2005 and 2010, percentages were adjusted for covariates using multiple logistic regression. The analysis was performed in 2012.

**Results—**Awareness decreased from 44.4% to 41.5% ($p<0.001$) between 2000 and 2005, and increased to 47.0% ($p<0.001$) in 2010. Awareness increased between 2005 and 2010 in most subgroups, particularly among individuals in the South ($p_{\text{-interaction}}=0.03$) or with a usual place of care ($p_{\text{-interaction}}=0.01$). In 2005 and 2010, awareness was positively associated with personal or family cancer history and high perceived cancer risk, and inversely associated with racial/ethnic minorities, age 25–39 or ≥60 years, male gender, lower education and income levels, public or no health insurance, and no provider contact in 12 months.

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**Conclusions—**Despite improvement from 2005 to 2010, ≤50% of the U.S. adult population was aware of cancer genetic testing in 2010. Notably, disparities persist for racial/ethnic minorities and individuals with limited health care access or income.

## Introduction

Approximately 5–10% of cancers diagnosed in the U.S. are associated with hereditary cancer susceptibility syndromes.[1] During the last two decades, clinical genetic testing has become available for several cancer susceptibility syndromes.[2] When used appropriately, genetic testing can provide valuable information for cancer risk assessment and management. Despite widespread availability, cancer genetic counseling and testing services remain underutilized in oncology and primary care settings.[3–4] This may, in part, be due to insufficient knowledge among providers[5–7] and lack of patient awareness.[8]

During the last decade, efforts have been made by the public health, medical, and scientific community to inform the public about concepts such as family history, hereditary cancer risk, and genetic testing for inherited cancer susceptibility. For example, in 2004, the Surgeon General declared Thanksgiving to be National Family History Day, and the Family Health History Initiative (www.hhs.gov/familyhistory/) was launched to promote awareness and improve family history information ascertainment.[9] Additionally, mass media delivered via news, entertainment, advertising, and public education campaigns have been instrumental in disseminating information on genetic concepts to the public. This information has likely set the stage for raising levels of knowledge, expectations, and concerns about cancer susceptibility genetic testing.[10]

Other factors that might influence cancer genetic testing awareness include direct-to-consumer (DTC) advertising of cancer genetic testing and federal regulations of genetic information. Myriad Genetics Laboratories, Inc. (Myriad), the sole provider of clinical *BRCA* testing in the U.S., launched several DTC campaigns in major cities between 2002 and 2009. In addition, an increasing number of companies provide genomic profiling services for health assessment, including cancer risk prediction.[11] In May 2008, the Genetic Information Nondiscrimination Act (GINA), which sets a minimum standard of protection against genetic discrimination in employment and health insurance, was signed into law.

Despite increased public exposure to genetic testing, little is known about the levels of public awareness. Prior studies have documented awareness at single time points.[8,12–16] This study evaluated changes in awareness of genetic testing for cancer risk in 2000, 2005, and 2010, as well as factors associated with awareness in 2005 and 2010.

## Methods

### Survey Design

The National Health Interview Survey (NHIS), conducted annually by the National Center for Health Statistics (CDC, Hyattsville MD), employs a stratified, multistage, cluster sample design in which African Americans and Hispanics are oversampled. An in-person, computer-assisted household interview is conducted by U.S. Census Bureau interviewers to

obtain basic health and demographic information on the U.S. population. A more detailed description of the 2000, 2005, and 2010 surveys can be obtained at: www.cdc.gov/nchs/about/major/nhis/quest_data_related_1997_forward.htm.

Every 5 years since 2000, a Cancer Control Module was added to the core questionnaire, and was administered to adults aged ≥18 years to assess knowledge, attitudes, and practices concerning cancer-related health behaviors and screening. The module included questions about awareness and use of genetic tests for inherited cancer susceptibility as well as family history of cancer in first-degree relatives (FDR; i.e., parents, siblings, and children). Genetic testing was first defined for the respondents as: *testing your blood to see if you carry genes which may predict a greater chance of developing cancer at some point in your life. This does not include tests to determine if you have cancer now*. Respondents were then asked: *Have you ever heard of genetic testing to determine if a person is at greater risk of developing cancer?*

## Statistical Analysis

The analysis was restricted to respondents aged ≥25 years because educational level is established for most people by that age. Respondents who did not report whether they had heard of cancer genetic testing were excluded (1485 for the year 2000, 1922 for 2005, and 1985 for 2010).

