Advance Data
From Vital and Health Statistics

Number 379 • December 4, 2006

Total, Free, and Percent Free Prostate-Specific Antigen Levels among U.S. Men, 2001–04

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Abstract

Objective—Screening for prostate cancer using prostate-specific antigen (PSA) tests is common but remains controversial. Total PSA using thresholds of 4.0 and 2.5 ng/mL has been used for screening men. In addition, the percent free PSA (free PSA/total PSA x 100%) using thresholds of less than 25% and 15% have been proposed for use in screening for prostate cancer in conjunction with the total PSA. The distributions of total PSA, free PSA, and percent free PSA, which vary with age and race-ethnicity among American men, would help determine the burden of screening using different thresholds of PSA tests.

Methods—PSA tests were performed on serum samples from men age 40 years and older (n= 2,546) who participated in the 2001–04 National Health and Nutrition Examination Survey (NHANES). Total, free and percent free PSA were estimated for Mexican American, non-Hispanic white, and non-Hispanic black men.

Results—About 6.2%, (95% confidence interval, 95% CI: 5.2–7.2%), corresponding to an estimated 3.6 million (95% CI: 3.0–4.2 million) men 40 years of age and older, had a total PSA of greater than or equal to 4.0 ng/mL. Approximately 3.6% (95% CI: 1.8–6.2%) of Mexican American men, 6.2% (95% CI: 5.1–7.6%) of non-Hispanic white men, and 7.8% (95% CI: 5.2–11.1) of non-Hispanic black men had total PSA of 4.0 ng/mL or more. Approximately 13.1 (95% CI: 11.7–14.5%) of men 40 years of age and older had total PSA greater than or equal to 2.5 ng/mL. For men with total PSA less than 2.5 ng/mL, 23.1% (95% CI: 21.0–25.3%) had a percent free PSA between 15% and 25%, and 5.0% had free PSA (95% CI: 3.9–6.4%) less than or equal to 15%.

Conclusions—The effect of lowering the total PSA thresholds increases the number of U.S. men who would be referred for screening for prostate cancer. Total and free PSA increased with age in Mexican American, non-Hispanic white, and non-Hispanic black men. Information about the distribution of total, free, and percent free PSA will help guide public health policy in screening for prostate cancer.

Keywords: Prostate-specific antigen • Prostate cancer screening • National Health and Nutrition Examination Survey (NHANES)

Introduction

Prostate cancer screening using prostate-specific antigen (PSA) is common, but remains controversial even after 20 years since its introduction (1,2). PSA screening issues include whether to conduct screening, what age to begin screening, what PSA threshold to use before recommending a prostate biopsy, and what age to stop screening. The U.S. Preventive Services Task Force has concluded that there is insufficient evidence to recommend for or against routine prostate cancer screening because it is unclear if the risks outweigh the benefits for screening for prostate cancer (3). However, the American Cancer Society (4) and American Urological Association (5) recommend offering information about screening for average-risk men beginning at 50 years of age. Also, they recommend offering information about screening at age 40 if men are at higher risk, such as African American men or men who have a family history of prostate cancer. In general, a prostate biopsy is highly recommended for total PSA values of 10 ng/mL or higher. For total PSA values between 4 and 10 ng/mL, a prostate biopsy is preferred,

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but lowering the threshold to 2.5 ng/mL has been suggested (1). The percent free PSA has also been recommended as an adjunct test for certain total PSA values to better discriminate whether men are more or less likely to develop prostate cancer. A lower percent free PSA is suggestive of prostate cancer. The threshold for percent free PSA has generally been less than 25% with some studies suggesting a threshold of less than 15% (6–8). Guidelines support discussing the risk and benefits of prostate cancer screening with men (3–5).

Population-based U.S. data on the distribution of PSA by age and race-ethnicity are helpful to both policy makers and clinicians. In this report, data from NHANES 2001–04 on the distributions of total, free, and percent free PSA for all males 40 years and older and for Mexican Americans, non-Hispanic white, and non-Hispanic black men are presented. Previous reports using the NHANES 2001–02 data have been published (9–11). Saraiya et al. provided race- and ethnic-specific data on median total PSA and percent free PSA values and presented modeling data examining the relationship of age and PSA tests (9). Lowering the total PSA threshold values would increase the number of men to be screened and thus have a significant impact on the burden of screening. Saraiya reported that 1–2 million men 50–69 years of age would have a total PSA value greater than 4 ng/mL and 1–3 million would have a PSA value between 2.5 and 4.0 ng/mL. Using 2001–02 data, Welch (10) similarly reported the number of men in the United States above certain PSA thresholds by 10-year age categories and compared this with the number of men projected to die from prostate cancer using incidence data from the Surveillance, Epidemiology, and End Results program of the National Cancer Institute (12). Porter used data from NHANES 2001–02 and the Prostate Cancer Prevention Trial (13) data to estimate the prevalence of biopsy detectable prostate cancer in men 62–85 years of age with a total PSA less than or equal to 4 ng/mL (11).

The addition of NHANES 2003–04 data used in this report allows for more precise estimates of the distribution of total, free, and percent free PSA values. PSA estimates among all men 40 years of age and older and non-Hispanic whites 80 years of age and older are provided. Also, estimates of percent free PSA less than or equal to 15% for various total PSA thresholds by age groups are presented.

Methods

Study population and sample design

The National Health and Nutrition Examination Survey (NHANES) conducted in 2001–04 is a cross-sectional, nationally representative survey of the civilian noninstitutionalized population of the United States. The procedures for selecting the sample and conducting the interviews and examinations for NHANES 2001–04 have been described (14,15). The NHANES design is a stratified, multistage, probability sample. This multistage sample is based on a selection of counties, blocks, households, and persons within households. NHANES categorizes race-ethnicity as non-Hispanic white, non-Hispanic black, Mexican American, and other persons (other Hispanics and all others) (16). Because the number of participants was small in the ''other'' category, estimates by race-ethnicity were restricted to non-Hispanic white persons, non-Hispanic black persons, and Mexican Americans. The analysis of all men 40 years and older included the ''other'' race-ethnicity group. Race-ethnicity categories are based on self-reported data. Mexican American persons, non-Hispanic black persons, and adults 60 years and older were over-sampled.

Men ages 40 years and older were eligible for PSA testing consisting of measured total and free PSA. Percent free PSA was calculated as free PSA/total PSA x 100%. For NHANES 2001–04, 4,533 men aged 40 years or older were eligible to participate in the survey, of whom 3,326 (73.4%) were interviewed and 3,108 (68.6%) were interviewed and underwent physical examination. After these men received general information about the PSA test from the examining NHANES physician, they were offered the opportunity to be tested. Of these 3,108 eligible men, 257 (8.3%) refused or did not give permission for the PSA test. In addition, men were excluded from PSA testing if they reported, refused to answer, or did not know if they had procedures or conditions that could alter PSA results. These exclusion criteria were current infection or inflammation of the prostate gland, digital rectal exam in the past week, prostate biopsy in the past 30 days, cystoscopy in the past 30 days, or history of prostate cancer. An additional 231 (7.4%) had one or more of the exclusion criteria that could affect PSA levels. Also, 74 (2.4%) of eligible men had missing PSA values. Hence, 2,546 of 3,108 or 81.9% of all examined men ages 40 years and older participated in the NHANES prostate-specific antigen testing.

