Published in final edited form as:
Cancer. 2012 March 1; 118(5): 1397–1403. doi:10.1002/cncr.26208.

Racial variation in tumor stage at diagnosis among Department of Defense beneficiaries

Lindsey Enewold, PhD, MPH[1], **Jing Zhou, MS**[1], **Katherine A. McGlynn, PhD, MPH**[2], **Susan S. Devesa, PhD**[2], **Craig D. Shriver, MD**[1,3], **John F. Potter, MD**[1,4], **Shelia H. Zahm, ScD**[2], and **Kangmin Zhu, MD, PhD**[1,4]

[1] United States Military Cancer Institute, Walter Reed Army Medical Center, Washington, DC

[2] Division of Cancer Epidemiology and Genetics, NCI, NIH, Bethesda, MD

[3] Department of Surgery, Division of Surgical Oncology, Walter Reed Army Medical Center, Washington, DC

[4] Uniformed Services University, Bethesda, MD

Abstract

Introduction—Tumor stage at diagnosis often varies by racial/ethnic group, possibly due to inequitable healthcare access. Within the Department of Defense (DoD) Military Health System, beneficiaries have equal healthcare access. This study aimed to determine if tumor stage differed between whites and blacks for breast, cervical, colorectal and prostate cancers, which have effective screening regimens, based on data from the DoD's Automated Cancer Tumor Registry from 1990–2003.

Methods—Distributions of tumor stage (localized vs. non-localized) between whites and blacks in the military were compared stratified by sex, active duty status, and age at diagnosis. Logistic regression was used to further adjust for age, marital status, year of diagnosis, geographic region, military service branch and tumor grade. Distributions of tumor stage were then compared between the military and general populations.

Results—Racial differences in the distribution of stage were significant only among non-active duty beneficiaries. After adjusting for covariates, earlier stages of breast cancer after age 49 and prostate cancer after age 64 were significantly more common among white than black non-active duty beneficiaries ($p<0.05$), although the absolute difference for prostate cancer was minimal.

Address Correspondence and reprints to: Lindsey Enewold, PhD MPH, United States Military Cancer Institute, Armed Forces Institute of Pathology (AFIP), Building 54, Rm N1512, 6825 16th Street NW, Washington, DC 20306-6000, Telephone: 202-782-7373, Fax: 202-782-3757, Lindsey.Enewold@us.army.mil.

Author Disclosure Statement: No competing financial interests exist.

Disclaimer:
We certify that all individuals who qualify as authors have been listed; that each has participated in the conception and design of this work, the analysis of data (when applicable), the writing of the document, and the approval of the submission of this version; that the document represents valid work; that if we used information derived from another source, we obtained all necessary approvals to use it and made appropriate acknowledgements in the document; and that each takes public responsibility for it. Nothing in the presentation implies any Federal/DOD/DON endorsement. The opinions and assertions contained in this article represent the private views of the authors and do not reflect the official views of the US Departments of the Army, Navy, or Defense, National Cancer Institute, or US Government.

Racial differences in stage for cervical and colorectal cancers were not significant after adjustment. Compared to the general population, the racial differences in the military were similar or slightly attenuated.

Conclusion—Racial disparities in stage at diagnosis were apparent in the DoD's equal access healthcare system among older non-active duty beneficiaries. Socioeconomic status, supplemental insurance, cultural beliefs and biological factors may be related to these results.

Introduction

Cancer is the second leading cause of death in the US,[1] resulting in an estimated 569,490 deaths in 2010.[2] Earlier tumor stage at diagnosis, which can be achieved by screening of some cancers, is associated with improved outcome. Cancer screening tests have been established for breast, cervical, colorectal, and prostate cancers. In the general US population, however, many of these tumors are still diagnosed at later stages, particularly among blacks. As a result, blacks tend to have lower relative survival rates than whites.[3]

The reasons for these racial disparities are complex and likely arise due to a combination of factors. The most often cited reasons for the worse statistics among blacks are lower socioeconomic status and decreased insurance coverage resulting in limited access to quality healthcare.[4–8] However, other factors such as cultural beliefs[4,7,9] and genetic or other biological variations[6,10] have also been implicated.

