Published in final edited form as:
Mil Med. 2012 June ; 177(6): 693–701.

Cancer Incidence among Patients of the United States Veterans Affairs (VA) Healthcare System

Leah L. Zullig, MPH[a,b], **George L. Jackson, PhD**[a,c], **Raye Anne Dorn, MPH**[d], **Dawn T. Provenzale, MD**[a,e,f], **Rebecca McNeil, PhD**[e], **Catherine M. Thomas, ScM**[e], and **Michael J. Kelley, MD**[g,h,i]

[a]Center for Health Services Research in Primary Care, Durham Veterans Affairs Medical Center, 508 Fulton Street, Durham, NC 27705, USA

[b]Department of Health Policy and Management, University of North Carolina at Chapel Hill, 1101 McGavran-Greenberg Hall, Chapel Hill, NC 27599, USA

[c]Division of General Internal Medicine, Duke University Medical Center, 2301 Erwin Road, Durham, NC 27710, USA

[d]Washington Veterans Affairs Medical Center, 50 Irving St. NW, Washington, DC 20422, USA

[e]Epidemiologic Research and Information Center, Durham Veterans Affairs Medical Center, Durham, NC, 508 Fulton Street, Durham, NC 27705, USA

[f]Division of Gastroenterology, Duke University Medical Center, 2301 Erwin Road, Durham, NC 27710, USA

[g]Office of Patient Care Services, Department of Veterans Affairs, 810 Vermont Ave., Washington, DC 20420, USA

[h]Hematology-Oncology Service, Durham Veterans Affairs Medical Center, Durham, NC, 508 Fulton Street, Durham, NC 27705, USA

[i]Division of Medical Oncology, Duke University Medical Center, 2301 Erwin Road, Durham, NC 27710, USA

Abstract

Objective—Approximately 40,000 incident cancer cases are reported in VA Central Cancer Registry (VACCR) annually (~3% of United States cancer cases). Our objective was to provide the first comprehensive description of cancer incidence as reported in VACCR.

Methods—Data were obtained from VACCR for incident cancers diagnosed in VA. Analyses focused on 2007 data. Cancer incidence among VA patients was compared to the general U.S. cancer population.

Results—In 2007, 97.5% of VA cancers were diagnosed among men. Approximately 78.5% of newly diagnosed patients were White, 19.0% Black, and 2.5% were another race. Median age at diagnosis was 66 years. The geographic distribution of cancer patients in VA aligns that of VA users. The most commonly diagnosed cancers were similar between VA and the U.S. male cancer population. The five most frequently diagnosed cancers among VA cancer patients were: prostate (31.8%), lung/bronchus (18.8%), colon/rectum (8.6%), urinary bladder (3.6%), and skin melanomas (3.4%). VA patients were diagnosed at an earlier stage of disease for the three most

Corresponding Author Contact Information: Michael J. Kelley, MD, Durham VA Medical Center, Hematology/Oncology (111G), 508 Fulton St. Durham, NC 27705, Work phone: 1-919-286-0411 ext. 7331; Fax: 1-919-286-6896; michael.kelley6@va.gov.

commonly diagnosed cancers – lung/bronchus, colon/rectum, and prostate – compared to the U.S. male cancer population.

Conclusions—Registry data indicate that incident cancers in VA in 2007 approximately mirrored those observed among U.S. men.

Keywords

Veterans; United States Department of Veterans Affairs; Neoplasms; Incidence

INTRODUCTION

In 2007, approximately five million Veterans received care in the Veterans Affairs (VA) healthcare system, making it one of the leading U.S. providers of healthcare.[1, 2] Moreover, approximately 3% of U.S. cancer diagnoses are made in VA annually. This equates to ~40,000 incidence cancer cases reported in the VA Central Cancer Registry (VACCR) each year. While state and national cancer statistics are routinely reported[3, 4], there has been no public reporting of cancer incidence from the VACCR. The objective of this paper is to provide the first-ever comprehensive description of cancer incidence as reported in the VACCR in 2007. To achieve this objective we present cancer frequencies within the VA population in 2007 and provide comparisons with the larger U.S. cancer population based on incidence estimates developed annually by the American Cancer Society.[4]

The VA patient population is unique. In order to qualify to receive VA healthcare, patients must have served in the United States armed forces. VA users must undergo a financial needs assessment and may receive care at a reduced cost due to financial need or because of a service-related injury or disease.[5] As a result of this qualification process, users of VA healthcare are more likely to have poor health status, have lower levels of education and income, and be of minority race.[6]

To provide health care for this distinct patient population, the VA currently operates a network of approximately 153 hospital facilities (at least one in each state, the District of Columbia, and Puerto Rico), and 788 community-based outpatient clinics focusing on primary care.[7] Approximately 143 VA hospitals have cancer diagnostic and treating capabilities. These facilities share a national electronic health record (EHR) system.[8] This EHR provides the basic information to equip registry activities. One hundred thirty-two VA facilities have some level of cancer registry activity. There are full cancer registry programs at 129 hospitals, covering the spectrum of the VA system. The VA Central Cancer Registry has maintained a comprehensive database containing records of cancer cases treated in the VA system retrospectively to 1995. We report VACCR cancer incidence information from 2007, which is the most current, complete year of data.

METHODS

The analyses for this report were conducted as part of a VA data quality improvement project approved by the Chief Officer of Patient Care Services. The goal of the project was to provide a descriptive analysis of cancer incidence in the VA.

The VA Central Cancer Registry

In response to a national directive in 1998, many VA facilities began local cancer registry operations. Additional VA facilities became operational until all facilities were accruing data in 2001 (Table 1). The VACCR was formally recognized in 2003.[9] After reaching national participation, the number of new cases reported through the VA registry system has remained stable at approximately 40,000 new cases annually.