Collection and storage of samples and laboratory methods

As part of the exam, blood samples were drawn by venipuncture, centrifuged, and the sera frozen at –20˚C within 1 hour of the phlebotomy. Within 1 week, the frozen specimens were sent on dry ice to the University of Washington Medical Center, Department of Laboratory Medicine, Immunology Division Laboratory (Seattle, WA), where they were kept at –70˚C until analyzed. The PSA values were determined using the Hybritech total PSA (17) and Hybritech free PSA monoclonal antibody (18) assays (Hybritech, San Diego, CA) on the Beckman Coulter Access analyzer (Fullerton, CA). The total PSA method is a two-site immunoenzymatic ''sandwich'' assay. The sample is mixed with mouse monoclonal anti-PSA alkaline phosphatase conjugate and paramagnetic particles coated with a second mouse monoclonal anti-PSA antibody. The PSA in the sample binds to the immobilized monoclonal anti-PSA on the solid phase while the monoclonal anti-PSA conjugate reacts with a

different antigenic site on the PSA. Separation in a magnetic field and washing removes material not bound to the solid phase. A chemiluminescent substrate is added and the complex is measured with a luminometer. The free PSA assay is also a two-site immunoenzymatic ''sandwich'' assay. It is similar to the Hybritech total PSA but uses a monoclonal anti-free PSA alkaline phosphatase conjugate and a mouse monoclonal anti-free PSA antibody.

The total PSA test had a coefficient of variation of less than 4.8% for quality control pool means with a range of 0.16 to 22.32 ng/mL. The free PSA test had a coefficient of variation of less than 5.5% for quality control pool means with a range of 0.59 to 4.77 ng/mL.

Statistical analysis

Distributions of total, free, and percent free PSA for NHANES 2001–04 were estimated for all males 40 years and older, and by age groups for Mexican American, non-Hispanic white, and non-Hispanic black persons (Tables 1–3). Age was stratified as 40–49, 50–59, 60–69, and 70 years and older. There were sufficient sample sizes to determine PSA levels for all males and non-Hispanic white persons for the age groups 70–79 and 80 years and older. The mean, standard error of the mean, 5th, 10th, 25th, 50th, 75th, 90th, and 95th percentiles were determined for each race-ethnicity by age group. The 95% confidence intervals for the percentiles were determined using the Woodruff method (19).

Proportions at different total PSA threshold values were estimated for all men and by age and race-ethnicity (Table 4). The PSA threshold values were based on the Prostate Cancer Prevention Trial (13). The 95% confidence intervals were calculated as exact limits based on the binomial distribution. Some proportion estimates did not meet standards of reliability and precision as determined by the relative standard error of the proportion (SE of the proportion/proportion x 100%) greater than 30%.

The distribution of percent free PSA by total PSA was estimated for age groups (Table 5). The percent free PSA was categorized as less than or equal to 15%, greater than 15%–25%, and greater than 25% when sufficient sample size and statistical precision were present. Otherwise, the percent free PSA was dichotomized as greater than or less than or equal to 25%. National estimates of the number of men in each PSA group were determined by multiplying the percentages and confidence intervals by the average population estimates from the 2001 to 2004 Current Population Survey.

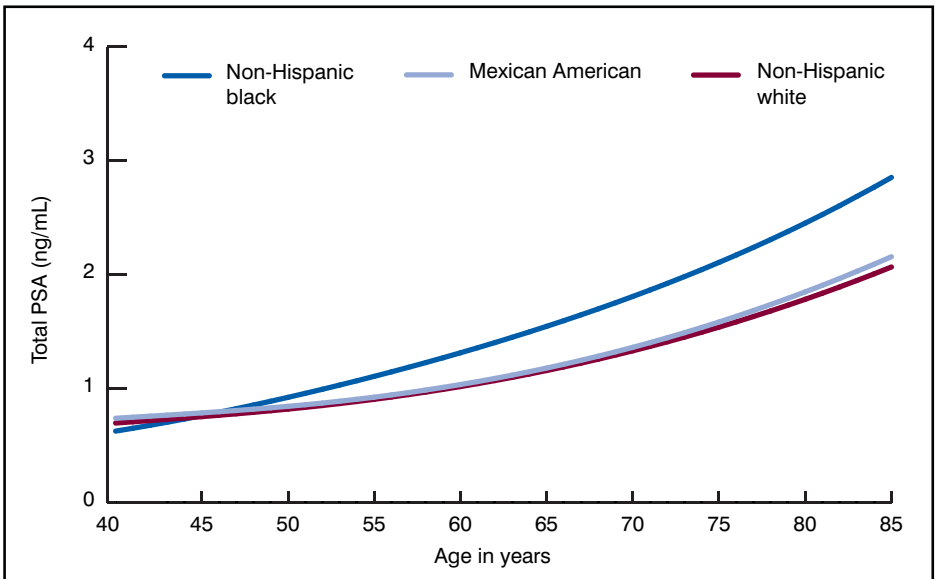
Three linear regression models were fit to determine the relationship between total, free, and percent free PSA and age (Figures 1–3). Age was transformed in each model using restricted cubic spline functions to allow for nonlinearity (20). All models were adjusted for race-ethnicity and examined for interaction between age and race-ethnicity to determine if the relationship between age and each PSA measure was similar across race-ethnicity groups. The PSA measures were log transformed in all models because of nonnormality. The predicted PSA values were then back transformed to the original scale. Due to the small number of denominator degrees of freedom, the *F*-statistic with Satterthwaite correction for the degrees of freedom was used to test significance.

Variance estimates were calculated using Taylor series linearization (21). Sample weights, which account for the differential probabilities of selection, nonresponse, and noncoverage were incorporated into the variance estimation process. Most statistics were generated using SUDAAN version 9.0 (Research Triangle Institute, Research Triangle Park, NC) and SAS version 9.1 (SAS Institute, Inc., Cary, NC). The survey package version 3.4.2 in R (22,23) version 2.2.1 (Free Software Foundation, Inc., Boston, MA) was used to determine the percentiles and confidence intervals for percentiles using the Woodruff method (19). Ninety-five percent confidence intervals for percentiles and proportions are shown in parenthesis in the text.

Results

Distribution of PSA tests

In all males and each of the race-ethnicity groups, the mean, median, 75th, 90th, and 95th percentiles for total PSA increased by age group (Table 1). Overall, the median total PSA was 0.70 (0.70–0.80) ng/mL for 40–49 years and increased to 2.10 (1.70–2.30) ng/mL for men 80 years or older. For men 70 years and older, the total PSA at the 75th



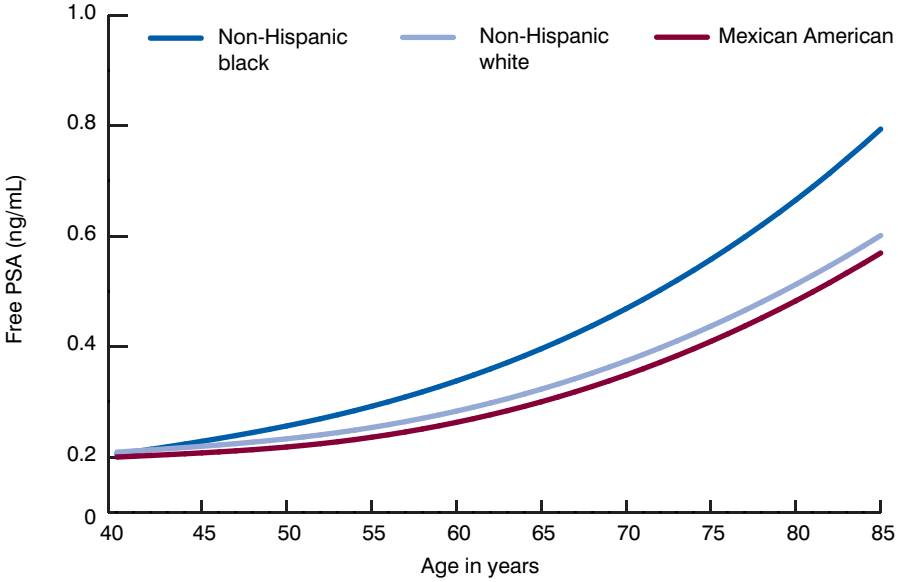
NOTE: All race-ethnicity groups had significant age effects ($p<0.001$). The age by race-ethnicity interaction was significant ($p<0.05$).