The Department of Defense (DoD)'s Military Health System provides a unique opportunity to study potential racial disparities because equal healthcare access is provided without regard to race or socioeconomic status. A recent survey of DoD beneficiaries indicated that self-reported cancer screening rates were higher, and racial/ethnic disparities in cancer screening rates were lower, in comparison to the general US population.[11] It is unclear if these findings translate to decreased racial disparities in tumor stage at diagnosis. Previous studies among combined DoD active and non-active duty beneficiaries have found evidence of racial variation by tumor stage at diagnosis for colorectal and breast cancers.[12–14] However, it was not known if racial if racial differences varied by active duty status or persisted after adjusting for other covariates.

The aim of this study was to conduct a DoD-wide comparison of tumor stage at diagnosis between whites and blacks for four cancers (breast, cervical, colorectal, and prostate). These cancer sites were selected because racial variations in stage at diagnosis observed in the general population may be partially attributable to access to the established screening tests. Comparisons were made between white and black beneficiaries by sex, active duty status, and age at diagnosis because active duty personnel may be monitored more closely and because cancer screening practices vary with age.[15] Data on racial differences by tumor stage at diagnosis in the general US population were obtained for comparison. It was hypothesized that tumor stage at diagnosis would not differ significantly within the military by race after covariate stratification and adjustment and that any racial differences observed in the military would be less than in the general population.

Methods

The Automated Cancer Tumor Registry (ACTUR) was established in 1986 and is the data collection and clinical tracking system for all cancer cases diagnosed or treated at military treatment facilities among DoD beneficiaries, including active-duty military personnel, retired military personnel, and their dependents. Certified cancer registrars at each facility enter and maintain the ACTUR data according to state and federal guidelines. The registry includes information on demographic factors (e.g., age, race, sex and geographic location), diagnostic factors (e.g., date of diagnosis), and tumor characteristics (e.g., histology, stage and grade). The anatomic sites of the cancers were categorized using the first International Classification of Diseases for Oncology (ICD-O) for cases diagnosed from 1986 to 1991,[16] the second edition ICD-O-2 for cases diagnosed from 1992 to 2001,[17] and the third edition ICD-O-3 for cases diagnosed since 2001;[18] all cases were recoded using the ICD-O-3 codes by ACTUR personnel.

For the purposes of this study, registry data for cases aged 18 years or older and diagnosed from 1990 to 2003 were included. Although all data submitted to ACTUR are reviewed and verified for accurate diagnoses, cases diagnosed between 1986 and 1989 were excluded to minimize the possibility of incomplete ascertainment. Procedures were developed with reference to national and state cancer registry guidelines[19,20] to identify and consolidate duplicate records so that only one record existed for each primary cancer. Tumor stage at diagnosis was determined by combining two variables: “SEER Summary Stage 1977” for cases diagnosed from 1990 to 2000 and “SEER Summary Stage 2000” for cases diagnosed from 2001 to 2003. These variables are described and used by the Surveillance, Epidemiology, and End Results (SEER) program of the National Cancer Institute.[21,22] When there were multiple records per tumor at the time of diagnosis with different tumor stage codes, the information was chosen as follows: 1) if surgery information was available, then the code associated with the most definitive surgery was selected; and 2) if no surgery information was available, then the most advanced stage code was selected. Cancer-specific age categories were based on the American Cancer Society (ACS) cancer screening recommendations: breast cancer screening via mammography starting at age 40 years; cervical cancer via Pap smear between 18 and 69 years; and colorectal and prostate cancer starting at age 50 years.[15] There are generally few older active duty beneficiaries, especially those who are Medicare eligible (age 65+); however, there are many older non-active duty beneficiaries, which allowed for further age stratification among this latter group. Breast, prostate and colorectal cancers were thereby investigated separately among individuals older than 64 years. Breast cancer was also investigated among women aged 50 to 64 years; the average age at menopause is 50 years and breast cancer etiology is known to vary by menopausal status. Cervical cancer was investigated stratified at age 30 years because ACS recommendations change at this age from annually/bi-annually to every 2–3 years, depending on the method used. Individuals aged 65 to 69 years were not investigated separately for cervical cancer due to small numbers.