In 2000, 27,405 NHIS respondents aged ≥25 years (11,333 answered *yes*, 15,878 *no*, and 194 *did not know*) were included for analysis. In 2005, 26,402 (10,305 *yes*, 15,832 *no*, and 274 *did not know*) were included. In 2010, 22,371 (9662 *yes*, 12,624 *no*, and 85 *did not know*) were included. Each respondent was assigned a base sampling weight, which was the inverse of the probability of the respondent being selected in the stratified multistage cluster sample design used in these surveys. The sampling weight was further adjusted for survey non-response by multiplying the base weight by the ratio of participating individuals to eligible individuals within each sampling stratum. Adjustment for post-stratification to known population totals within specific demographic categories was performed to obtain a final sampling weight for each respondent, which was used in the weighted analyses. Weighted percentages and 95% CIs were calculated for the overall population and subgroups within each demographic, personal and family history of cancer, and healthcare factor, to estimate the percentage of the U.S. population who was aware of genetic tests for increased cancer risk in 2000, 2005, and 2010. Point percentage differences between 2000 and 2005, and 2005 and 2010 were assessed using t-tests.[17] Demographic factors (race/ethnicity, age group, gender, region of residence, education, and family income), healthcare factors (usual place of care, health insurance, and whether the respondent last saw or spoke with a health professional within the past 12 months), and a composite personal or family history of cancer (breast and/or ovarian, any other cancer, and none) were included in the multiple logistic regression modeling used to estimate adjusted sample-weighted percentages, also called predicted marginals. A separate multiple logistic regression model was used to estimate the adjusted percentages from the combined 2005 and 2010 data for each factor. Each model included all of these factors as main effects and an interaction term between the factor being examined and year.[17] The results from these models yielded year-

specific adjusted percentages, standardized to the distribution of the covariates for the combined 2005 and 2010 U.S. populations, for each factor, 95% CIs around the percentages, *p*-values for the association of each factor with genetic test awareness within the year, and *p*-values for the Wald-*F* global tests of interaction between the factor and year. Significant interactions indicate whether patterns of cross-sectional associations for the subgroups within a factor changed from 2005–2010. The 2000 data were not included in this analysis because results were previously reported,[8] and this paper focused on the 2005–2010 period, when genetic tests became more available. Respondents who answered *did not know* to having heard of genetic tests and those with a missing value for at least one of these variables (7.4%) were excluded from the regression analysis. Compared with those included, slightly larger proportions of excluded respondents were non-whites, from the Northeast, aged ≥60 years, had no college education, income <$35,000, and public or no insurance. SAS v.9.1 (SAS Institute Inc., Cary NC) and SAS-callable SUDAAN v.10.0.1 (Research Triangle Research, Research Triangle Park NC) statistical software was used to conduct the analyses in 2012. All reported *p*-values are two-sided.

## Results

Weighted unadjusted percentage differences in awareness of genetic testing between 2000 and 2005, and between 2005 and 2010, are shown in Table 1 for the total and various subgroups. Overall awareness in the U.S. population aged ≥25 years was 2.9 percentage points lower in 2005 than 2000 (41.5% vs 44.4%, $p<0.001$). Corresponding decreases between 2000 and 2005 were observed across all subgroups, except those who were aged ≥60 years at the time of the survey (Table 1). Between 2005 and 2010, overall awareness increased by 5.5 percentage points (41.5% vs 47.0%, $p<0.001$). Awareness increased in most subgroups, with the highest percentage point increases observed in non-white American Indians (16.1 percentage points, $p<0.05$), individuals who lived in the South (8.2 percentage points, $p<0.001$), those aged ≥60 years (8.0 percentage points, $p<0.001$), those with a personal or family history of breast and/or ovarian cancer (8.0 percentage points, $p<0.001$), or those who perceived their cancer risk to be “high” (8.4 percentage points, $p<0.001$). Moreover, the weighted adjusted percentages for each population subgroup who had heard of cancer genetic testing in 2005 and 2010 (Table 2) showed that significantly higher increases occurred among respondents living in the South ($p=0.03$, test for interaction between region and year) and those with a usual place of care ($p=0.01$, test for interaction between usual place of care and year).