The VACCR retrospectively abstracted incident cases diagnosed on or after January 1, 1995. VACCR continues to abstract prospectively, striving to capture all cancer cases occurring within the VA system. It has been estimated that VACCR captures nearly 90% of cancer cases treated in VA.[9,10] To achieve this level of case identification and abstraction, cancer registrars in VA use custom software, called OncoTraX, which is directly integrated with the VA electronic health record system. Cancer registrars manually abstract case data, conforming to standards set by the North American Association of Central Cancer Registries (NAACCR). In keeping with the NAACCR criteria for reportable cases, the VACCR includes cases that are diagnosed outside of the VA healthcare system if they subsequently receive care within VA. Data are then aggregated into the national cancer registry located in Washington, DC. Once the data are centralized, cases are merged and quality assurance checks are conducted. Data in the registry are retrospectively updated as new information is obtained by VACCR.

All VA medical centers diagnosing and treating veterans with reportable malignancies are required to collect and submit patient-level data to the VACCR biannually. To ensure data integrity, local registry data files must meet the NAACCR electronic quality standards before being consolidated into the national master file.[11] As a result of this process, VACCR incurs reporting delays slightly in excess of one year. By comparison, other national cancer registries generally lag by two years post-diagnosis.[12]

For this analysis, data were obtained from VACCR for all incident cases diagnosed in the Veteran Affairs population from 1995 through 2007, the most current year that has been internally validated.

This report describes cancer incidence using VACCR data from 2007. *In situ* cancers (n=3,684) were excluded from analysis unless otherwise noted; these were identified by a Surveillance, Epidemiology and End Results (SEER) summary stage of 0. SEER is a constellation of geographically-based cancer registries that collect information on incidence, prevalence, and survival from approximately one-fourth of the nation. This exclusion primarily affected the reported frequency of urinary bladder cancer (n=1,252) and melanoma of the skin (n=1,178). No other exclusions were made.

Descriptive Variables

Within the VA, geographic location is described by Veterans Integrated Service Networks (VISN). To simplify analysis, each case's VISN of origin was sub-grouped into geographic regions. These regions were defined as follows: 1) Northeastern region, defined as VISNs 1, 2, 3, and 4; 2) Southern region, defined as VISNs 5, 6, 7, 8, 9, 16, and 17; 3) Midwestern region, defined as VISNs 10, 11, 12, and 15; and 4) Western region, defined as VISNs 18, 19, 20, 21, and 22. Due to VHA reorganization, VISNs 13 and 14 were merged to create VISN 22. The regions described here are not equally distributed based on landmass or patient population, but approximate standard geographical divisions of the U.S.[13]

Primary anatomic site was defined according to International Classification of Diseases for Oncology (ICD-O-3) site and histology (i.e. type) codes.[14] ICD-O-3 codes are commonly used in pathology reports and cancer registries to capture information about the topography and morphology of neoplasms. The unit of analysis throughout this report is the specific cancer diagnosis and not unique patient. Therefore, patients with multiple cancer diagnoses have multiple records in the database and may be included in the analysis several times. A recurrence of an existing cancer diagnosis would not be coded separately.

Statistical Analysis

Frequency distributions of incident cancer diagnoses were evaluated by primary anatomical site, sex, race, and geographic region. Cancer frequency trends within the VA population were examined descriptively and comparisons were made with the larger U.S. cancer population. Due to the categorical nature of these data, the characteristics of cancer cases were summarized using frequencies and proportions. These were compared by sex and race at the organ system level using a chi-square test when a minimum of 25 cases occurred in each comparison group. Standard methods of age-adjustment to the 2000 projected U.S. population[15] were used in support of comparisons with the general U.S. population, as follows: 1) within each age category, calculated the crude cancer incidence within the VA based on the 2007 VA population; 2) within each age category, calculated the expected cancer frequency for the 2000 Standard Population as (crude incidence in VA) x (2000 Standard Population); 3) summed the expected cancer frequencies over age categories; and 4) estimated the age-adjusted cancer incidence by dividing the summed frequencies by the 2000 Standard Population total. Statistical analyses were performed using Stata 10 (StataCorp LP, College Station, TX) and SAS 9.2 (SAS Institute Inc., Cary, NC).

RESULTS

Mirroring the format of other reports on cancer incidence in the United States, we have provided a summary of key characteristics of patients with incident cancer among VA patients.[4] In addition to descriptive text and tables, we provide a brief interpretation of our findings, which are categorized by: 1) overall incidence, 2) sex, 3) race, 4) age, 5) geographic distribution, 6) stage at diagnosis, 7) and change in number of incident cases.

Demographic Characteristics

In fiscal year 2007 (October 1, 2006 through September 30, 2007), approximately five million patients received care in VA.[1] Approximately 39,505 of these patients were diagnosed with cancer. Among these cancer diagnoses, 97.5% occurred in men (38,513/39,505), while 2.5% were in women (989/39,505). To mitigate the potential impact of outlying patients who were diagnosed at very young or very old ages, the median age at diagnosis was examined rather than the mathematical mean. The median age of VA patients newly diagnosed with cancer in 2007 was 66 years (min.=15, max.=100 years). Approximately 78.5% of cancer occurred among White patients (31,010/39,505), compared to approximately 19% among Black patients (7,523/39,505).

Incidence of Common Cancers

The number of incident cancer cases by anatomic site is described in Table 2. Within the VA, these cancers are prostate, lung and bronchus, colon and rectum, urinary bladder, melanomas of the skin, kidney, liver, non-Hodgkin's lymphoma, leukemia, and larynx (Table 2).