For comparison to the general US population, data for cases diagnosed from 1990 to 2003 were obtained on breast and cervical cancers among women and colorectal cancers among both sexes from the nine original SEER registries (Connecticut, Iowa, New Mexico, Utah,

Hawaii, Detroit, San Francisco-Oakland, Atlanta, and Seattle-Puget Sound), which cover about 10% of the US population.[23] As in ACTUR, tumor site was based on ICD-O-3 codes. Stage at diagnosis was determined for each case according to "SEER Historic Stage A" codes (in situ, localized, regional, distant, unstaged; in situ cancers were not included in this analysis).[24] SEER Historic Stage A codes are comparable to SEER Summary Stage codes (for localized vs. regional/distant stages) that were used by ACTUR for breast, prostate and cervical cancers. Codes for colorectal cancer stages differ somewhat in that colorectal tumors with "invasion of/through serosa" are classified as localized in SEER and regional in ACTUR.[25] Stage comparisons of prostate cancer between the two populations were not conducted because SEER Historic Stage A codes for prostate cancer group localized and regional cases in a single category.[26]

The distributions of tumor stage between whites and blacks within the same population were compared, stratified by sex, cancer, categorical age at diagnosis and active duty status at diagnosis. For active-duty members only univariate analyses were conducted using Chi-square tests or Fisher's exact tests because sample sizes were relatively small. For non-active-duty members and the SEER population, odds ratios (ORs) and 95% confidence intervals (CIs) comparing tumor stage (localized vs. regional/distant) between blacks and whites while adjusting for continuous age, marital status (Married, Single/Divorced/Separated/Widowed, Unknown), year of diagnosis, geographic region (North, South, West, Unknown),[27] tumor grade (I, II, III/IV, Unknown) and military service branch (Army, Navy, Air Force, Marine, Other; ACTUR only) were calculated if cell frequencies for the binary tumor stage variable were at least 10. All analyses were conducted using SAS software, version 9.1 (SAS Institute Inc., Cary, NC), and the two-sided significance level was set at $p<0.05$.

The protocol for this study was reviewed and approved by the National Naval Medical Center Institutional Review Board (IRB), and the Armed Forced Institute of Pathology IRB.

Results

For descriptive purposes, the demographic characteristics of the included cancer cases in the military by duty status and in the general population are presented by cancer site in Table 1. Among active duty beneficiaries, there were 782 breast, 133 cervical, and 69 colorectal cancers with known tumor stage diagnosed from 1990 to 2003 among women and 817 prostate and 588 colorectal cancers included among men. No significant differences in tumor stage distribution for any of these cancers were observed between white and black active duty beneficiaries (Table 2).

Among non-active duty beneficiaries, there were 16,306 breast, 1,196 cervical, and 3,679 colorectal cancers included among women and 21,867 prostate and 6,016 colorectal cancers among men (Table 3). Significant racial variation was observed among both sexes. White women older than 49 years of age were less likely to have nonlocalized breast cancers than were black women, after adjustment for age, marital status, year of diagnosis, geographic region, military service branch and tumor grade. This racial difference increased with age (18–39: OR=1.07; 40–49: OR=0.85; 50–64: OR=0.77; 65+: OR=0.63; p-interaction<0.01).

A significant racial difference in stage distribution was observed for prostate cancer among men age 65 years or older (adjusted OR=0.78; 95% CI=0.68–0.91), but the actual variation in the distribution was small, suggesting that statistical significance was the result of the large sample size. After adjustment, no significant racial differences in stage distribution were observed for cervical or colorectal cancers.

There were 222,952 breast, 11,544 cervical, and 78,896 colorectal cancers included among women and 79,977 colorectal cancers included among men in the general population (Table 3). The percentages of cancers that were localized were significantly higher among whites than blacks for all four cancers, even after adjustment. Racial differences did not vary significantly by age.