In both 2005 and 2010 (Table 2), test awareness was positively associated with having a personal or family history of cancer, and a “high” perceived cancer risk, but inversely associated with Asian, Hispanic, or African-American race/ethnicity, age 25–39 or ≥60 years, male gender, lower levels of education, lower annual household income, public or no health insurance, and no provider contact in 12 months. Within the racial/ethnic subgroups, Asians had the lowest level of awareness, 26.4% in 2005 and 29.4% in 2010. Respondents in the 40–59 age group had greater awareness than younger or older respondents ($p<0.0001$ in both 2005 and 2010). Compared to women, men had lower awareness of cancer genetic testing (38.8% vs 46.7%, $p<0.0001$ in 2005; 43.2% vs 52.1%, $p<0.0001$ in 2010). Another striking difference was education, with significant association in both 2005 and 2010

($p<0.0001$). Specifically, markedly lower awareness was reported among those with a less than high school education than those with a bachelor's or higher education level (25.2% vs 55.4% in 2005; 28.9% vs 60.2% in 2010).

## Discussion

In this study, cancer genetic testing awareness decreased between 2000 and 2005 and increased between 2005 and 2010. Despite the increase, awareness remained low in 2010, particularly in certain socioeconomic and race/ethnic subgroups. Limited awareness about cancer genetic testing is concerning, as it would likely contribute to suboptimal utilization of risk-appropriate genetic counseling and testing services.

It is unclear why reported cancer genetic testing awareness overall and across most subgroups declined between 2000 and 2005. Genetic testing for a majority of the more prevalent cancer susceptibility syndromes became more commonly utilized in the early 2000s.[2] Although NHIS respondents were provided a definition prior to being asked if they had heard of genetic testing for cancer susceptibility, more respondents in 2000 may have confused genetic tests with cancer screening or other tests. This could have resulted in inflated genetic testing awareness estimates in the 2000 survey, as respondents reported having heard of other types of testing as genetic testing. The Family Health History Initiative, launched in 2004 by the General Surgeon, provided education on disease risk based on family history,[9] and increased utilization of mass media to promote health communication[10] might have improved public understanding of genetics, including that specific to cancer risk. Thus, the lower awareness levels in 2005 may more accurately reflect the public's knowledge regarding cancer genetic testing (i.e., the higher level reported in the year 2000 survey might have included a positive response to other types of testing, for example, prostate-specific antigen cancer screening).

Between 2005 and 2010, cancer genetic testing awareness increased across all demographic, personal and family cancer history, and healthcare subgroups. During the last several years, DTC advertising of cancer genetic testing has become more common in the U.S.[18] Myriad launched its first DTC campaigns in two major U.S. cities beginning in 2002, followed by a larger 2007 campaign in the Northeastern U.S.[19] These campaigns targeted women aged 25–54 years in the general population and included television, radio, and print advertisements.[20] A survey of consumers and providers conducted after the first campaign showed that more residents in target cities than in comparison cities reported having heard of the test in the media,[21] suggesting that DTC advertisement might have contributed to the increased public awareness of cancer genetic testing. The present study showed that respondents with a personal or family history of breast and/or ovarian cancer (target cancers for Myriad's *BRCA* genetic test) had the highest percentage point increase in awareness compared to those with a personal or family history of other cancer or no cancer. Furthermore, with the widespread application of genome-wide association studies to identify genetic variants associated with cancer risk and advances in sequencing technologies, more companies now provide genomic profiling services for risk prediction[11] and advertise directly to consumers using multiple channels including the Internet, television, radio, and print.[22–24] Although only some of these companies offered genetic testing purported to evaluate cancer risk,[22] exposure to

advertisements might have raised awareness about genetic risk evaluation. Thus, with the increase in DTC advertisement of cancer genetic and genomic testing, it is likely that more of the general population was exposed to information about genetic health risk assessment either through the media or healthcare providers. In addition, the passage of GINA in 2008 to protect individuals from genetic discrimination may have facilitated increased discussion of genetic information and testing.

Although awareness increased between 2005 and 2010 across all examined factors, some subgroups showed greater increases compared with others within the same factor, namely individuals living in the South or with a usual place of care. Awareness in the South was much lower than elsewhere in 2005, but was comparable to the general population in 2010. The increase in the South may be partly attributed to Myriad's DTC campaign that focused on the two most populous southern states, Texas and Florida, between 2008 and 2009,[25] and perhaps to other media exposure or other factors not measured in this study.