Figure 1. Total PSA versus age by race-ethnicity

percentile were 3.45 (2.70–4.39), 3.40 (3.10–3.90), and 5.40 (4.51–6.10) ng/mL for Mexican American, non-Hispanic white, and non-Hispanic black persons, respectively. For all men and for each race-ethnicity group, the mean, median, 75th, 90th, and 95th percentiles for free PSA also increased with each older age group (Table 2). For all men, the median free PSA ranged from 0.22 (0.20–0.23) ng/mL for men 40–49 years to 0.58 (0.50–0.72) ng/mL for men 80 years and older. For men 70 years and older, the free PSA at the 75th percentile was 0.67 (0.59–0.92), 0.88 (0.78–0.97), and 1.51 (0.77–1.75) ng/mL for Mexican American, non-Hispanic white, and non-Hispanic black persons, respectively. In contrast to the pattern seen with total and free PSA with age, the median percent free PSA was somewhat constant across the age groups within the race-ethnicity groups (Table 3). The median percent free PSA ranged from 28.0% to 30.0% for the different age groups. Non-Hispanic black persons showed a decreasing percent free PSA with older age. At the 90th percentile, non-Hispanic black persons had a percent free PSA of 50.0% (45.0–56.0) for men 40–49 years and 42.0% (38.8–44.6) for men 70 years and older.

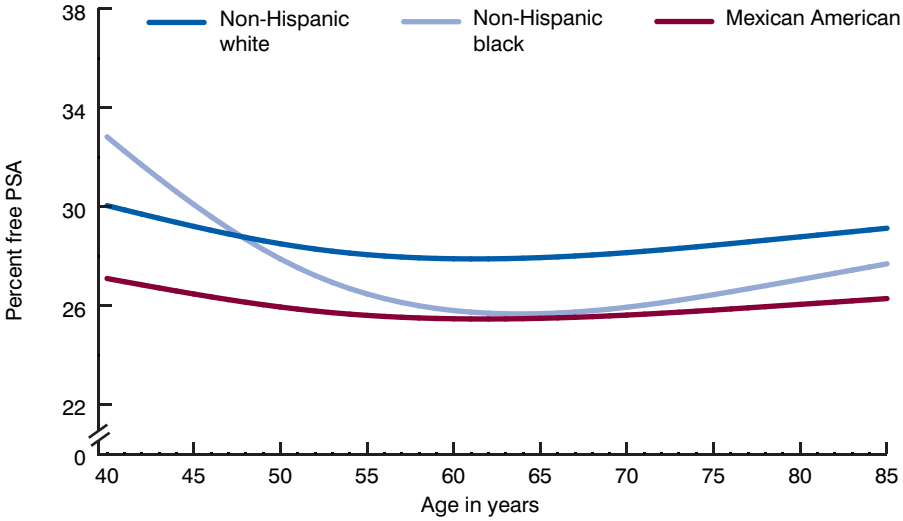
Relation of PSA to age

Regression analysis showed that total PSA increased with age (Figure 1), but the relationship between age and total PSA varied significantly across the three race-ethnicity groups. The total PSA increased more steeply with age among non-Hispanic black persons compared with non-Hispanic white and Mexican American persons. The free PSA also showed an increase with age for the three race-ethnicity groups, however, the age by race-ethnicity interaction was not significant (Figure 2). There was a significant nonlinear relationship between percent free PSA and age among non-Hispanic black persons (Figure 3). Increasing age was associated with decreasing percent free PSA for non-Hispanic black men under 60 years of age.



NOTE: All race-ethnicity groups had significant age effects ($p<0.001$). The age by race-ethnicity interaction was not significant ($p>0.10$).

Figure 2. Free PSA versus age by race-ethnicity



NOTE: The non-Hispanic black group had significant age effects ($p<0.01$). The age by race-ethnicity interaction was significant ($p<0.10$).

Figure 3. Percent free PSA verus age by race-ethnicity

PSA threshold values

The proportion of men who had total PSA levels at or above different thresholds is seen in Table 4. The proportions equal to or above a total PSA threshold increased by age in men 40 years and older in each race-ethnicity group. Overall, 6.2% (5.2–7.2) of men over 40 years had total PSA greater than or equal to 4 ng/mL and 13.1% (11.7–14.5) were greater than 2.5 ng/mL, the lower suggested screening threshold. For men 80 years and older, 29.0% (22.4–36.4) had PSA levels greater than or equal to 4 ng/mL. Overall, total PSA was greater than or equal to 4 ng/mL for 3.6% (1.8–6.2), 6.2% (5.1–7.6), and 7.8% (5.2–11.1) for Mexican American, non-Hispanic white, and non-Hispanic black men, respectively. Also, 1.1% (0.7–1.6) of

men had a total PSA threshold greater than or equal to 10 ng/mL. For men 80 years and older, 6.3% (3.3–10.8) had total PSA greater than or equal to 10 ng/mL.

The distribution of percent free PSA thresholds by total PSA thresholds for different age groups is seen in Table 5. In general, as age increased, the percentage of men with percent free PSA less than or equal to 25% also increased across the range of total PSA values. For example, of men ages 40–49 years, 6.5% (4.8–8.6) had a total PSA level less than 2.5 ng/mL and a percent free PSA less than or equal to 15%, and 25.3% (21.3–29.7) had a total PSA level less than 2.5 ng/mL and a percent free PSA of greater than 15%–25%. Of men 40–49 years of age, 2.3% (1.3–3.6) had a total PSA 2.5 to less than 4.0 ng/mL and a percent free PSA less than or equal to 25%, or an estimated 484,000 men. There were 6.8% (4.0–10.5) of men ages 70–79 years with a PSA of 2.5 to less than 4.0 ng/mL and a percent free PSA less than or equal to 25%. In this age group, 9.1% (5.6–13.6) of men had a PSA of 4.0 to less than 10 ng/mL and a percent free PSA less than or equal to 25%, representing approximately 618,000 men. All men 80 years and older with a total PSA greater than or equal to 10 ng/mL had free percent PSA less than or equal to 25%.

Discussion

The American Cancer Society (4) and the American Urological Association (5) recommend offering information regarding the risks and benefits of total PSA screening and digital rectal examination. In addition, the use of percent free PSA (free/total PSA), complexed PSA, PSA velocity, and PSA density with ultrasound of the prostate have been proposed as additional tests to enhance the specificity of total PSA (24). Recently, serum proteomics patterns have been used to detect prostate cancer (25). Previous reports on total and percent free PSA using the NHANES 2001–02 data have been published (9–11).

The distribution of the free PSA for NHANES was not reported previously. The age-specific distribution of free PSA generally followed the same age pattern as total PSA (Tables 1,2). With increasing age, both free and total PSA levels increased for all race-ethnicity groups (Figures 1,2). Non-Hispanic blacks had steeper increases in total PSA with increasing age compared with non-Hispanic white and Mexican American persons (interaction of age by race-ethnicity, $p<0.05$).

The proportion of men at or above various total PSA thresholds for different race-ethnicity groups were estimated (Table 4). Age-specific estimates for total PSA thresholds of 1, 2, 2.5, 3, 4, 6, 8, and 10 ng/mL are reported for the first time for Mexican American, non-Hispanic white, and non-Hispanic black men. Estimates for some threshold values could not be reported due to limitations in sample size or statistical precision.

Finally, estimates of percent free PSA less than or equal to 15% for various total PSA thresholds by age groups are presented for the first time (Table 5). The threshold for percent free PSA has been less than 25%, but a threshold of less than 15% has been suggested for follow-up of elevated total PSA levels. For total PSA of 2.5 to less than 4.0 ng/mL, 1.5% (1.0–2.2) of men 40 years and older had percent free PSA less than or equal to 15%, and 2.9% (2.3–3.7) had percent free PSA greater than 15%– 25%. The percent free PSA less than or equal to 15% generally increased with age. The range of percent free PSA less than or equal to 15% was from 8.4% (6.4–10.7) of men ages 40–49 to 12.9% (8.0–19.3) for men ages 80 years and older.