When compared to the general population, the racial difference in percentage of cancers that were localized among non-active duty beneficiaries tended to be similar or slightly attenuated. For example in SEER, among women aged 18 to 39 years, 53% of white and 44% of black women were diagnosed with local breast cancers (difference= 9%) compared to 50% and 51% of their respective counterparts in ACTUR (difference= −1%). Comparisons between the general population and the active duty military population were not conducted because no significant racial differences were observed among the latter population.

Discussion

The distribution of tumor stage by race did not appear to vary greatly among active duty beneficiaries for the four cancers studied but small sample sizes may have resulted in insufficient power to detect true differences. In contrast, racial differences were observed among non-active duty beneficiaries, particularly among older individuals with breast or prostate cancers. Nonetheless, the racial differences observed in the military appear to be similar or attenuated in comparison to the general population; the racial difference in percentage of cancers that were localized was smaller for breast among young non-active duty female beneficiaries in comparison to young women in the general population.

Our results among non-active duty beneficiaries were in agreement with a previous DoD-wide breast cancer study, although the calendar years differed.[14] Our findings further indicated that significant racial differences exist after covariate adjustment and occur for age groups for whom mammography is recommended. It is unclear why racial differences in breast cancer stage increased with age in the military but not in the general population. After covariate adjustment our findings indicated that stage at diagnosis for colorectal cancer did not differ significantly between whites and blacks, which is contradictory to previous unadjusted studies among DoD beneficiaries.[12,13] This inconsistency may have resulted from differences in study populations as one of the previous studies[12] was based on registry data from one DoD medical center whereas our study was DoD-wide. Geographical variation in utilization and physician practices have been observed in the Department of Veterans Affairs (VA) healthcare system,[28] which is composed of military veterans. Additionally, our study adjusted for covariates whereas the previous studies[12,13] did not. To

our knowledge, stage at diagnosis of prostate and cervical cancers among DoD beneficiaries have not been previously summarized and compared by race.

Larger racial disparities were observed among older non-active duty individuals. We can only speculate as to what the reasons are. The disparity may be due to increased physical or cultural barriers to healthcare utilization and variations in healthcare options among older individuals. These barriers could result in a greater tendency for black individuals to forgo more frequent care and/or postpone seeking medical care until after symptoms appear, thus resulting in a greater proportion of older black beneficiaries diagnosed at later stages of cancer. Although our data did not contain information on the use of cancer screening tests and could not show any racial differences in cancer screening, perceived cancer risk and cancer screening awareness have been observed to vary by race.[29,30] Racial variations in other health insurance (i.e., through employment, spouse or Medicare) may also influence healthcare seeking behaviors. Additionally, it is possible that racial differences in genetics or other biological factors might result in variations in tumor aggressiveness[31] and thus differences in tumor stage at diagnosis.

The main strength of this study was the use of data from a healthcare system that is based on equal access to assess racial variations. Limitations of the study included the small numbers of specific cancer cases by race among active duty beneficiaries. Such numbers may have limited the power to detect racial differences. Secondly, the grouped categorization of localized and regional prostate cancers in the SEER data precluded us from comparing the magnitude of the racial difference in tumor stage between the two populations for this cancer site. There is also the possibility of under-reporting in ACTUR. Although DoD policies require cancer cases to be reported to ACTUR, some military treatment facilities, especially small ones, might not have reported their cancer patients. While the extent of the under-reporting is not known, differential reporting of tumor stage by race would have to exist to explain the observed differences. Additionally, there is the possibility of selection bias of the cases that were included in the study because beneficiaries have to be seen at a DoD medical center to be reported to ACTUR; beneficiaries with other health insurance may seek care elsewhere. There would have to be differential selection by stage and race for this to account for the observed differences. If whites have greater access to other healthcare and are diagnosed elsewhere at earlier stages, it is possible that our findings could represent an underestimate of the true racial difference in tumor stage at diagnosis among non-active duty military beneficiaries. Finally, for colorectal cancer, differences in tumor stage criteria between the two populations may partially explain the higher percentage of localized tumors in the general population; therefore, results should be interpreted with caution. However, unless the percentage of tumors with “invasion of/through serosa” differed by race, the racial difference in percentage of localized tumors in the two populations should be comparable.