Despite overall increases in 2010, only 47% of respondents aged ≥25 years reported having heard of genetic testing, with Asians and Hispanics reporting much lower levels of awareness. Previous studies examining racial and ethnic disparities in awareness of genetic testing for cancer risk using 2000 and 2005 NHIS data showed substantial disparities that were partially explained by education, length of residence in the U.S., and degree of acculturation among Hispanics.[15–16] Moreover, minority women were less aware of the availability of genetic testing and utilized testing less often, even in high-risk settings, with potential barriers including concern about the misuse of genetic information and unfamiliarity with the concept of preventive medicine among recent immigrants.[26–29]

Age was also significantly associated with awareness. Respondents aged 40–59 years reported higher awareness than younger and older groups. It is possible that this age group has more access to the media and DTC advertising, and is consequently more exposed to genetic testing information. More women reported having heard of cancer genetic testing than men. This is consistent with prior studies documenting that women are generally more knowledgeable about their family cancer history[30–32] and more likely to seek health information.[33] Myriad's DTC campaign was focused on women and might have contributed to the gender gap in awareness. Lower levels of education and income were also associated with lower awareness. These findings likely represent lack of access to health information among these subgroups, particularly about newer genetic technologies, both through the media and healthcare providers. Lastly, the association between a personal or family history of cancer and higher awareness suggests that cancer genetic counseling and testing of individuals potentially at increased risk have become more widely integrated into clinical practice. Individuals with a personal or family history of a common cancer may also be more likely to seek information to explain their personal and/or family history of cancer.

These national survey results suggest that some U.S. population subgroups lack access to cancer genetics information. Moreover, the factors associated with lower awareness from the 2005 and 2010 NHIS data are similar to those observed in 2000,[8] indicating persistent health disparities in lower socioeconomic and racial/ethnic subgroups. A recent review identified several access barriers to genetic services in minority populations, including financial

constraints, access to specialists, language/cultural differences, awareness, medical mistrust, and fear of discrimination.[34]

This study used data from a large, nationally representative survey to estimate the prevalence of cancer genetic testing awareness in the U.S. population early in the clinical adoption of such tests and over a 10-year period. These unique, cross-sectional data provided the ability to investigate trends in awareness and to identify factors associated with these trends. Additionally, the large NHIS sample size made it possible to distinguish differences in test awareness among major demographic subgroups and to identify factors associated with disparities in risk assessment. Identification of these factors has the potential to provide insight into areas for intervention. Although there are numerous strengths, these findings should be considered in light of specific limitations. First, awareness was based on self-reports, which are subject to individual interpretation. Second, although the overall awareness level was <50%, whether the reported awareness was clinically relevant is outside the scope of this analysis. We did not evaluate risk levels based on personal and family cancer history or examine awareness among respondents for whom genetic cancer risk evaluation would have been clinically appropriate. Only those with a personal and/or family history that is likely to confer increased familial cancer risk or is suggestive of a hereditary cancer syndrome would have benefited clinically from knowledge about the availability of genetic cancer risk evaluation. A study based on NHIS survey data focusing on genetic cancer risk levels and utilization of genetic tests could shed light on clinical appropriateness. Another limitation is that the definition given to the respondents did not distinguish between predictive single-gene genetic testing for a known cancer predisposition syndrome and genomic profiling. Previous studies have shown that up to 29% of the surveyed populations reported having knowledge of genomic profiling for health risk[35]; thus, it is not clear how much of the awareness reported in this study is related to genomic profiling, and therefore not clinically relevant. Furthermore, the source of knowledge was not collected; therefore, we cannot ascertain which factors most likely contributed to the increase in public awareness of cancer genetic testing. Knowing this information would have been valuable in focusing the efforts on the most effective mechanism.

In conclusion, this study showed that awareness of cancer genetic tests is increasing, but as of 2010, slightly over half of the U.S. population had not heard of such tests, and disparities persist for racial/ethnic minorities and people with limited healthcare access or income. Thus, intervention efforts are needed to improve awareness, with a special focus on low socioeconomic and minority subgroups to improve risk-appropriate access to cancer genetics services and overall health care in these populations.