The limitation of NHANES data is that it is cross-sectional and does not allow for the diagnosis and outcome of prostate cancer. Also, approximately 20% of all examined men greater than or equal to 40 years did not participate in PSA testing. Men with missing PSA test values were older and were more likely to be non-Hispanic black. However, the distribution of total, free, and percent free PSA in men ages 40 and older using NHANES 2001–04 data should help guide policies of screening of prostate cancer. Further collection of PSA test data will allow for further stratification of the PSA data and increase the precision of the distributions among sample persons.

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Table 1. Distribution of total PSA (ng/mL)

Age and race-ethnicity	Number	Geometric mean (SE)	Percentiles (95% confidence intervals) of distribution						
			5	10	25	50	75	90	95
All men[1]									
40 years and older	2,546	0.94 (0.02)	0.30 (0.20–0.30)	0.40 (0.30–0.40)	0.50 (0.50–0.60)	0.90 (0.80–0.90)	1.50 (1.40–1.60)	2.90 (2.70–3.20)	4.40 (4.00–4.90)
40–49 years	747	0.73 (0.02)	0.30 (0.20–0.30)	0.30 (0.30–0.40)	0.50 (0.50–0.50)	0.70 (0.70–0.80)	1.00 (1.00–1.10)	1.60 (1.40–1.80)	2.20 (1.80–2.60)
50–59 years	546	0.92 (0.03)	0.30 (0.20–0.30)	0.40 (0.30–0.40)	0.50 (0.50–0.60)	0.90 (0.80–1.00)	1.50 (1.37–1.70)	2.43 (2.20–2.70)	3.60 (2.82–4.40)
60–69 years	555	1.13 (0.05)	0.24 (0.20–0.30)	0.40 (0.30–0.40)	0.60 (0.50–0.70)	1.10 (1.00–1.30)	2.09 (1.90–2.30)	3.49 (3.20–4.00)	5.20 (4.40–5.60)
70 years and older	698	1.66 (0.06)	0.30 (0.20–0.40)	0.40 (0.30–0.50)	0.80 (0.80–0.90)	1.60 (1.50–1.80)	3.50 (3.20–3.90)	6.20 (5.60–7.04)	8.94 (7.60–10.72)
70–79 years	447	1.56 (0.08)	0.30 (0.20–0.40)	0.40 (0.40–0.50)	0.80 (0.70–0.80)	1.50 (1.40–1.70)	3.20 (2.90–3.70)	5.44 (4.99–6.51)	8.02 (6.38–10.00)
80 years and older	251	1.98 (0.17)	0.20 (0.10–0.30)	0.40 (0.20–0.50)	1.09 (0.70–1.25)	2.10 (1.70–2.30)	4.38 (3.48–5.60)	7.69 (6.50–10.80)	**
Mexican American									
40 years and older	485	0.91 (0.04)	0.30 (0.30–0.40)	0.40 (0.40–0.50)	0.60 (0.50–0.60)	0.80 (0.80–0.90)	1.30 (1.27–1.40)	2.47 (1.98–3.02)	3.60 (2.90–4.50)
40–49 years	166	0.78 (0.05)	0.40 (0.10–0.40)	0.40 (0.30–0.50)	0.50 (0.50–0.60)	0.71 (0.70–0.80)	1.10 (1.00–1.20)	1.40 (1.30–1.70)	1.87 (1.41–3.56)
50–59 years	74	0.95 (0.06)	0.30 (0.20–0.45)	0.40 (0.30–0.50)	0.60 (0.50–0.60)	0.90 (0.63–1.00)	1.60 (1.30–1.87)	2.48 (1.96–3.60)	3.16 (2.47–4.50)
60–69 years	140	1.08 (0.10)	0.29 (0.10–0.30)	0.35 (0.28–0.40)	0.52 (0.40–0.70)	1.00 (0.80–1.30)	1.90 (1.60–2.30)	*3.39 (2.80–7.30)	**
70 years and older	105	1.68 (0.13)	0.40 (0.10–0.50)	0.52 (0.40–0.60)	0.90 (0.71–1.10)	1.60 (1.30–1.90)	3.45 (2.70–4.39)	4.85 (3.91–7.99)	**
Non-Hispanic white									
40 years and older	1,476	0.94 (0.02)	0.30 (0.20–0.30)	0.40 (0.30–0.40)	0.50 (0.50–0.60)	0.90 (0.80–0.90)	1.60 (1.40–1.70)	2.90 (2.60–3.20)	4.30 (4.00–4.90)
40–49 years	363	0.74 (0.03)	0.30 (0.20–0.30)	0.30 (0.30–0.40)	0.50 (0.50–0.50)	0.70 (0.70–0.80)	1.10 (1.00–1.20)	1.60 (1.50–1.90)	2.37 (1.84–2.70)
50–59 years	328	0.88 (0.04)	0.30 (0.10–0.30)	0.40 (0.30–0.40)	0.50 (0.40–0.60)	0.90 (0.70–0.90)	1.40 (1.30–1.70)	2.40 (2.20–2.70)	3.11 (2.60–4.83)
60–69 years	287	1.13 (0.06)	0.24 (0.19–0.30)	0.40 (0.30–0.40)	0.60 (0.50–0.70)	1.10 (1.00–1.30)	2.10 (1.90–2.40)	3.40 (3.20–4.05)	4.98 (4.11–5.59)
70 years and older	498	1.63 (0.07)	0.30 (0.20–0.40)	0.40 (0.30–0.50)	0.80 (0.70–0.90)	1.70 (1.50–1.80)	3.40 (3.10–3.90)	6.00 (5.30–6.80)	8.66 (7.00–11.06)
70–79 years	295	1.54 (0.09)	0.30 (0.20–0.40)	0.40 (0.40–0.50)	0.80 (0.70–0.80)	1.50 (1.40–1.80)	3.20 (2.80–3.70)	5.30 (4.52–6.21)	7.01 (6.00–10.28)
80 years and older	203	1.89 (0.16)	0.21 (0.10–0.30)	0.40 (0.23–0.50)	1.00 (0.67–1.25)	1.90 (1.70–2.30)	4.07 (3.30–5.52)	7.65 (6.40–10.80)	*10.80 (8.40–22.46)
Non–Hispanic black									
40 years and older	435	0.99 (0.05)	0.30 (0.20–0.40)	0.40 (0.37–0.40)	0.50 (0.50–0.60)	0.90 (0.80–1.00)	1.60 (1.40–1.85)	2.80 (2.35–4.50)	5.45 (4.50–7.70)
40–49 years	174	0.74 (0.04)	0.30 (0.10–0.40)	0.40 (0.30–0.40)	0.50 (0.40–0.60)	0.70 (0.70–0.80)	1.10 (1.00–1.20)	1.73 (1.34–2.00)	2.00 (1.80–2.59)
50–59 years	101	1.04 (0.10)	0.40 (0.20–0.40)	0.40 (0.40–0.50)	0.50 (0.50–0.68)	0.80 (0.75–1.10)	1.80 (1.30–2.20)	2.80 (2.25–4.79)	**
60–69 years	99	1.54 (0.17)	0.30 (0.10–0.40)	0.40 (0.30–0.56)	0.79 (0.50–1.00)	1.50 (1.20–1.77)	2.70 (2.00–3.79)	*5.77 (3.70–11.88)	10.30 (7.47–14.28)
70 years and older	61	2.16 (0.42)	**	*0.40 (0.10–0.62)	0.89 (0.50–1.20)	**	5.40 (4.51–6.10)	**	**

* Relative standard error 30–40 percent.
** Relative standard error greater than 40 percent, and the value was suppressed.
[1]All men includes sample persons of "other" race-ethnicity, but they are not shown separately.