In conclusion, racial disparities in tumor stage at diagnosis were not observed in the DoD Military Health System among active duty beneficiaries, but disparities were apparent among older non-active duty beneficiaries, with whites generally being diagnosed with earlier stage breast and prostate cancers than blacks. Although the DoD system is based on equal access, racial variation in socioeconomic status and supplemental insurance may still

affect tumor stage at diagnosis. As such, more studies are needed to assess the independent impact of these and other possible factors.

Acknowledgments

Sources of support: This research was supported by the United States Military Cancer Institute via the Uniformed Services University of the Health Sciences under the auspices of the Henry M. Jackson Foundation for the Advancement of Military Medicine and by the Division of Cancer Epidemiology and Genetics (DCEG), National Cancer Institute.

This research was supported by the United States Military Cancer Institute via the Uniformed Services University of the Health Sciences under the auspices of the Henry M. Jackson Foundation for the Advancement of Military Medicine and by the Division of Cancer Epidemiology and Genetics (DCEG), National Cancer Institute. The authors thank the Armed Forces Institute of Pathology for providing the ACTUR data, especially Ms. Annette Anderson for coordinating the process; Dr. Hongyu Wu of USMCI for her help in computer programming; Dr. Larry Maxwell, Mr. William Mahr and Ms. Anne Dimke of United States Military Cancer Institute for their support and help; and Dr. Sally Bushhouse of Minnesota Cancer Surveillance System for providing the useful MN-PATRL document.

References

1. Heron M, Hoyert DL, Murphy SL, Xu J, Kochanek KD, Tejada-Vera B. Deaths: Final data for 2006. National Vital Statistics Reports. 2009; 57(14):1–135. [PubMed: 19788058]
2. American Cancer Society. Cancer facts and figures 2010. Atlanta: American Cancer Society; 2010.
3. Horner, MJ.; Ries, LAG.; Krapcho, M., et al. SEER Cancer Statistics Review, 1975–2006. National Cancer Institute; Bethesda, MD: 2009. http://seer.cancer.gov/csr/1975_2006/, based on November 2008 SEER data submission, posted to the SEER web site
4. Blackman DJ, Masi CM. Racial and ethnic disparities in breast cancer mortality: are we doing enough to address the root causes? J Clin Oncol. 2006 May 10; 24(14):2170–8. [PubMed: 16682736]
5. Downs LS, Smith JS, Scarinci I, Flowers L, Parham G. The disparity of cervical cancer in diverse populations. Gynecol Oncol. 2008 May; 109(2 Suppl):S22–30. [PubMed: 18482555]
6. Freedland SJ, Isaacs WB. Explaining racial differences in prostate cancer in the United States: sociology or biology? Prostate. 2005 Feb 15; 62(3):243–52. [PubMed: 15389726]
7. Gerend MA, Pai M. Social determinants of Black-White disparities in breast cancer mortality: a review. Cancer Epidemiol Biomarkers Prev. 2008 Nov; 17(11):2913–23. [PubMed: 18990731]
8. Kauh J, Brawley OW, Berger M. Racial disparities in colorectal cancer. Curr Probl Cancer. 2007 May-Jun;31(3):123–33. [PubMed: 17543944]
9. Behbakht K, Lynch A, Teal S, Degeest K, Massad S. Social and cultural barriers to Papanicolaou test screening in an urban population. Obstet Gynecol. 2004; 104:1355–61. [PubMed: 15572502]
10. Martin DN, Boersma BJ, Yi M, et al. Differences in the tumor microenvironment between African-American and European-American breast cancer patients. PLoS One. 2009; 4(2):e4531. [PubMed: 19225562]
11. Bagchi AD, Schone E, Higgins P, Granger E, Casscells SW, Croghan T. Racial and ethnic health disparities in TRICARE. Journal of the National Medical Association. 2009; 101(7):663–70. [PubMed: 19634587]
12. Hassan MO, Arthurs Z, Sohn VY, Steele SR. Race does not impact colorectal cancer treatment or outcomes with equal access. Am J Surg. 2009 Apr; 197(4):485–90. [PubMed: 18639231]
13. Hofmann LJ, Lee S, Waddell B, Davis KG. Effect of Race on Colon Cancer Treatment and Outcomes in the Department of Defense Healthcare System. Dis Colon Rectum. 2010; 53:9–15. [PubMed: 20010344]
14. Jatoi I, Becher H, Leake CR. Widening disparity in survival between White and African-American patients with breast carcinoma treated in the U. S. Department of Defense Healthcare System. Cancer. 2003; 98(5):894–9. [PubMed: 12942554]