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**Table 1**

Prevalence of cancer genetic test awareness: The 2000, 2005, and 2010 National Health Interview Surveys

| | NHIS 2000 | | NHIS 2005 | | NHIS 2010 | | Percentage point difference[b] | |
|---|---|---|---|---|---|---|---|---|
| **Population characteristics** | **Total number** | **%[a] (95% CI)** | **Total number** | **%[a] (95% CI)** | **Total number** | **%[a] (95% CI)** | **2000 to 2005** | **2005 to 2010** |
| **Total** | 27,405 | 44.4 (43.6, 45.2) | 26,402 | 41.5 (40.7, 42.3) | 22,371 | 47.0 (46.1, 48.0) | −2.9*** | 5.5*** |
| ***Demographic factors*** | | | | | | | | |
| **Race/ethnicity** | 27,405 | | 26,402 | | 22,371 | | | |
| Non-Hispanic white | 18,316 | 49.9 (48.9, 0.8) | 17,383 | 47.7 (46.7, 48.8) | 12,975 | 54.4 (53.2, 55.5) | −2.1** | 6.6*** |
| Non-Hispanic black | 3,728 | 32.9 (30.9, 35.0) | 3,533 | 30.3 (28.3, 32.3) | 3,519 | 34.5 (32.5, 36.6) | −2.6* | 4.2** |
| Hispanic | 4,313 | 20.6 (19.0, 22.3) | 4,356 | 18.0 (16.7, 19.4) | 4,084 | 23.7 (22.1, 25.3) | −2.6* | 5.6*** |
| Asian | 679 | 27.9 (24.2, 32.1) | 759 | 27.1 (23.5, 31.1) | 1,386 | 32.9 (29.8, 36.1) | −0.8 | 5.8* |
| American Indians/Alaskan Natives | 140 | 32.3 (23.6, 42.3) | 112 | 28.5 (19.7, 39.3) | 94 | 44.6 (32.6, 57.3) | −3.8 | 16.1* |
| Other | 229 | 49.7 (42.1, 57.4) | 259 | 42.4 (35.3, 49.8) | 313 | 51.6 (44.3, 58.8) | −7.3 | 9.2 |
| **Region** | 27,405 | | 26,402 | | 22,371 | | | |
| Northeast | 5,172 | 46.7 (44.9, 48.5) | 4,562 | 44.1 (42.5, 45.8) | 3,610 | 48.3 (46.2, 50.3) | −2.6* | 4.1** |
| Midwest | 6,311 | 48.7 (47.0, 50.3) | 6,185 | 46.8 (45.1, 48.6) | 4,920 | 51.5 (49.4, 53.6) | −1.8 | 4.6*** |
| South | 9,927 | 41.0 (39.7, 42.4) | 9,729 | 36.6 (35.1, 38.1) | 8,230 | 44.8 (43.2, 46.4) | −4.5*** | 8.2*** |
| West | 5,995 | 43.0 (41.3, 44.6) | 5,926 | 41.3 (39.6, 43.0) | 5,611 | 45.1 (43.2, 47.0) | − 1.7 | 3.8** |
| **Age group (years)** | 27,405 | | 26,402 | | 22,371 | | | |
| 25–39 | 9,348 | 43.7 (42.5, 44.9) | 8,130 | 39.0 (37.7, 40.3) | 6,852 | 42.6 (41.0, 44.2) | −4.7*** | 3.6*** |
| 40–59 | 10,557 | 50.4 (49.2, 51.5) | 10,702 | 46.1 (44.9, 47.4) | 8,631 | 51.8 (50.4, 53.2) | −4.2*** | 5.7*** |
| ≥60 | 7,500 | 35.5 (34.3, 36.8) | 7,570 | 36.8 (35.5, 38.1) | 6,888 | 44.8 (43.2, 46.3) | 1.2 | 8.0*** |
| **Gender** | 27,405 | | 26,402 | | 22,371 | | | |
| Male | 11,811 | 41.6 (40.5, 42.7) | 11,541 | 37.6 (36.4, 38.7) | 9,836 | 42.5 (41.3, 43.7) | −4.0*** | 4.9*** |
| Female | 15,594 | 47.1 (46.1, 48.1) | 14,861 | 45.1 (44.1, 46.2) | 12,535 | 51.3 (50.0, 52.5) | −1.9** | 6.1*** |