Sex Differences in Incidence

The most frequently diagnosed cancer among Veteran men was prostate cancer, accounting for about 33% (12,543/38,513) of male cancer diagnoses. Among women Veterans, breast cancer was the most commonly diagnosed, accounting for about 30% (292/989) of female cancers. For both sexes, cancers of the lung and bronchus, and colon and rectum, occur second and third most frequently, respectively. Urinary bladder is fourth in ranking for men both nationally and within VA (1,397/38,513), comprising 4% of VA male cancer diagnoses. For women in the VA, the fourth ranked cancer is corpus uteri (49/989), accounting for 5% of female cancers.

Racial Differences in Incidence

Table 3 provides a tabulation of incident cases by cancer site and racial group. Moderate differences between White and Black Veterans are apparent, such as for lung and bronchus (19.7% vs. 15.5%) and melanoma (4.2% vs. 0.1%). The most striking difference is in prostate cancer, which accounted for 28.9% of cancers in White Veterans but 42.7% of cancers in Black Veterans.

Age Distribution

The median age of Veterans enrolled in VA is approximately 57 years[16], compared to the median age of the general population of approximately 38 years.[18] However, the median age at diagnosis for VA cancers in both sexes in 2007 was 67 years, exactly the same as the median age at diagnosis for all SEER cancer sites.[19] The most cancers occurred in Veterans aged 55–64 years, accounting for approximately 37% of cancer diagnoses (Table 4). Those aged 65–74 years were the second most frequently diagnosed group, with 28% of cancer diagnoses. These age categories also had the highest number of incident cases after age-adjustment. After adjusting the age structure of the VA population to that of the 2000 U.S. Standard Population, we estimated that the age-adjusted cancer incidence is 426 cases per 100,000 person-years.

The median age at diagnosis differed between men and women. Among male Veterans with cancer, the median age at diagnosis was 66 years, while it was 58 among females. Age at diagnosis in women in VA is nearly 10 years younger than among all women with cancer. National SEER estimates from 2003–2007 depict an overall median age at diagnosis of 65 years for women diagnosed with any type of cancer.[19] In addition, median age at diagnosis within sexes has remained relatively consistent over time within the VA cancer patient population. For women, the median age at diagnosis has ranged from 58–61 years over the span of 2000–2007. Similarly, men's median age at diagnosis has been approximately 67 years over the same seven-year span. The median age at diagnosis varied slightly according to anatomic site. For prostate cancer, the median age at diagnosis was 66 years. This is similar to the SEER national estimate, which is 67 years.[19] For VA colorectal cancer patients, median age at diagnosis was 68 years, identical to the SEER estimate. However, VA lung cancer patients are slightly younger at diagnosis than those in the U.S. as a whole. Within VA, the median age at lung cancer diagnosis is 68 years; the SEER median age at diagnosis for men is 70 years.[19]

Geographic Distribution

The geographic distribution of cancer patients in VA generally mirrors the geographic distribution of VA users. Among Veterans enrolled in VA, more live in the South, approximately 41%, compared to other regions. The Midwest and West each contain about 20% of the VA population. Slightly fewer (17%) live in the Northeast. The South has approximately 42% (16,738/39,505), Midwest 22% (8,869/39,505), West 21% (8,295/39,505), and Northeast 14% (5,603/39,505) of VA cancer patients.

Distribution of Stage at Diagnosis

Stage at diagnosis is an important predictor of prognosis and five-year survival rates.[4] Stage at diagnosis was examined for the three most commonly occurring cancer sites: lung and bronchus, colon and rectum, and prostate. The distribution of stage at diagnosis in VA differs from that in the general population for these cancers.

In 2007, approximately 23% (1,699/7,437) of lung cancer diagnoses made in VA were localized. In contrast, only 15% of the SEER lung cancer population was diagnosed with localized disease.[19] Similarly, slightly under 46% of lung cancers (3,431/7,437) in VA were

metastatic at time of diagnosis, compared with 56% in the broader population.[19] Colon and rectal cancer rates follow a similar pattern of earlier stage at diagnosis within VA. In VA, approximately 42% (1,441/2,384) of colorectal cancers are localized at diagnosis, compared with about 39% in the SEER population. The rate of diagnosis of metastatic colorectal cancer is similar with about 18% (614/2,384) in VA and 19% in the SEER populations.[19] Likewise, prostate cancers are diagnosed earlier among Veterans. Approximately 89% (11,117/12,544) of VA prostate cancers are localized when diagnosed, compared with 80% in the broader population. Rates of metastatic prostate cancer diagnosis are the same in VA and outside at approximately 4%.[19]

Changes in the Number of VA Incident Cancers

As the number of VA patients has grown, there has been a commensurate increase in the number of incident cancer cases in the VA from 2001 to 2007. Breast and lung cancer incidence remained stable. However, liver and prostate cancers are on an upward trend. Incident prostate cancer cases rose from 11,603 to 12,544 per year over this six-year span – an increase of 941 cases, representing an absolute 2% increase in prostate cancer's fraction of overall VA cancer cases. During this timeframe, the number of new liver cancer cases increased from 570 to 1,057 cases – an increase of 487 cases, which represents a near-doubling of crude frequency of liver cancer over six years. Conversely, colorectal cancer experienced a slight decline in both incidence and rate. There was a decrease of 351 colorectal cancer patients between 2001 (3,865) and 2007 (3,446). This equates to a 1.2% decrease in colorectal cancer's fraction of total cancer cases. Given the small number of incident cases, breast cancer remains a small fraction of cancers in VA (0.9%); this fraction has remained constant from 2001 to 2007.