Table 2. Distribution of free PSA (ng/mL)

Age and race–ethnicity	Number	Geometric mean (SE)	Percentiles (95% confidence intervals) of distribution						
			5	10	25	50	75	90	95
All men[1]									
40 years and older	2,546	0.27 (0.01)	0.08 (0.07–0.09)	0.11 (0.10–0.12)	0.17 (0.16–0.18)	0.26 (0.25–0.27)	0.41 (0.38–0.44)	0.67 (0.63–0.73)	0.97 (0.88–1.07)
40–49 years	747	0.21 (0.01)	0.08 (0.07–0.09)	0.10 (0.09–0.12)	0.14 (0.13–0.16)	0.22 (0.20–0.23)	0.31 (0.29–0.34)	0.43 (0.40–0.49)	0.51 (0.48–0.59)
50–59 years	546	0.25 (0.01)	0.09 (0.07–0.10)	0.12 (0.09–0.13)	0.17 (0.16–0.18)	0.24 (0.23–0.26)	0.39 (0.35–0.46)	0.57 (0.54–0.63)	0.73 (0.66–0.79)
60–69 years	555	0.32 (0.01)	0.09 (0.06–0.10)	0.12 (0.10–0.14)	0.19 (0.18–0.23)	0.32 (0.30–0.35)	0.51 (0.47–0.55)	0.82 (0.74–0.94)	1.08 (0.99–1.24)
70 years and older	698	0.47 (0.02)	0.09 (0.06–0.12)	0.15 (0.12–0.18)	0.27 (0.25–0.29)	0.46 (0.43–0.50)	0.89 (0.81–0.98)	1.56 (1.43–1.69)	2.10 (1.87–2.40)
70–79 years	447	0.44 (0.02)	0.10 (0.06–0.13)	0.15 (0.12–0.19)	0.26 (0.23–0.28)	0.42 (0.38–0.46)	0.82 (0.71–0.91)	1.40 (1.19–1.56)	1.76 (1.57–2.23)
80 years and older	251	0.56 (0.04)	0.07 (0.04–0.11)	0.13 (0.10–0.17)	0.32 (0.24–0.36)	0.58 (0.50–0.72)	1.12 (0.93–1.35)	1.99 (1.64–2.60)	2.92 (2.09–4.40)
Mexican American									
40 years and older	485	0.24 (0.01)	0.08 (0.06–0.10)	0.12 (0.09–0.13)	0.16 (0.15–0.17)	0.23 (0.21–0.24)	0.32 (0.31–0.36)	0.54 (0.49–0.65)	0.72 (0.66–0.96)
40–49 years	166	0.21 (0.01)	0.08 (0.05–0.12)	0.12 (0.08–0.15)	0.16 (0.15–0.17)	0.21 (0.19–0.23)	0.28 (0.26–0.30)	0.36 (0.31–0.40)	0.43 (0.39–0.56)
50–59 years	74	0.23 (0.01)	0.07 (0.04–0.09)	0.09 (0.06–0.13)	0.15 (0.13–0.19)	0.23 (0.20–0.27)	0.33 (0.31–0.38)	0.53 (0.38–0.82)	0.67 (0.54–1.13)
60–69 years	140	0.29 (0.02)	0.07 (0.04–0.09)	0.10 (0.07–0.13)	0.18 (0.14–0.19)	0.28 (0.24–0.34)	0.50 (0.42–0.62)	0.86 (0.62–1.25)	**
70 years and older	105	0.42 (0.03)	0.10 (0.07–0.13)	0.13 (0.09–0.17)	0.22 (0.18–0.30)	0.42 (0.39–0.53)	0.67 (0.59–0.92)	**	**
Non–Hispanic white									
40 years and older	1,476	0.27 (0.01)	0.08 (0.07–0.09)	0.11 (0.10–0.12)	0.17 (0.16–0.18)	0.26 (0.25–0.28)	0.42 (0.39–0.46)	0.70 (0.65–0.75)	0.99 (0.88–1.10)
40–49 years	363	0.22 (0.01)	0.08 (0.05–0.09)	0.10 (0.08–0.12)	0.14 (0.13–0.17)	0.22 (0.20–0.25)	0.33 (0.29–0.36)	0.45 (0.41–0.51)	0.53 (0.49–0.67)
50–59 years	328	0.25 (0.01)	0.08 (0.06–0.10)	0.12 (0.09–0.13)	0.17 (0.15–0.18)	0.24 (0.22–0.26)	0.38 (0.33–0.47)	0.56 (0.51–0.63)	0.72 (0.65–0.80)
60–69 years	287	0.32 (0.01)	0.09 (0.06–0.10)	0.11 (0.10–0.14)	0.20 (0.17–0.23)	0.32 (0.29–0.35)	0.51 (0.47–0.54)	0.82 (0.71–0.95)	1.07 (0.87–1.30)
70 years and older	498	0.47 (0.02)	0.10 (0.08–0.12)	0.15 (0.12–0.19)	0.27 (0.25–0.29)	0.46 (0.43–0.51)	0.88 (0.78–0.97)	1.49 (1.34–1.60)	2.02 (1.69–2.18)
70–79 years	295	0.44 (0.02)	0.10 (0.08–0.14)	0.15 (0.13–0.20)	0.27 (0.24–0.28)	0.43 (0.38–0.46)	0.83 (0.73–0.93)	1.32 (1.18–1.49)	1.63 (1.49–2.16)
80 years and older	203	0.54 (0.04)	0.08 (0.04–0.11)	0.13 (0.11–0.17)	0.30 (0.24–0.36)	0.56 (0.50–0.69)	1.08 (0.86–1.33)	1.98 (1.58–2.21)	2.60 (2.09–3.27)
Non–Hispanic black									
40 years and older	435	0.28 (0.01)	0.10 (0.06–0.11)	0.12 (0.10–0.14)	0.17 (0.15–0.18)	0.26 (0.24–0.28)	0.41 (0.38–0.47)	0.67 (0.58–0.91)	1.22 (0.84–1.61)
40–49 years	174	0.22 (0.01)	0.10 (0.05–0.10)	0.10 (0.10–0.12)	0.15 (0.14–0.17)	0.23 (0.21–0.25)	0.31 (0.28–0.34)	0.41 (0.38–0.49)	0.49 (0.45–0.56)
50–59 years	101	0.29 (0.02)	0.10 (0.07–0.13)	0.13 (0.11–0.15)	0.17 (0.15–0.20)	0.27 (0.23–0.33)	0.42 (0.33–0.60)	0.67 (0.56–1.04)	0.99 (0.67–1.59)
60–69 years	99	0.41 (0.04)	0.10 (0.05–0.14)	0.14 (0.09–0.19)	0.25 (0.19–0.30)	0.42 (0.34–0.48)	0.66 (0.54–0.76)	**	*1.93 (1.16–4.19)
70 years and older	61	0.56 (0.10)	*0.08 (0.04–0.15)	0.15 (0.04–0.19)	0.22 (0.17–0.29)	0.56 (0.33–0.78)	1.51 (0.77–1.75)	**	*4.14 (1.76–7.02)

* Relative standard error 30–40 percent.

** Relative standard error greater than 40 percent, and the value was suppressed.

[1]All men includes sample persons of "other" race-ethnicity, but they are not shown separately.