15. Smith R, Cokkinides V, Brawley OW. Cancer screening in the United States, 2009: a review of current American Cancer Society guidelines and issues in cancer screening. CA Cancer J Clin. 2009; 59(1):27–41. [PubMed: 19147867]
16. International Classification of Diseases for Oncology. Geneva: World Health Organization; 1976.
17. Percy, C.; Van Holten, V.; Muir, C. International Classification of Diseases for Oncology. 2. Geneva: World Health Organization; 1990.
18. Fritz, A.; Percy, C.; Jack, A., et al. International Classification of Diseases for Oncology. 3. Geneva: World Health Organization; 2000.
19. Johnson, CH.; Peace, S.; Adamo, P.; Fritz, A.; Percy-Laurry, A.; Edwards, BK. Surveillance, Epidemiology and End Results Program. National Cancer Institute; Bethesda, MD: 2007. The 2007 multiple primary and histology coding rules.
20. The North American Association of Central Cancer Registries. Report of the Automated Tumor Work Group of the ROC. 2005.
21. Shambaugh, EM.; Weiss, MA.; Axtell, LM., editors. Summary Staging Guide For The Cancer Surveillance, Epidemiology and End Results Reporting (SEER) Program. National Cancer Institute; Bethesda, MD: 1977.
22. Young, JL Jr; Roffers, SD.; Ries, LAG.; Fritz, AG.; Hurlbut, AA., editors. NIH Pub. No. 01-4969. National Cancer Institute; Bethesda, MD: 2001. SEER Summary Staging Manual - 2000: Codes and Coding Instructions.
23. Surveillance, Epidemiology, and End Results (SEER) Program. National Cancer Institute, DCCPS, Surveillance Research Program, Cancer Statistics Branch; SEER*Stat Database: Incidence - SEER 17 Regs Limited-Use + Hurricane Katrina Impacted Louisiana Cases, Nov 2008 Sub (1973–2006 varying) - Linked To County Attributes - Total U.S., 1969–2006 Counties. (www.seer.cancer.gov)released April 2009, based on the November 2008 submission
24. SEER Research Data Record Description Cases Diagnosed in 1973–2007*. SEER Research Data File Documentation. Apr. 2010 seer.cancer.gov/manuals/TextData.FileDescription.pdf
25. Young, JL., Jr; Roffers, SD.; Ries, LAG.; Fritz, AG.; Hurlbut, AA., editors. NIH Pub. No. 01-4969. National Cancer Institute; Bethesda, MD: 2001. http://seer.cancer.gov/tools/ssm/
26. Surveillance Epidemiology and End Results. Localized/Regional/Distant Stage Adjustments For Data through 2007 (November 2009 Submission). http://seer.cancer.gov/seerstat/variables/seer/yr1973_2007/lrd_stage/ Accessed
27. TRICARE Management Activity. [Accessed, 2009] TRICARE Regions. <http://www.tricare.mil/mybenefit/ProfileFilter.do?puri=%2Fhome%2Foverview%2FRegions>
28. Ashton CM, Petersen NJ, Souchek J, et al. Geographic variation in utilization rates in Veterans Affairs hospitals and clinics. NEJM. 1999; 340:32–9. [PubMed: 9878643]
29. Thurman N, Ragin C, Heron DE, et al. Comparison of knowledge and attitudes toward cancer among African Americans. Infect Agent Cancer. 2009; 4 (Suppl 1):S15. [PubMed: 19208206]
30. Wolff M, Bates T, Beck B, Young S, Ahmed SM, Maurana C. Cancer prevention in underserved African American communities: barriers and effective strategies--a review of the literature. WMJ. 2003; 102(5):36–40. [PubMed: 14621929]
31. Albain KS, Unger JM, Crowley JJ, Coltman CA Jr, Hershman DL. Racial disparities in cancer survival among randomized clinical trials patients of the Southwest Oncology Group. JNCI. 2009; 101(14):984–92. [PubMed: 19584328]