DISCUSSION

Data from the VA Central Cancer Registry (VACCR) in 2007 suggest that cancer incidence in the VA is similar to that which is seen in the general male U.S. cancer patient population. Over 45,000 new cases of cancer were diagnosed in VA, approximately 40,000 of which were invasive. It is estimated that VA cares for 175,000 Veteran cancer patients annually, with over 3% of all U.S. cancer diagnoses made in VA each year.[4]

The Veteran Affairs patient population is a unique subset of the American population, with a distinct demographic distribution.[6] Following the historical composition of the U.S. military, VA serves a predominately male population. However, the composition of the Nation's military is evolving – transforming the future Veteran population. Women comprise a small, but increasing portion of VA patients. Of those who have served in the military since 1990, approximately 15% are women.[22] In addition, Veteran patients are older than the general US population. Most healthcare systems have a more expansive distribution of age groups; however, the requirement for prior military service limits the number of VA patients under the age of 20. Most are considerably older – the median age of Veterans is approximately 57 years compared to the median age of the general population of approximately 38 years.[18] As the sex and age distribution of the overall Veteran population shifts, the cancer composition will also change. These demographic differences between Veterans and the overall U.S. population result in differences in the cancers identified and treated in VA.

Moreover, when compared with nationally published cancer statistics, the most commonly diagnosed cancers for Veterans are similar to those of the male United States population.[3, 4] However, the frequency of these cancers as a fraction of all cancers in VA varies somewhat from national percentages. For example, approximately 25% of cancer diagnoses in men nationally are prostate,[3, 4] while within VA, prostate cancer accounts for approximately 33% of male cancer diagnoses. These differences may be a reflection of the older age of the VA

population relative to the general U.S. population.[6] Similarly, younger age and earlier stage at diagnosis have been associated with better prognosis and increased survival rates,[4] but patients qualifying for and using VA healthcare tend to be older. As a result of this changing demographic, interpretation of age and sex differences is complex. The overall age of female Veterans treated within VA is younger than that of their male counterparts. This is due to the changing sex composition of military service members.[20,21] As a result, the difference in median age at diagnosis between men and women may reflect the fact that female VA patients tend to be younger than male VA patients.

Several studies have noted racial variations in cancer incidence and treatment.[4] The U.S. Census Bureau (which surveys all Veterans, not just those using the VA healthcare system) estimates that 83% of Veterans are White and under 10% of Veterans are African-American.[16] There is evidence that users of the VA healthcare system are more likely to be African American, are less likely to be employed, and likely has a lower annual income.[17] The observed racial distribution of cancer in VA (78.5% among White and 19% among Black) reflects a similar burden of illness among Black Veterans.

We found that patients in VA are diagnosed with commonly occurring cancers at earlier stages, relative to the general population. This finding is consistent with evidence from the Government Performance Review Act Report on Oncology (2010).[23] Intensive screening directives and an electronic clinical reminder system may be responsible for earlier detection. However, VA has no screening program for lung cancer, which had the largest shift toward earlier stage at diagnosis in VA relative to the US population. VA patients diagnosed with lung cancer have more frequent and more severe lung disease,[23] which may prompt more frequent diagnostic evaluation that may incidentally result in diagnosis of asymptomatic lung cancer.

This analysis provides anecdotal evidence of VACCR's utility as an epidemiological tracking and research tool. This finding has important implications. VACCR has a myriad of potential future uses. VACCR data could be used to assemble and report measurements of incident cancers among Veterans; to provide information on changes over time in extent of disease at diagnosis and treatment; to promote and conduct studies designed to identify factors relating to cancer etiology, prevention, and control; to respond to requests from individuals and organizations in the Department of Veterans Affairs for cancer data and analysis; and to provide data and expertise for cancer research activities and educational opportunities. These possible uses of VACCR could aid decision-making for resource allocation and to provide a data source for research.

VACCR data have served an integral role in informing numerous VA quality improvement and research initiatives. Specifically, VACCR data have been used as a basis for cancer case identification and patient tracking for a number of studies examining colorectal cancer screening, diagnosis, receipt of guideline-concordant cancer care, and timeliness of treatment.[10, 24–26] VACCR data have also been examined to assess possible changes in the composition of VA cancer cases and related diseases over time.[24, 25] Data from the VACCR have also been utilized to make comparisons between VA cancer care and care delivered in the private sector. It has been determined that cancer care for older Americans is generally equivalent in both settings.[23] Furthermore, data have been used to identify cancer patients that may be eligible for research initiatives or may be experiencing barriers to cancer care.[27]

Limitations

Despite the utility of VACCR data, this analysis has important limitations. Previous studies have indicated that that VACCR captures an estimated 87% to nearly 90% or better of cancer patients treated by the VA.[10, 20] Like most registries, VACCR is tasked with

systematic collection of data about cancer incidence. By design, VACCR does not currently contain timely mortality data; for example, only 7% of patients diagnosed with lung cancer in 2001 are recorded as deceased in VACCR. This makes calculating survival rates and outcomes based solely on VACCR data difficult. A positive difference between the VA cancer registry and other cancer registries is that VA has access to system-wide integrated electronic medical record and supporting administrative data. Furthermore, the quality of VACCR is currently unknown, but there is an ongoing validation project comparing VACCR data with manually abstracted data from the electronic medical record for a sample of lung cancer cases. VACCR data can be supplemented with administrative vital status information. These resources also better equip VA to accurately measure its registry capture rate, whereas other registries must rely upon population predictions.

A second limitation of this analysis is that the estimated annual incidence rates should not be generalized to all Veterans in the United States. Veterans have a choice in where they receive their healthcare. Patients may receive all or part of their care in the private sector. Some Veterans may begin using VA healthcare services upon receiving a diagnosis of cancer elsewhere. This leads to healthcare system overlap. For example, patients may be counted both in a SEER registry and in the VACCR.[28] This could result in duplication bias. The SEER summary data is a historical data comparison, therefore caution should be exercised in interpreting this comparison.

It should be noted that patients using the VA tend to be older, sicker, and of lower socioeconomic status than the overall U.S. and Veteran populations as a whole.[29] As a result, estimates presented in this report apply only to patients receiving care in the VA healthcare system, not all Veterans in the United States. Furthermore, these underlying differences in the VA patient population and the general U.S. result in limited generalizability of study findings to a broader national context.