Table 3. Distribution of percent free PSA

Age and race–ethnicity	Number	Geometric mean (SE)	Percentiles (95% confidence intervals) of distribution						
			5	10	25	50	75	90	95
All men[1]									
40 years and older	2,546	28.35 (0.50)	13.0 (12.0–14.0)	16.0 (15.0–17.0)	22.0 (21.0–23.0)	29.0 (28.0–30.0)	39.0 (38.0–40.0)	48.0 (47.0–50.0)	53.0 (52.0–55.6)
40–49 years	747	28.94 (0.63)	13.0 (12.0–14.0)	17.0 (14.0–18.0)	22.9 (20.0–23.0)	30.0 (28.0–32.0)	40.0 (38.0–42.0)	49.0 (47.0–50.1)	53.0 (50.1–57.9)
50–59 years	546	27.72 (0.54)	13.0 (11.0–14.0)	15.0 (14.0–17.0)	22.0 (20.0–23.0)	28.0 (27.0–29.0)	38.0 (36.0–40.0)	47.8 (45.0–49.9)	53.0 (50.0–59.2)
60–69 years	555	28.08 (0.73)	13.0 (12.0–15.0)	16.0 (15.0–18.0)	22.0 (20.0–23.0)	28.0 (27.0–30.0)	38.0 (35.0–40.0)	46.0 (43.0–50.0)	53.0 (50.0–60.0)
70 years and older	698	28.29 (0.86)	13.0 (8.8–14.0)	15.0 (13.0–17.0)	22.0 (20.0–24.0)	30.0 (28.0–31.0)	39.0 (37.0–40.0)	47.8 (46.0–50.0)	55.0 (51.0–58.0)
70–79 years	447	28.24 (0.93)	12.5 (11.3–13.0)	15.0 (13.0–17.0)	22.0 (20.0–24.0)	30.0 (28.0–31.6)	38.0 (36.0–40.0)	47.0 (45.2–50.0)	53.0 (50.0–60.0)
80 years and older	251	28.41 (1.10)	13.0 (8.7–14.0)	15.0 (13.0–16.5)	21.0 (18.0–23.0)	30.0 (27.0–33.0)	40.0 (38.5–41.0)	50.0 (46.0–55.0)	57.0 (53.0–58.1)
Mexican American									
40 years and older	485	26.14 (0.63)	13.0 (11.0–13.0)	15.0 (13.0–16.0)	20.0 (19.0–21.0)	27.0 (26.0–28.0)	35.0 (33.0–37.4)	43.0 (40.2–48.5)	50.0 (47.0–52.0)
40–49 years	166	26.83 (0.87)	13.0 (7.2–14.6)	16.0 (13.0–17.5)	20.0 (19.0–23.0)	28.0 (26.0–30.0)	35.7 (34.0–38.0)	43.0 (40.0–48.5)	47.8 (43.0–58.8)
50–59 years	74	24.72 (0.93)	13.0 (11.0–13.0)	13.4 (12.0–17.0)	18.0 (15.9–20.0)	23.0 (21.0–27.0)	32.5 (29.0–39.0)	43.0 (38.7–51.4)	50.0 (43.0–67.0)
60–69 years	140	26.84 (1.56)	12.0 (4.0–15.4)	15.7 (11.5–18.0)	20.0 (18.3–22.1)	26.0 (23.0–30.2)	36.0 (32.0–41.5)	46.6 (40.0–60.7)	57.5 (47.2–89.3)
70 years and older	105	25.02 (0.84)	11.9 (11.0–12.7)	14.0 (11.5–16.0)	20.0 (16.0–21.0)	26.0 (22.8–28.0)	31.0 (30.0–35.1)	41.1 (37.0–50.5)	49.8 (43.9–57.8)
Non–Hispanic white									
40 years and older	1,476	28.64 (0.48)	13.0 (12.0–14.0)	16.2 (15.0–17.0)	23.0 (21.7–23.0)	29.0 (28.0–30.0)	39.0 (38.0–40.0)	48.0 (47.0–50.0)	54.0 (53.0–57.0)
40–49 years	363	29.18 (0.64)	13.0 (12.0–15.0)	17.0 (15.0–18.0)	23.0 (21.0–23.0)	30.0 (28.0–32.0)	40.0 (38.8–43.0)	49.0 (48.0–52.6)	54.0 (51.0–58.0)
50–59 years	328	28.28 (0.56)	13.0 (12.0–14.0)	16.3 (14.0–18.0)	23.0 (21.0–23.0)	28.0 (27.0–30.0)	38.0 (35.0–40.0)	47.3 (43.0–50.0)	54.0 (50.0–60.0)
60–69 years	287	27.91 (0.86)	13.0 (11.6–15.0)	16.0 (14.4–18.0)	22.0 (20.0–23.0)	28.0 (26.0–30.0)	38.0 (35.0–40.0)	44.8 (40.0–52.0)	52.5 (47.0–63.9)
70 years and older	498	28.77 (0.96)	13.0 (7.6–15.0)	15.0 (13.0–17.0)	22.0 (20.0–24.0)	30.0 (28.0–32.0)	39.0 (38.0–41.0)	50.0 (47.0–50.3)	57.0 (52.0–60.0)
70–79 years	295	28.79 (1.08)	12.3 (9.4–14.0)	15.0 (13.0–18.0)	22.0 (20.0–26.0)	30.0 (28.0–32.8)	39.0 (36.0–41.0)	47.4 (46.0–50.1)	53.6 (50.0–61.2)
80 years and older	203	28.73 (1.22)	13.0 (8.6–14.3)	15.0 (13.0–17.0)	21.0 (18.0–24.0)	30.0 (26.4–33.0)	40.0 (39.0–42.0)	50.0 (47.0–57.0)	57.0 (53.0–61.5)
Non–Hispanic black									
40 years and older	435	28.33 (0.67)	12.5 (11.0–13.0)	15.0 (13.0–16.0)	21.0 (19.0–23.0)	30.0 (28.0–33.0)	40.0 (38.0–41.0)	48.0 (46.0–50.0)	54.0 (51.8–56.0)
40–49 years	174	29.68 (1.16)	13.0 (11.4–15.0)	16.0 (13.0–18.0)	23.0 (18.9–26.0)	31.0 (27.5–34.0)	41.0 (38.0–43.0)	50.0 (45.0–56.0)	56.0 (52.0–62.1)
50–59 years	101	27.63 (0.97)	11.0 (5.1–14.2)	15.3 (10.3–17.7)	21.1 (19.0–23.0)	28.0 (26.4–30.0)	40.0 (37.3–43.0)	48.0 (45.1–51.0)	51.0 (48.0–54.9)
60–69 years	99	26.77 (1.60)	10.0 (5.0–12.8)	13.0 (10.0–15.0)	18.0 (15.0–23.0)	29.0 (25.0–33.0)	39.0 (35.6–43.9)	47.8 (42.2–59.2)	54.0 (47.9–88.0)
70 years and older	61	26.09 (1.17)	10.3 (6.0–12.0)	12.0 (8.7–16.2)	20.0 (17.0–23.3)	29.8 (27.4–32.0)	36.0 (33.0–40.0)	42.0 (38.8–44.6)	43.3 (41.6–48.0)

[1]All men includes sample persons of ''other'' race-ethnicity, but they are not shown separately.

Table 4. Percent (95% confidence intervals) of men at different total PSA thresholds