Table 1

Distribution of demographic variables among cancer cases in the Department of Defense's Automated Central Tumor Registry (ACTUR) and the general population (SEER) by cancer site, 1990–2003.

			ACTUR					
			Active Duty		Non-Active Duty		SEER	
Cancer site	Demographic variable		N	%	N	%	N	%
Breast	Age*	18–39	407	52%	1,591	10%	12,608	6%
		40+	375	48%	14,715	90%	210,344	94%
	Race	White	487	62%	14,302	88%	203,353	91%
		Black	295	38%	2,004	12%	19,599	9%
Cervix	Age*	18–29	39	29%	145	12%	1,048	9%
		30–69	94	71%	1,051	88%	10,496	91%
	Race	White	107	80%	1,059	89%	9,742	84%
		Black	26	20%	137	11%	1,802	16%
Colorectum	Age*	18–49	565	86%	948	10%	11,480	7%
		50+	92	14%	8747	90%	147,393	93%
	Race	White	500	76%	8,432	87%	143,675	90%
		Black	157	24%	1,263	13%	15,197	10%
	Sex	Women	69	11%	3,679	38%	78,896	50%
		Men	588	89%	6,016	62%	79,977	50%
Prostate**	Age*	18–49	413	51%	423	2%		
		50+	404	49%	21444	98%		
	Race	White	623	76%	17,894	82%		
		Black	194	24%	3,973	18%		

*Age categories were cancer site specific based on American Cancer Society cancer screening recommendations.

**Prostate cancer in SEER was not analyzed.

Table 2

Racial comparison of tumor stage at diagnosis for selected cancers among active duty Department of Defense healthcare beneficiaries by sex, cancer site and age at diagnosis, Automated Central Tumor Registry 1990–2003.

Sex	Site	Age at diagnosis	Stage*	White		Black		p-value**
Women	Breast	18–39	Localized	112	49%	90	50%	0.89
			Regional/Distant	115	51%	90	50%	
		40+	Localized	162	62%	62	54%	0.13
			Regional/Distant	98	38%	53	46%	
	Cervix	18–29	Localized	27	84%	4	57%	0.14
			Regional/Distant	5	16%	3	43%	
		30–69	Localized	67	89%	16	84%	0.69
			Regional/Distant	8	11%	3	16%	
	Colorectum	18–49	Localized	17	46%	6	26%	0.12
			Regional/Distant	20	54%	17	74%	
		50+	Localized	3	43%	1	50%	1.00
			Regional/Distant	4	57%	1	50%	
Men	Prostate	18–49	Localized	242	88%	119	86%	0.61
			Regional/Distant	33	12%	19	14%	
		50+	Localized	280	80%	47	84%	0.54
			Regional/Distant	68	20%	9	16%	
	Colorectum	18–49	Localized	140	37%	42	34%	0.62
			Regional/Distant	242	63%	81	66%	
		50+	Localized	39	53%	5	56%	1.00
			Regional/Distant	35	47%	4	44%	

* SEER Summary Stage 1977: cases diagnosed 1990–2000 and SEER Summary Stage 2000: cases diagnosed 2001–2003.

** Two-sided p-value from a Chi-square test or Fishers exact test (expected cell frequencies <5) comparing the distribution between whites and blacks.

Table 3

Racial comparison of tumor stage at diagnosis for selected cancers among non-active duty Department of Defense healthcare beneficiaries (ACTUR) and individuals in the general US population (SEER) by sex, cancer site and age at diagnosis, 1990–2003.