Third, the age-adjusted incidence rates should be interpreted with caution. The “population” of VA patients is dependent on definitions of who uses the healthcare system. Population figures were obtained from the VA Office of Policy and Planning (OPP). In addition, information was not available to subtract individuals with prevalent cancer from the VA population denominator, which could lead to an under-estimate of incidence rate. However, this may be offset by the fact that the VA cancer registry does not capture all incident cases. As a result, the numbers should be interpreted as the best available approximation of the age-adjusted incidence rate available, but not exact numbers.

Similarly, we were unable to obtain information about the underlying racial distribution of patients using the VA healthcare system. As a result, we were unable to produce race-adjusted statistics. Future analyses would be strengthened by adjusting for both age and race.

CONCLUSION

VA Central Cancer Registry data indicate that incident cancers in VA in 2007 approximately mirrored those observed among U.S. men. Furthermore, data from the VA Central Cancer Registry are pivotal to provide accurate estimates of VA cancer incidence. This information can be used to plan efforts to improve quality of cancer care and access to services. These registry data indicate that incident cancers in VA in 2007 approximately mirrored those observed among U.S. men.

Acknowledgments

Financial Support: This work was conducted as part of a quality improvement effort of the Veterans Health Administration Office of Patient Care Services. Ms. Zullig was supported by funding from the National Cancer Institute (5R25CA116339).

References

1. U.S. Department of Veterans Affairs, Office of the Assistant Deputy Under Secretary for Health for Policy and Planning [Intranet], Washington, D.C. Selected VHA Health Statistics FY 2006 – 2007. [updated 2011 Oct 5; cited 2011 Nov 23]Available from: http://vaww4.va.gov/VHAOPP/index.asp
2. Westat [Internet]. Rockville. National Survey of Veterans, Active Duty Service Members, Demobilized National Guard and Reserve Members, Family Members, and Surviving Spouses. [updated 2010 Oct 18; cited 2011 Nov 23]Available from: http://www.va.gov/vetdata/docs/SurveysAndStudies/NVSSurveyFinalWeightedReport.pdf
3. Jemal A, Siegel R, Ward E, Hao Y, Xu J, Thun MJ. Cancer statistics, 2009. CA: a cancer journal for clinicians. Jul-Aug;2009 59(4):225–249. [PubMed: 19474385]
4. Jemal A, Siegel R, Ward E, Murray T, Xu J, Thun MJ. Cancer statistics, 2007. CA: a cancer journal for clinicians. Jan-Feb;2007 57(1):43–66. [PubMed: 17237035]
5. U.S. Department of Veterans Affairs [Internet]. Washington, D.C: VA Health Care Eligibility & Enrollment Ratings and Evaluations; Service Connection 3.303-1 [updated 2009 Sept 15; cited 2011 Nov 12]. Available from: http://www.va.gov/healtheligibility/library/pubs/healthcareoverview/
6. Agha Z, Lofgren RP, VanRuiswyk JV, Layde PM. Are patients at Veterans Affairs medical centers sicker? A comparative analysis of health status and medical resource use. Arch Intern Med. Nov 27; 2000 160(21):3252–3257. [PubMed: 11088086]
7. National Center for Veterans Analysis and Statistics [Internet]. Washington, D.C: VA Benefits & Health Care Utilization; [updated 2010 April 28; cited 2011 Nov 12]. Available from: http://www.va.gov/VETDATA/Pocket-Card/4X6_spring10_sharepoint.pdf
8. Jackson GL, Krein SL, Alverson DC, et al. Defining core issues in utilizing information technology to improve access: evaluation and research agenda. J Gen Intern Med. Nov; 26(Suppl 2):623–627. [PubMed: 21989613]
9. U.S. Department of Veterans Affairs [Internet]. Washington, D.C: VHA Directive 2003–034 National Cancer Strategy; [updated 2003 June 20; cited 2011 Nov 20]. Available from: http://vaww1.va.gov/vhapublications/ViewPublication.asp?pub_ID=261
10. Jackson GL, Melton LD, Abbott DH, et al. Quality of Nonmetastatic Colorectal Cancer Care in the Department of Veterans Affairs. Journal of Clinical Oncology. Jun 1.2010 28(19)
11. American College of Surgeons [Internet]. Chicago: Facility Oncology Registry Data Standards; [updated 2010 Dec 21; cited 2011 Nov 3]. Available from: http://www.facs.org/cancer/coc/fordsmanual.html
12. Clegg LX, Feuer EJ, Midthune DN, Fay MP, Hankey BF. Impact of reporting delay and reporting error on cancer incidence rates and trends. Journal of the National Cancer Institute. Oct 16; 2002 94(20):1537–1545. [PubMed: 12381706]
13. U.S. Department of Veterans Affairs [Internet]. Washington, D.C: Veterans Health Administration Locations; [updated 2010 July 23; cited 2011 Nov 1]. Available from: http://www2.va.gov/directory/guide/division.asp?dnum=1
14. Surveillance Epidemiology and End Results [Internet]. Washington, D.C: SEER; Site Recode ICD-O-3 (1/27/2003) Definition [updated 2003 Jan 27; cited 2011 Oct 30]. Available from: http://seer.cancer.gov/siterecode/icdo3_d01272003/
15. Klein RJ, Schoenborn CA. Age adjustment using the 2000 projected U.S. population. Healthy People 2010 statistical notes: from the Centers for Disease Control and Prevention/National Center for Health Statistics. Jan.2001 (20):1–10. [PubMed: 11676466]
16. U.S. Census Bureau [Internet]. Washington, D.C: Veterans 2000 Census Brief; [updated 2003 May; cited 2011 Nov 13]. Available from: http://www.census.gov/prod/2003pubs/c2kbr-22.pdf