Age and race–ethnicity	Number	PSA ≥ 1 ng/mL	PSA ≥ 2 ng/mL	PSA ≥ 2.5 ng/mL	PSA ≥ 3 ng/mL	PSA ≥ 4 ng/mL	PSA ≥ 6 ng/mL	PSA ≥ 8 ng/mL	PSA ≥ 10 ng/mL
All men[1]									
40 years and older	2,546	45.1 (42.4–47.9)	17.8 (16.3–19.4)	13.1 (11.7–14.5)	9.5 (8.1–10.9)	6.2 (5.2–7.2)	2.9 (2.2–3.6)	1.7 (1.2–2.2)	1.1 (0.7–1.6)
40–49 years	747	31.3 (26.9–35.9)	6.0 (4.1–8.4)	4.2 (2.7–6.3)	*2.3 (0.9–5.0)	*1.7 (0.6–3.7)	**	**	**
50–59 years	546	45.7 (41.0–50.5)	16.7 (13.0–21.1)	10.0 (7.4–13.1)	6.4 (3.9–9.9)	3.8 (2.3–5.9)	*1.6 (0.6–3.4)	**	**
60–69 years	555	57.6 (51.9–63.2)	27.2 (23.5–31.1)	20.2 (16.8–24.1)	14.9 (12.0–18.1)	8.0 (5.9–10.6)	3.6 (2.2–5.5)	1.9 (0.9–3.4)	*1.1 (0.4–2.3)
70 years and older	698	70.0 (66.4–73.4)	44.0 (40.1–48.0)	36.9 (33.3–40.6)	30.5 (27.1–34.0)	22.0 (19.0–25.3)	11.2 (9.0–13.8)	6.3 (4.3–8.9)	4.1 (2.6–6.1)
70–79 years	447	67.3 (62.7–71.6)	41.5 (36.8–46.4)	35.1 (30.6–39.7)	28.3 (24.0–32.9)	19.5 (15.5–23.9)	8.8 (5.8–12.8)	5.1 (3.2–7.8)	3.3 (1.6–5.8)
80 years and older	251	77.3 (70.3–83.3)	50.8 (43.3–58.3)	42.0 (34.3–49.9)	36.3 (29.8–43.2)	29.0 (22.4–36.4)	17.7 (13.2–23.0)	9.6 (5.3–15.8)	6.3 (3.3–10.8)
Mexican American									
40 years and older	485	42.7 (37.3–48.2)	13.6 (10.5–17.3)	10.2 (6.9–14.4)	6.7 (4.1–10.4)	3.6 (1.8–6.2)	*1.4 (0.5–2.8)	**	**
40–49 years	166	33.7 (25.4–42.9)	*5.3 (2.0–11.1)	**	**	**	**	**	**
50–59 years	74	48.1 (36.3–60.0)	17.5 (9.6–28.0)	*11.1 (5.0–20.5)	**	**	**	**	**
60–69 years	140	50.7 (40.9–60.5)	24.0 (17.2–32.0)	17.6 (10.6–26.5)	15.0 (7.8–25.0)	*8.5 (3.2–17.8)	**	**	**
70 years and older	105	71.8 (62.2–80.2)	40.2 (30.8–50.2)	38.0 (28.3–48.5)	31.2 (21.4–42.5)	18.8 (10.2–30.3)	4.7 (1.5–10.6)	**	**
Non–Hispanic white									
40 years and older	1,476	45.4 (42.1–48.7)	18.4 (16.5–20.5)	13.5 (11.7–15.3)	9.6 (8.0–11.4)	6.2 (5.1–7.6)	2.7 (1.9–3.6)	1.5 (1.0–2.3)	1.0 (0.6–1.7)
40–49 years	363	31.6 (26.3–37.4)	6.5 (4.2–9.5)	4.9 (2.9– 7.6)	*2.7 (1.0–5.8)	**	**	**	**
50–59 years	328	44.1 (38.5–49.8)	15.8 (11.1–21.5)	9.2 (6.2–12.9)	5.5 (2.7–9.8)	*3.2 (1.5–6.0)	**	**	**
60–69 years	287	57.6 (51.0–64.1)	27.8 (22.7–33.4)	20.6 (16.0–25.7)	14.9 (11.0–19.6)	7.6 (4.8–11.3)	3.3 (1.5–6.0)	*1.4 (0.4–3.5)	**
70 years and older	498	69.7 (65.5–73.7)	44.0 (39.6–48.5)	35.9 (31.7–40.3)	29.2 (25.3–33.4)	21.1 (17.6–25.0)	10.5 (8.0–13.6)	5.8 (3.7–8.7)	4.1 (2.5–6.4)
70–79 years	295	67.2 (61.5–72.5)	41.9 (36.2–47.7)	34.3 (28.9–40.0)	27.3 (22.3–32.8)	19.0 (14.7–23.9)	8.2 (4.9–12.6)	4.3 (2.2–7.4)	*3.3 (1.5–6.3)
80 years and older	203	76.4 (68.6–83.1)	49.6 (41.7–57.6)	40.0 (32.2–48.3)	34.3 (27.7–41.3)	26.6 (19.8–34.4)	16.8 (11.9–22.7)	9.8 (5.4–16.1)	6.1 (3.0–10.8)
Non–Hispanic black									
40 years and older	435	45.7 (40.1–51.3)	19.0 (14.6–24.1)	12.5 (9.2–16.3)	9.5 (6.6–13.2)	7.8 (5.2–11.1)	4.3 (2.6–6.7)	3.0 (1.6–5.1)	*1.9 (0.9–3.7)
40–49 years	174	33.7 (26.7–41.2)	*5.9 (2.2–12.5)	**	**	**	**	**	**
50–59 years	101	47.4 (35.6–59.3)	24.2 (16.3–33.8)	13.9 (7.8–22.2)	*8.5 (3.7–16.3)	*7.9 (3.2–15.7)	**	**	**
60–69 years	99	68.3 (58.2–77.3)	35.7 (26.3–45.9)	26.5 (18.2–36.4)	21.3 (13.7–30.7)	16.6 (9.1–26.7)	*9.8 (4.3–18.5)	*9.1 (3.6–18.0)	*5.7 (2.0–12.3)
70 years and older	61	70.8 (56.8–82.4)	47.9 (33.8–62.3)	46.2 (31.1–61.9)	43.6 (29.1–58.9)	37.2 (24.8–51.0)	20.0 (10.8–32.2)	*12.7 (4.9–25.5)	**

* Relative standard error 30–40 percent.
** Relative standard error greater than 40 percent, and the value was suppressed.
[1]All men includes sample persons of ''other'' race-ethnicity, but they are not shown separately.

Table 5. Distribution of percent free PSA by total PSA for different age groups

Age group and Total PSA (ng/mL)	Percent free PSA (percent)	Number	Percent of men (95% CI)	Estimated population (95% CI)[2]
All men[1]				
Total	Total	2,546	100.0	57,609,000
	≤15	259	9.2 (7.6–11.0)	5,305,000 (4,391,000–6,339,000)
	>15–25	714	28.0 (25.8–30.3)	16,136,000 (14,889,000–17,430,000)
	>25	1,573	62.8 (59.6–65.9)	36,168,000 (34,319,000–37,971,000)
0 to <2.5	Total	2,077	86.9 (85.5–88.3)	50,091,000 (49,234,000–50,890,000)
	≤15	121	5.0 (3.9–6.4)	2,898,000 (2,252,000–3,663,000)
	>15–25	543	23.1 (21.0–25.3)	13,282,000 (12,071,000–14,553,000)
	>25	1,413	58.9 (55.9–61.8)	33,911,000 (32,219,000–35,576,000)
2.5+	Total	469	13.1 (11.7–14.5)	7,519,000 (6,720,000–8,376,000)
2.5 to <4.0	Total	224	6.9 (5.8–8.0)	3,960,000 (3,361,000–4,629,000)
	≤15	47	1.5 (1.0–2.2)	867,000 (555,000–1,290,000)
	>15–25	91	2.9 (2.3–3.7)	1,681,000 (1,304,000–2,132,000)
	>25	86	2.4 (1.9–3.1)	1,411,000 (1,086,000–1,802,000)
4.0+	Total	245	6.2 (5.2–7.2)	3,559,000 (3,012,000–4,170,000)
4.0 to <10	Total	195	5.1 (4.2–6.1)	2,929,000 (2,413,000–3,517,000)
	≤15	58	1.9 (1.3–2.8)	1,107,000 (731,000–1,605,000)
	>15–25	67	1.8 (1.3–2.4)	1,020,000 (730,000–1,386,000)
	>25	70	1.4 (1.0–1.9)	802,000 (561,000–1,110,000)
10.0+	Total	50	1.1 (0.7–1.6)	630,000 (419,000–909,000)
	≤15	33	0.8 (0.5–1.2)	433,000 (261,000–673,000)
	>15–25	13	*0.3 (0.1–0.6)	*153,000 (60,000–318,000)
	>25	4	**	**
40–49 years				
Total	Total	747	100.0	21,363,000
	≤15	59	8.4 (6.4–10.7)	1,786,000 (1,365,000–2,285,000)
	>15–25	204	27.4 (23.4–31.8)	5,859,000 (4,993,000–6,787,000)
	>25	484	64.2 (59.4–68.8)	13,718,000 (12,686,000–14,707,000)
0 to <2.5	Total	718	95.8 (93.7–97.3)	20,464,000 (20,021,000–20,793,000)
	≤15	48	6.5 (4.8–8.6)	1,396,000 (1,028,000–1,844,000)
	>15–25	189	25.3 (21.3–29.7)	5,406,000 (4,542,000–6,342,000)
	>25	481	64.0 (59.3–68.5)	13,663,000 (12,660,000–14,625,000)
2.5+	Total	29	4.2 (2.7–6.3)	899,000 (570,000–1,341,000)
2.5 to <4.0	Total	20	2.5 (1.5–3.9)	540,000 (326,000–838,000)
	>25	17	2.3 (1.3–3.6)	484,000 (283,000–770,000)
4.0+	Total	9	*1.7 (0.6–3.7)	*359,000 (129,000–787,000)
4.0 to <10.0	Total	8	**	**
10.0+	Total	1	**	**
50–59 years				
Total	Total	546	100.0	16,373,000
	≤15	60	10.0 (7.3–13.4)	1,640,000 (1,189,000–2,188,000)
	15–25	171	29.5 (24.9–34.4)	4,831,000 (4,078,000–5,639,000)
	25	315	60.5 (56.2–64.6)	9,902,000 (9,201,000–10,585,000)
0 to <2.5	Total	487	90.0 (86.9–92.6)	14,733,000 (14,226,000–15,155,000)
	≤15	32	5.3 (3.4–7.7)	866,000 (564,000–1,264,000)
	15–25	147	25.6 (21.4–30.2)	4,197,000 (3,510,000–4,943,000)
	25	308	59.1 (54.8–63.2)	9,671,000 (8,974,000–10,351,000)
2.5+	Total	59	10.0 (7.4–13.1)	1,640,000 (1,218,000–2,147,000)
2.5 to <4.0	Total	36	6.2 (4.3–8.6)	1,013,000 (701,000–1,408,000)
	≤25	31	4.9 (3.0–7.5)	809,000 (499,000–1,231,000)
4.0+	Total	23	3.8 (2.3–5.9)	627,000 (379,000–970,000)
4.0 to <10.0	Total	18	3.0 (1.6–5.1)	497,000 (265,000–842,000)
	≤25	16	2.9 (1.4–5.1)	469,000 (231,000–841,000)
10.0+	Total	5	**	**