				ACTUR					SEER				
Sex	**Site**	**Age**	**Stage***	**White**		**Black**		**OR** (95% CI)**	**White**		**Black**		**OR** (95% CI)**
Women	Breast	18–39	Localized	606	50%	193	51%	1.07 (0.85–1.36)	5,533	53%	919	44%	0.71 (0.64–0.79)
			Regional/Distant	605	50%	187	49%		5,005	47%	1,151	56%	
		40–49	Localized	1,491	58%	271	52%	0.85 (0.70–1.03)	19,914	60%	2,311	51%	0.76 (0.71–0.81)
			Regional/Distant	1,059	42%	253	48%		13,509	40%	2,202	49%	
		50–64	Localized	4076	67%	450	58%	0.77 (0.66–0.90)	41,701	65%	3,551	55%	0.73 (0.69–0.77)
			Regional/Distant	2036	33%	329	42%		22,579	35%	2,941	45%	
		65+	Localized	3297	74%	202	63%	0.63 (0.49–0.81)	67,086	71%	3,963	61%	0.72 (0.68–0.76)
			Regional/Distant	1132	26%	119	37%		28,026	29%	2,562	39%	
	Cervix	18–29	Localized	99	78%	15	83%	--	768	84%	101	77%	0.63 (0.37–1.07)
			Regional/Distant	28	22%	3	17%		148	16%	31	23%	
		30–69	Localized	645	69%	81	68%	1.01 (0.65–1.57)	5,286	60%	837	50%	0.74 (0.66–0.84)
			Regional/Distant	287	31%	38	32%		3,540	40%	833	50%	
	Colorectum	18–49	Localized	128	30%	47	34%	1.30 (0.83–2.04)	1,655	37%	307	32%	0.71 (0.60–0.84)
			Regional/Distant	301	70%	90	66%		2,759	63%	663	68%	
		50–64	Localized	486	39%	88	37%	0.92 (0.68–1.26)	5,281	40%	853	38%	0.81 (0.73–0.89)
			Regional/Distant	749	61%	147	63%		7,765	60%	1,413	62%	
		65+	Localized	634	43%	52	33%	0.71 (0.49–1.02)	22,460	42%	1,860	39%	0.84 (0.78–0.89)
			Regional/Distant	853	57%	104	67%		31,008	58%	2,872	61%	
Men	Prostate	18–49	Localized	190	84%	157	80%	0.70 (0.39, 1.27)					
			Regional/Distant	36	16%	40	20%						
		50–64	Localized	5743	81%	1707	82%	1.14 (0.99, 1.31)					
			Regional/Distant	1336	19%	380	18%						
		65+	Localized	8904	84%	1369	81%	0.78 (0.68, 0.91)					
			Regional/Distant	1685	16%	320	19%						
	Colorectum	18–49	Localized	77	26%	24	29%	0.96 (0.52, 1.76)	1,895	36%	292	32%	0.79 (0.67–0.93)
			Regional/Distant	221	74%	60	71%		3,301	64%	608	68%	

				ACTUR					SEER				
Sex	**Site**	**Age**	**Stage***	**White**		**Black**		**OR** (95% CI)**	**White**		**Black**		**OR** (95% CI)**
		50–64	Localized	864	39%	132	36%	0.85 (0.67, 1.08)	7,640	42%	897	37%	0.77 (0.70–0.85)
			Regional/Distant	1363	61%	237	64%		10,669	58%	1,502	63%	
		65+	Localized	1221	44%	112	40%	0.78 (0.60, 1.01)	21,665	44%	1,573	40%	0.81 (0.76–0.87)
			Regional/Distant	1535	56%	170	60%		27,578	56%	2,357	60%	

* ACTUR: SEER Summary Stage 1977: cases diagnosed 1990–2000 and SEER Summary Stage 2000: cases diagnosed 2001–2003. SEER: SEER Historic Stage A.

** Odds Ratio and 95% Confidence Interval comparing local vs. regional/distant tumors between blacks vs. whites adjusted for continuous age, marital status, year of diagnosis, geographic region, tumor grade and military service branch (ACTUR only). Not calculated for prostate cancer in SEER because Historic Stage A codes combine local and regional cases.

--Not calculated if frequency was <10