17. Agha Z, Lofgren RP, VanRuiswyk JV, Layde PM. Are patients at Veterans Affairs medical centers sicker? A comparative analysis of health status and medical resource use. Arch Intern Med. 2000; 160(21):3252–3257. [PubMed: 11088086]
18. U.S. Census Bureau [Internet]. Washington, D.C: Age and Sex Composition; 2010. [updated 2011 May; cited 2011 Nov 12]. Available from: http://www.census.gov/prod/cen2010/briefs/c2010br-03.pdf
19. Altekruse, SF.; Kosary, CL.; Krapcho, M.; Neyman, N.; Aminou, R.; Waldron, W.; Ruhl, J.; Howlader, N.; Tatalovich, Z.; Cho, H.; Mariotto, A.; Eisner, MP.; Lewis, DR.; Cronin, K.; Chen, HS.; Feuer, EJ.; Stinchcomb, DG.; Edwards, BK., editors. Cancer Statistics Review, 1975–2007. Bethesda: SEER; National Cancer Institute; Internet[updated 2010; cited 2011 Nov 23]. Available from: http://seer.cancer.gov/csr/1975_2007/
20. Kimerling R, Pavao J, Valdez C, Mark H, Hyun JK, Saweikis M. Military sexual trauma and patient perceptions of Veteran Health Administration health care quality. Womens Health Issues. Jul-Aug;2011 21(4 Suppl):S145–151. [PubMed: 21724134]
21. Murdoch M, Bradley A, Mather SH, Klein RE, Turner CL, Yano EM. Women and war. What physicians should know. J Gen Intern Med. Mar; 2006 21(Suppl 3):S5–10. [PubMed: 16637946]
22. U.S. Census Bureau [Internet]. Washington, D.C: American FactFinder Veterans; [updated 2009 Oct 27; cited 2011 Oct 30]. Available from: http://fastfacts.census.gov/servlet/ACSSAFFPeople?_event=&geo_id=01000US&_geoContext=01000US&_street=&_county=&_cityTown=&_state=&_zip=&_lang=en&_sse=on&ActiveGeoDiv=&_useEV=&pctxt=fph&pgsl=010&_submenuId=people_12&ds_name=null&_ci_nbr=&qr_name=&reg=%3A&_keyword=&_industry=
23. Keating NL, Landrum MB, Lamont EB, et al. Quality of care for older patients with cancer in the Veterans Health Administration versus the private sector: a cohort study. Ann Intern Med. Jun 7; 2011 154(11):727–736. [PubMed: 21646556]
24. Chao HH, Schwartz AR, Hersh J, et al. Improving colorectal cancer screening and care in the Veterans Affairs Healthcare system. Clin Colorectal Cancer. Jan; 2009 8(1):22–28. [PubMed: 19203893]
25. Powell AA, Nugent S, Ordin DL, Noorbaloochi S, Partin MR. Evaluation of a VHA Collaborative to Improve Follow-up After a Positive Colorectal Cancer Screening Test. Med Care. Jun 2.2011
26. Jackson GL, Powell AA, Ordin DL, et al. Developing and sustaining quality improvement partnerships in the VA: the Colorectal Cancer Care Collaborative. J Gen Intern Med. Jan; 2010 25(Suppl 1):38–43. [PubMed: 20077150]
27. Zullig LL, Jackson GL, Provenzale D, Griffin JM, Phelan S, van Ryn M. Transportation - A Vehicle or Roadblock to Cancer Care for VA Patients with Colorectal Cancer? Clin Colorectal Cancer. Jul 28.2011
28. Howlader N, Ries LA, Stinchcomb DG, Edwards BK. The impact of underreported Veterans Affairs data on national cancer statistics: analysis using population-based SEER registries. J Natl Cancer Inst. 2009 Apr 1; 101(7):533–6. Epub 2009 Mar 24. [PubMed: 19318639]
29. Morgan RO, Teal CR, Reddy SG, Ford ME, Ashton CM. Measurement in Veterans Affairs Health Services Research: veterans as a special population. Health services research. Oct; 2005 40(5 Pt 2):1573–1583. [PubMed: 16178996]

Table 1

Number of Cases Reported Annually to VA Central Cancer Registry, 1995–2007.[a]

Year	Number of Reporting Facilities[b]	Number of Cases	Average Number of Cases Per Facility
1995	99	31,291	316
1996	100	31,173	312
1997	104	31,111	299
1998	105	33,440	318
1999	110	34,877	317
2000	112	36,941	330
2001	114	38,835	341
2002	115	39,725	345
2003	116	38,802	335
2004	117	39,621	339
2005	121	38,788	321
2006	123	40,085	326
2007	129	39,505	306
Total	--	**474,194**	--

[a] Cases with a SEER summary stage of 0 have been excluded.

[b] A facility is defined as a VA medical center (primary, secondary, or tertiary) that has the capacity to diagnosis and treat cancer. The number of reporting facilities for each year and definition of “facility” were provided by the National Program Director of VACCR.

Table 2

Incident Cancer Cases by Sex in Veteran Affairs Patients, 2007.[a]