See footnotes at end of table.

Table 5. Distribution of percent free PSA by total PSA for different age groups—Con.

Age group and Total PSA (ng/mL)	Percent free PSA (percent)	Number	Percent of men (95% CI)	Estimated population (95% CI)[2]
60–69 years				
Total	Total	555	100.0	9,932,000
	≤15	57	8.2 (6.0–10.8)	812,000 (594,000–1,078,000)
	>15%–25	173	30.8 (25.8–36.3)	3,064,000 (2,559,000–3,605,000)
	>25	325	61.0 (55.0–66.8)	6,056,000 (5,458,000–6,631,000)
0 to 2.5	Total	439	79.8 (75.9–83.2)	7,921,000 (7,543,000–8,264,000)
	≤15	20	*2.7 (1.2–5.1)	*271,000 (123,000–511,000)
	15%–25	126	22.5 (18.8–26.6)	2,234,000 (1,864,000–2,639,000)
	>25	293	54.5 (49.6–59.4)	5,416,000 (4,926,000–5,901,000)
2.5+	Total	116	20.2 (16.8–24.1)	2,011,000 (1,668,000–2,389,000)
2.5 to 4.0	Total	61	12.2 (8.9–16.2)	1,212,000 (883,000–1,609,000)
	≤25	39	7.3 (4.6–10.8)	722,000 (456,000–1,077,000)
	>25	22	4.9 (2.7–8.2)	489,000 (265,000–817,000)
4.0+	Total	55	8.0 (5.9–10.6)	799,000 (588,000–1,056,000)
4.0 to 10.0	Total	43	7.0 (5.0–9.4)	691,000 (495,000–934,000)
	≤25	35	5.5 (3.7–7.9)	551,000 (367,000–789,000)
	>25	8	*1.4 (0.5–3.0)	*141,000 (53,000–300,000)
10.0+	Total	12	*1.1 (0.4–2.3)	*108,000 (40,000–233,000)
	≤25	10	*1.0 (0.3–2.2)	*98,000 (34,000–220,000)
70–79 years				
Total	Total	447	100.0	6,817,000
	≤15	51	10.6 (6.8–15.5)	720,000 (463,000–1,054,000)
	>15%–25	105	22.5 (17.0–28.8)	1,533,000 (1,160,000–1,961,000)
	>25	291	66.9 (58.3–74.8)	4,563,000 (3,974,000–5,100,000)
0 to 2.5	Total	288	64.9 (60.3–69.4)	4,427,000 (4,112,000–4,729,000)
	≤25	67	14.6 (9.6–20.8)	993,000 (656,000–1,416,000)
	>25	221	50.4 (43.8–57.0)	3,435,000 (2,983,000–3,885,000)
2.5+	Total	159	35.1 (30.6–39.7)	2,390,000 (2,088,000–2,705,000)
2.5 to 4.0	Total	71	15.6 (12.4–19.3)	1,063,000 (842,000–1,316,000)
	≤25	36	6.8 (4.0–10.5)	461,000 (276,000–716,000)
	>25	35	8.8 (6.1–12.4)	602,000 (412,000–842,000)
4.0+	Total	88	19.5 (15.5–23.9)	1,326,000 (1,059,000–1,627,000)
4.0 to 10.0	Total	73	16.2 (12.4–20.7)	1,105,000 (842,000–1,410,000)
	≤25	40	9.1 (5.6–13.6)	618,000 (384,000–930,000)
	>25	33	7.1 (4.9–10.0)	486,000 (333,000–680,000)
10.0+	Total	15	3.3 (1.6–5.8)	222,000 (111,000–394,000)
	≤25	13	2.7 (1.4–4.6)	181,000 (93,000–316,000)
80 years and above				
Total	Total	251	100.0	3,125,000
	≤15	32	12.9 (8.0–19.3)	403,000 (249,000–604,000)
	>15%–25	61	25.7 (20.4–31.5)	802,000 (636,000–985,000)
	>25	158	61.5 (53.9–68.6)	1,921,000 (1,686,000–2,144,000)
0 to <2.5	Total	145	58.0 (50.1–65.7)	1,814,000 (1,566,000–2,052,000)
	≤25	35	14.4 (10.3–19.4)	451,000 (323,000–606,000)
	>25	110	43.6 (37.2–50.2)	1,363,000 (1,162,000–1,568,000)
2.5+	Total	106	42.0 (34.3–49.9)	1,311,000 (1,073,000–1,559,000)
2.5 to <4.0	Total	36	12.9 (9.1–17.7)	405,000 (283,000–554,000)
	≤25	15	5.3 (2.7–9.3)	167,000 (85,000–292,000)
	>25	21	7.6 (4.4–12.1)	238,000 (137,000–378,000
4.0+	Total	70	29.0 (22.4–36.4)	907,000 (700,000–1,136,000)
4.0 to <10.0	Total	53	22.7 (17.2–29.0)	709,000 (537,000–907,000)
	≤25	26	12.5 (7.8–18.5)	389,000 (245,000–577,000)
	>25	27	10.3 (6.4–15.3)	320,000 (200,000–479,000)
10.0+	Total	17	6.3 (3.3–10.8)	197,000 (103,000–336,000)
	≤25	17	6.3 (3.3–10.8)	197,000 (103,000–336,000)

* Relative standard error 30–40 percent.
** Relative standard error is greater than 40 percent, and the value was suppressed.
[1]All men includes sample persons of ''other'' race-ethnicity, but they are not shown separately.
[2]Estimated population and 95% confidence interval are rounded to nearest 1,000.

Suggested citation

Lacher DA, Thompson TD, Hughes JP, Saraiya M. Total, free, and percent free prostate-specific antigen levels among U.S. men, 2001–04. Advance data from vital and health statistics; no 379. Hyattsville, MD: National Center for Health Statistics. 2006.

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06-0151 (12/06)
CS107046
T26957
DHHS Publication No. (PHS) 2007-1250

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