| Population characteristics | NHIS 2000 Total number | NHIS 2000 %[a] (95% CI) | NHIS 2005 Total number | NHIS 2005 %[a] (95% CI) | NHIS 2010 Total number | NHIS 2010 %[a] (95% CI) | Percentage point difference[b] 2000 to 2005 | Percentage point difference[b] 2005 to 2010 |
|---|---|---|---|---|---|---|---|---|
| **Education** | 27,226 | | 26,159 | | 22,282 | | | |
| Less than high school graduate | 5,672 | 19.7 (18.3, 21.2) | 4,858 | 17.3 (16.0, 18.7) | 3,808 | 19.9 (18.2, 21.6) | −2.4* | 2.6* |
| High school graduate | 8,011 | 37.6 (36.4, 38.9) | 7,450 | 32.9 (31.5, 34.2) | 5,850 | 36.9 (35.3, 38.5) | −4.8*** | 4.0*** |
| Some college/Associates degree | 7,162 | 51.4 (49.9, 52.9) | 6,991 | 46.9 (45.3, 48.5) | 6,331 | 52.3 (50.8, 53.9) | −4.4*** | 5.4*** |
| Bachelors degree or higher | 6,381 | 62.8 (61.5, 64.1) | 6,860 | 59.3 (57.9, 60.5) | 6,293 | 63.4 (61.9, 65.0) | −3.5*** | 4.2*** |
| **Family income** | 27,405 | | 26,402 | | 22,371 | | | |
| <$20,000 | 7,487 | 28.1 (26.8, 29.5) | 6,375 | 24.6 (23.2, 26.0) | 5,083 | 29.0 (27.4, 30.7) | −3.6*** | 4.4*** |
| $20,000 to <$35,000 | 6,042 | 37.0 (35.3, 38.6) | 5,573 | 33.3 (31.5, 35.1) | 4,271 | 37.2 (35.2, 39.2) | −3.7** | 3.9** |
| $35,000 to <$55,000 | 5,476 | 45.4 (43.9, 47.0) | 5,101 | 40.5 (38.8, 42.3) | 4,411 | 43.4 (41.5, 45.2) | −4.9*** | 2.9* |
| $55,000 to <$75,000 | 3,443 | 50.7 (48.6, 52.8) | 3,227 | 46.2 (44.3, 48.1) | 2,722 | 50.4 (48.1, 52.7) | −4.5** | 4.2** |
| ≥$75,000 | 4,958 | 59.0 (57.2, 60.8) | 6,126 | 54.2 (52.7, 55.8) | 5,884 | 60.5 (58.9, 62.0) | −4.8*** | 6.2*** |
| ***Personal/family cancer history and perceived cancer risk in self*** | | | | | | | | |
| **Cancer history in self or first-degree relatives** | 27,282 | | 26,181 | | 22,271 | | | |
| Breast or ovarian | 2,909 | 51.2 (49.1, 53.3) | 3,121 | 49.3 (47.3, 51.3) | 2,830 | 57.3 (55.0, 59.5) | −1.9 | 8.0*** |
| Cancer other than breast and ovarian | 8,976 | 47.7 (46.6, 48.9) | 8,681 | 46.4 (45.0, 47.7) | 7,381 | 51.7 (50.2, 53.1) | −1.4 | 5.3*** |
| None | 15,397 | 41.3 (40.3, 42.3) | 14,379 | 37.1 (36.1, 38.2) | 12,060 | 41.6 (40.3, 42.9) | −4.2*** | 4.4*** |
| **Perceived cancer risk in self[c]** | 25,419 | | 24,466 | | 21,225 | | | |
| High (more likely) | 2,848 | 48.6 (46.5, 50.7) | 3,260 | 45.6 (43.6, 47.7) | 2,672 | 54.0 (51.7, 56.2) | −3.0* | 8.4*** |
| Medium (as likely) | 7,548 | 50.8 (49.4, 52.2) | 12,962 | 43.4 (42.2, 44.6) | 10,428 | 49.4 (48.2, 50.7) | −7.4*** | 6.0*** |
| Low (less likely) | 15,023 | 41.9 (40.8, 43.0) | 8,244 | 40.0 (38.8, 41.3) | 8,125 | 43.3 (42.0, 44.7) | −1.9* | 3.3*** |
| ***Health care factors*** | | | | | | | | |
| **Usual place of care** | 27,387 | | 26,383 | | 22,364 | | | |
| Yes | 23,492 | 46.0 (45.2, 46.8) | 22,679 | 42.8 (41.9, 43.6) | 18,661 | 49.1 (48.1, 50.1) | −3.2*** | 6.3*** |
| No or hospital ER | 3,895 | 34.6 (32.7, 36.6) | 3,704 | 33.4 (31.7, 35.1) | 3,703 | 35.9 (34.0, 37.8) | −1.3 | 2.5 |