	Incident Cases, 2007			
	All Sexes n (% total cancers)	Male n (% male cancers)	Female n (% female cancers)	p-value[c]
All sites	**39505**	**38513**	**989**	
Head & neck	**1712 (4.3%)**	**1689 (4.4%)**	**23 (2.3%)**	--
Tongue	452 (1.1%)	443 (1.2%)	9 (0.9%)	
Lip	101 (0.3%)	101 (0.3%)	0 (0%)	
Mouth	746 (1.9%)	739 (1.9%)	7 (0.7%)	
Pharynx	357 (0.9%)	350 (0.9%)	7 (0.7%)	
Nasal cavity & sinuses	56 (0.1%)	56 (0.1%)	0 (0%)	
Digestive system	**6965 (17.6%)**	**6827 (17.7%)**	**137 (13.9%)**	**0.0016**
Esophagus	804 (2.0%)	798 (2.1%)	6 (0.6%)	
Stomach	548 (1.4%)	543 (1.4%)	5 (0.5%)	
Small intestine	127 (0.3%)	124 (0.3%)	3 (0.3%)	
Colon	2384 (6.0%)	2329 (6.1%)	55 (5.6%)	
Rectum[b]	1037 (2.6%)	1015 (2.6%)	21 (2.1%)	
Anus	137 (0.4%)	122 (0.3%)	15 (1.5%)	
Liver & intrahepatic bile duct	1054 (2.7%)	1039 (2.7%)	15 (1.5%)	
Gallbladder	18 (<0.1%)	16 (<0.1%)	2 (0.2%)	
Pancreas	727 (1.8%)	713 (1.9%)	14 (1.4%)	
Other digestive organs	129 (0.3%)	128 (0.3%)	1 (0.1%)	
Respiratory system	**8254 (20.9%)**	**8090 (21.0%)**	**164 (16.6%)**	**0.0007**
Larynx	807 (2.0%)	800 (2.1%)	7 (0.7%)	
Lung & bronchus	7437 (18.8%)	7280 (18.9%)	157 (15.9%)	
Other respiratory organs	10 (<0.1%)	10 (<0.1%)	0 (0%)	
Bones & joints	**25 (<0.1%)**	**23 (<0.1%)**	**2 (0.2%)**	--
Bone Marrow	**484 (1.2%)**	**471 (1.2%)**	**13 (1.3%)**	--
Soft tissue (including heart)	**175 (0.4%)**	**168 (0.4%)**	**7 (0.7%)**	--
Melanoma	**1327 (3.4%)**	**1289 (3.4%)**	**38 (3.8%)**	**0.39**
Breast	**358 (0.9%)**	**66 (0.2%)**	**292 (29.5%)**	--
Genital system	**12812 (32.4%)**	**12701 (33.0%)**	**110 (11.1%)**	--
Uterine cervix	32 (<0.1%)	N/A	32 (3.2%)	
Uterine corpus	49 (0.1%)	N/A	49 (5.0%)	
Ovary	15 (<0.1%)	N/A	15 (1.5%)	
Vulva	9 (<0.1%)	N/A	9 (0.9%)	
Vagina & other genital female	5 (<0.1%)	N/A	5 (0.5%)	
Prostate[b]	12544 (31.8%)	12543 (32.6%)	N/A	
Testis	77 (0.2%)	77 (0.2%)	N/A	
Penis & other genital male	81 (0.2%)	81 (0.2%)	N/A	
Urinary system	**2804 (7.1%)**	**2756 (7.2%)**	**48 (4.9%)**	**0.0054**

	Incident Cases, 2007			
	All Sexes n (% total cancers)	Male n (% male cancers)	Female n (% female cancers)	p-value[c]
Urinary bladder	1417 (3.6%)	1397 (3.6%)	20 (2.0%)	
Kidney & renal pelvis	1307 (3.3%)	1279 (3.3%)	28 (2.8%)	
Ureter & other urinary organs	80 (0.2%)	80 (0.2%)	0 (0%)	
Eye & Orbit	**24 (0.1%)**	**24 (0.1%)**	**0 (0%)**	--
Central nervous system	**370 (0.9%)**	**350 (0.9%)**	**20 (2.0%)**	--
Brain	264 (0.7%)	257 (0.7%)	7 (0.7%)	
Other central nervous system	106 (0.3%)	93 (0.2%)	13 (1.3%)	
Endocrine system	**458 (1.2%)**	**408 (1.1%)**	**50 (5.1%)**	**< 0.0001**
Thyroid	373 (0.9%)	329 (0.9%)	44 (4.5%)	
Other endocrine	85 (0.2%)	79 (0.2%)	6 (0.6%)	
Lymphoma	**1244 (3.2%)**	**1207 (3.1%)**	**37 (3.7%)**	**0.28**
Hodgkin lymphoma	92 (0.2%)	89 (0.2%)	3 (0.3%)	
Non-Hodgkin lymphoma	1152 (2.9%)	1118 (2.9%)	34 (3.4%)	
Myeloma	**449 (1.1%)**	**441 (1.2%)**	**8 (0.8%)**	--
Leukemia	**901 (2.3%)**	**883 (2.3%)**	**18 (1.8%)**	--
Other & unspecified primary sites[b]	**1143 (2.9%)**	**1120 (2.9%)**	**22 (2.2%)**	--

[a] Cases with a SEER summary stage of 0 have been excluded.

[b] Columns may not sum to All Sexes due to presence of Other/Not stated sex.

[c] p-values are presented for male-female comparison within organ systems with a minimum of 25 cases in each category.

Table 3

Incident Cancers by Site and Race in Veteran Affairs Patients, 2007.[a]