| Population characteristics | NHIS 2000 | | NHIS 2005 | | NHIS 2010 | | Percentage point difference[b] | |
|---|---|---|---|---|---|---|---|---|
| | Total number | %[a] (95% CI) | Total number | %[a] (95% CI) | Total number | %[a] (95% CI) | 2000 to 2005 | 2005 to 2010 |
| **Saw/spoke with a health care professional in the past 12 months** | 27,338 | | 26,328 | | 22,348 | | | |
| Yes | 22,791 | 46.1 (45.2, 46.9) | 22,058 | 43.5 (42.6, 44.3) | 18,562 | 49.0 (48.0, 50.0) | −2.6*** | 5.6*** |
| No | 4,547 | 36.7 (35.0, 38.4) | 4,270 | 31.8 (30.2, 33.5) | 3,786 | 37.0 (34.9, 39.1) | −4.9*** | 5.1*** |
| **Health insurance** | 27,304 | | 26,343 | | 22,318 | | | |
| Private or military | 19,444 | 49.3 (48.4, 50.2) | 17,968 | 46.7 (45.7, 47.7) | 14,018 | 54.0 (53.0, 55.1) | −2.5*** | 7.3*** |
| Public only or none | 7,860 | 29.2 (27.9, 30.5) | 8,375 | 27.6 (26.4, 28.8) | 8,300 | 32.2 (30.9, 33.6) | −1.6 | 4.6*** |

[a] Percentages are weighted to the U.S. civilian non-institutionalized population. Estimates reflect population prevalence of test awareness unadjusted for covariates.

[b] t-test.

[c] Question wording was different in 2000 and 2005/2010. In 2000, the question was: *Would you say your risk of getting cancer in the future is low, medium, or high?* In 2005 and 2010, it was: *Compared to the average man/woman your age, would you say that you are more likely to get cancer, less likely, or about as likely?*

* $p<0.05$,

** $p<0.01$,

*** $p<0.001$.

**Table 2**

Variables associated with cancer genetic test awareness, 2005 and 2010 combined data

| Population characteristics | Percentage[a] (95% CI) | | Wald-*F* global tests of interaction[b] |
|---|---|---|---|
| | 2005 | 2010 | |
| **Race/ethnicity** | | | |
| Non-Hispanic white | 46.7 (45.7, 47.7) | 51.9 (50.9, 52.9) | 0.8 |
| African American | 37.2 (35.0, 39.4) | 40.9 (38.6, 43.2) | |
| Hispanic | 28.5 (26.5, 30.5) | 33.2 (31.2, 35.2) | |
| Asian/Pacific Islander | 26.4 (22.7, 30.1) | 29.4 (26.5, 32.3) | |
| American Indian/Alaskan Native | 33.1 (23.9, 42.3) | 45.9 (33.4, 58.4) | |
| Other | 46.5 (38.5, 54.5) | 53.3 (46.6, 60.0) | |
| | ***p*<0.0001** | ***p*<0.0001** | |
| **Region of U.S.** | | | |
| Northeast | 43.5 (41.7, 45.3) | 47.3 (45.3, 49.3) | **0.03** |
| Midwest | 45.4 (43.8, 47.0) | 49.7 (47.9, 51.5) | |
| South | 39.8 (38.4, 41.2) | 46.9 (45.5, 48.3) | |
| West | 45.0 (43.4, 46.6) | 47.6 (45.8, 49.4) | |
| | ***p*<0.0001** | *p*=0.13 | |
| **Age (years)** | | | |
| 25–39 | 41.6 (40.2, 43.0) | 44.9 (43.3, 46.5) | 0.2 |
| 40–59 | 45.3 (44.1, 46.5) | 51.0 (49.8, 52.2) | |
| ≥60 | 40.8 (39.4, 42.2) | 46.1 (44.5, 47.7) | |
| | ***p*<0.0001** | ***p*<0.0001** | |
| **Gender** | | | |
| Male | 38.8 (37.6, 40.0) | 43.2 (42.0, 44.4) | 0.4 |
| Female | 46.7 (45.7, 47.7) | 52.1 (50.9, 53.3) | |
| | ***p*<0.0001** | ***p*<0.0001** | |
| **Education** | | | |
| Less than high school graduate | 25.2 (23.2, 27.2) | 28.9 (26.5, 31.3) | 0.8 |