	White N=31,010	Black N=7,523	Other N=972	p-value[b]
Head & neck	**1408 (4.5%)**	**260 (3.5%)**	**44 (4.5%)**	**< 0.0001**
Tongue	392 (1.3%)	51 (0.7%)	9 (0.9%)	
Lip	100 (0.3%)	0 (0%)	1 (0.1%)	
Mouth	613 (2.0%)	114 (1.5%)	19 (2.0%)	
Pharynx	258 (0.8%)	88 (1.2%)	11 (1.1%)	
Nasal cavity & sinuses	45 (0.2%)	7 (<0.1%)	4 (0.4%)	
Digestive system	**5381 (17.4%)**	**1418 (18.9%)**	**166 (17.1%)**	**0.0023**
Esophagus	647 (2.1%)	140 (1.9%)	17 (1.8%)	
Stomach	366 (1.2%)	157 (2.1%)	25 (2.6%)	
Small intestine	95 (0.3%)	30 (0.4%)	2 (0.2%)	
Colon	1878 (6.1%)	459 (6.1%)	47 (4.8%)	
Rectum	832 (2.7%)	183 (2.4%)	22 (2.3%)	
Anus	106 (0.3%)	28 (0.4%)	3 (0.3%)	
Liver & intrahepatic bile duct	766 (2.5%)	260 (3.5%)	28 (2.9%)	
Gallbladder	16 (<0.1%)	2 (<0.1%)	0 (0%)	
Pancreas	574 (1.9%)	136 (1.8%)	17 (1.8%)	
Other digestive organs	101 (0.3%)	23 (0.3%)	5 (0.5%)	
Respiratory system	**6763 (21.8%)**	**1327 (17.6%)**	**164 (16.9%)**	**< 0.0001**
Larynx	635 (2.1%)	158 (2.1%)	14 (1.4%)	
Lung & bronchus	6118 (19.7%)	1169 (15.5%)	150 (15.4%)	
Other respiratory organs	10 (<0.1%)	0 (0%)	0 (0%)	
Bones & joints	**24 (<0.1%)**	**1 (<0.1%)**	**0 (0%)**	**--**
Bone Marrow	**414 (1.3%)**	**65 (0.9%)**	**5 (0.5%)**	**--**
Soft tissue (including heart)	**136 (0.4%)**	**33 (0.4%)**	**6 (0.6%)**	**--**
Melanoma	**1301 (4.2%)**	**10 (0.1%)**	**16 (1.7%)**	**--**
Breast	**274 (0.9%)**	**74 (1.0%)**	**10 (1.0%)**	**--**
Genital system	**9179 (29.6%)**	**3248 (43.2%)**	**385 (39.6%)**	**< 0.0001**
Uterine cervix	16 (<0.1%)	11 (0.1%)	5 (0.5%)	
Uterine corpus	42 (0.1%)	6 (<0.1%)	1 (0.1%)	
Ovary	14 (<0.1%)	1 (<0.1%)	0 (0%)	
Vulva	6 (<0.1%)	2 (<0.1%)	1 (0.1%)	
Vagina & other genital female	5 (<0.1%)	0 (0%)	0 (0%)	
Prostate	8963 (28.9%)	3210 (42.7%)	371 (38.2%)	
Testis	65 (0.2%)	8 (0.1%)	4 (0.4%)	
Penis & other genital male	68 (0.2%)	10 (0.1%)	3 (0.3%)	
Urinary system	**2340 (7.6%)**	**404 (5.4%)**	**60 (6.2%)**	**< 0.0001**
Urinary bladder	1247 (4.0%)	134 (1.8%)	36 (3.7%)	
Kidney & renal pelvis	1024 (3.3%)	260 (3.5%)	23 (2.4%)	

	White N=31,010	Black N=7,523	Other N=972	p-value[b]
Ureter & other urinary organs	69 (0.2%)	10 (0.1%)	1 (0.1%)	
Eye & Orbit	**23 (<0.1%)**	**1 (<0.01%)**	**0 (0%)**	--
Central nervous system	**318 (1.0%)**	**45 (0.6%)**	**7 (0.7%)**	--
Brain	236 (0.8%)	23 (0.3%)	5 (0.5%)	
Other central nervous system	82 (0.3%)	22 (0.3%)	2 (0.2%)	
Endocrine system	**359 (1.2%)**	**71 (0.9%)**	**28 (2.9%)**	**0.11**
Thyroid	303 (1.0%)	46 (0.6%)	24 (2.5%)	
Other endocrine	56 (0.2%)	25 (0.3%)	4 (0.4%)	
Lymphoma	**1057 (3.4%)**	**167 (2.2%)**	**20 (2.1%)**	--
Hodgkin lymphoma	70 (0.2%)	21 (0.3%)	1 (0.1%)	
Non-Hodgkin lymphoma	987 (3.2%)	146 (1.9%)	19 (2%)	
Myeloma	**304 (1.0%)**	**131 (1.7%)**	**14 (1.4%)**	--
Leukemia	**783 (2.5%)**	**94 (1.3%)**	**24 (2.5%)**	--
Other & unspecified primary sites	**946 (3.1%)**	**174 (2.3%)**	**23 (2.4%)**	--

[a] Cases with a SEER summary stage of 0 have been excluded.

[b] p-values are presented for black-white comparison within organ systems with a minimum of 25 cases in each category.

Table 4

Age-adjusted cancer incidence in Veterans Affairs Patients, 2007.[a]

Age at Diagnosis	2007 VA Population	Cancers	Crude Incidence[b,c]	2000 Std. Population	Age-adjusted Cancers[d]	Age-adjusted Incidence[b,e]
All ages	4,875,740	39,505	810	203,851,000	869,415	426
< 25	44,581	27	61	26,258,000	15,903	
25–34	199,848	110	55	37,233,000	20,494	
35–44	287,333	358	125	44,659,000	55,642	
45–54	619,643	3,189	515	37,030,000	190,575	
55–64	1,342,466	14,703	1095	23,961,000	262,426	
65–74	966,561	11,032	1141	18,136,000	206,998	
75–84	1,077,278	8,308	771	12,315,000	94,974	
≥ 85	338,030	1,778	526	4,259,000	22,402	

[a] Cases with a SEER summary stage of 0 have been excluded.

[b] Incidence per 100,000 person-years.

[c] Crude cancer incidence is calculated as (Cancers/2007 VA Population) x 100,000.

[d] Age-adjusted cancer frequency is calculated as (2000 Std. Population) x (Cancers/2007 VA Population).

[e] Age-adjusted cancer incidence is calculated as [sum(Age-adjusted Cancers)]/[sum(2000 Std. Population)]. That is, sum the age-adjusted cancer frequencies, and divide this total by the total 2000 Std. Population.