| Population characteristics | Percentage[a] (95% CI) | | Wald-*F* global tests of interaction[b] |
|---|---|---|---|
| | 2005 | 2010 | |
| High-school graduates | 34.1 (32.7, 35.5) | 38.9 (37.3, 40.5) | |
| Some college/Associates degree | 45.5 (43.9, 47.1) | 51.7 (50.1, 53.3) | |
| Bachelors degree or higher | 55.4 (54.0, 56.8) | 60.2 (58.6, 61.8) | |
| | ***p*<0.0001** | ***p*<0.0001** | |
| **Income** | | | |
| 0 to <$20,000 | 35.4 (33.6, 37.2) | 39.4 (37.4, 41.4) | 0.7 |
| $20,000 to <$35,000 | 39.6 (37.6, 41.6) | 45.3 (43.1, 47.5) | |
| $35,000 to <$55,000 | 42.6 (40.8, 44.4) | 46.2 (44.4, 48.0) | |
| $55,000 to <$75,000 | 44.6 (42.6, 46.6) | 49.3 (47.1, 51.5) | |
| ≥$75,000 | 47.1 (45.5, 48.7) | 52.9 (51.3, 54.5) | |
| | ***p*<0.0001** | ***p*<0.0001** | |
| **Cancer history in self or first- degree relatives** | | | |
| Breast or ovarian | 46.8 (44.8, 48.8) | 53.5 (51.3, 55.7) | 0.4 |
| Cancer other than breast and ovarian | 45.0 (43.6, 46.4) | 49.7 (48.3, 51.1) | |
| None | 40.6 (39.4, 41.8) | 45.1 (43.9, 46.3) | |
| | ***p*<0.0001** | ***p*<0.0001** | |
| **Perceived cancer risk in self** | | | |
| High (more likely) | 43.7 (41.7, 45.7) | 50.8 (48.6, 53.0) | 0.2 |
| Medium (as likely) | 43.7 (42.5, 44.9) | 48.3 (47.1, 49.5) | |
| Low (less likely) | 41.7 (40.5, 42.9) | 46.0 (44.8, 47.2) | |
| | ***p*=0.04** | ***p*=0.002** | |
| **Usual place to go when sick** | | | |
| Yes | 42.4 (41.6, 43.2) | 47.8 (46.8, 48.8) | **0.01** |
| No or hospital emergency room | 46.5 (44.4, 48.8) | 48.1 (45.9, 50.3) | |
| | ***p*=0.001** | *p*=0.87 | |
| **Time since last saw or spoke with a health professional** | | | |
| ≤1 year | 43.4 (42.6, 44.2) | 48.2 (47.2, 49.2) | 0.7 |
| >1 year | 40.2 (38.2, 42.2) | 45.4 (43.3, 47.7) | |

| Population characteristics | Percentage[a] (95% CI) | | Wald-*F* global tests of interaction[b] |
|---|---|---|---|
| | 2005 | 2010 | |
| | ***p*=0.005** | ***p*=0.03** | |
| **Health insurance** | | | |
| None or public insurance | 40.8 (39.2, 42.4) | 44.3 (42.5, 46.1) | 0.1 |
| Private or military insurance | 43.7 (42.7, 44.7) | 49.1 (48.1, 50.1) | |
| | ***p*=0.006** | ***p*<0.0001** | |

*Note:* Boldface indicates significant *p*-values.

[a] Percentages and 95% CIs are weighted to the U.S. population and adjusted for all covariates in the table using multivariate regression analysis. *p*-values below the estimates are derived from global Wald-*F* tests of association between awareness and demographic, personal and family cancer history, and healthcare factors variables.

[b] *p*-values are derived from Wald-*F* tests for interaction of each demographic, personal and family cancer history, and healthcare factor by survey year.