2013 Cancer in Washington

Annual Report of the
Washington State Cancer Registry

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Percent Distribution of Cancer
All Sites Combined
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Brain and Other Nervous System
Breast (Female)
Cervix (Uterine)
Colorectal
Endometrium
Esophagus
Hodgkin Lymphoma
Kidney and Renal Pelvis
Larynx
Leukemia
Liver and Intrahepatic Bile Duct
Lung and Bronchus
Melanoma of the Skin
Myeloma
Non-Hodgkin Lymphoma
Oral Cavity and Pharynx

Ovary
Pancreas
Prostate
Soft Tissue Including Heart
Stomach
Testis
Thyroid
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Cancer by Site, Race and Ethnicity

Percent Distribution of Cancer, Race and Ethnicity
All Sites Combined
Breast (Female)
Colorectal
Endometrium
Kidney and Renal Pelvis
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Preface

This annual report of the Washington State Cancer Registry (WSCR) presents cancer data for Washington State with a focus on cancer incidence data collected by WSCR. This information is presented to assist health care providers, public health officials, voluntary organizations, and concerned citizens in their efforts to prevent and control cancer in Washington.

Introduction

Cancer is a heterogeneous group of diseases characterized by uncontrolled growth and spread of abnormal cells. In 2013, there were 38,934 new cases of cancer diagnosed in Washington. The various forms of cancer were responsible for 11,812 deaths among Washington residents in 2013, comprising approximately twenty-three percent of all deaths. In 2013, cancer (all types combined) was the most common cause of death among adults aged 45 to 84 years and the leading cause of death for all ages combined. Based on national data, some form of cancer will likely strike about 4 of 10 Washingtonians in their lifetime.[1]

Illness and death due to cancer are increasingly preventable through two types of strategies. Primary prevention aims to reduce the likelihood that a healthy individual will develop cancer. Primary prevention usually occurs through lifestyle change or screening to treat pre-cancerous conditions. Secondary prevention is accomplished by screening asymptomatic people to diagnose cancers at early and more readily treatable stages.

This report summarizes information on new cases of cancer (incidence) and deaths due to cancer (mortality) for Washington state residents and, for comparative purposes, the United States as a whole. The report provides information on cancer of all types combined and the 25 most frequently diagnosed cancers. Information is also provided on “Hodgkin lymphoma” because this cancer site was listed as the 25 most frequently diagnosed cancers in several previous years of the WSCR Annual Report. This information can be used at the state and county levels to identify the burden of morbidity and mortality associated with each type of cancer. Combined with information on cancer prevention, early detection, and treatment, this information is useful for program planning and policy development aimed at reducing the burden of cancer.

Washington State Cancer Registry

Background

RCW 70.54.230 made cancer a reportable condition in Washington in 1990 and mandated the Department of Health to establish a statewide cancer registry program. Under this mandate, the Department established the Washington State Cancer Registry (WSCR) in 1991 with data collection starting January 1, 1992. The registry is dedicated to fulfilling the legislative intent "...to establish a system to accurately monitor the incidence of cancer in the State of Washington for the purposes of understanding, controlling, and reducing the occurrence of cancer in this state.” Since 1994, funding for WSCR has been provided, in part, through the Centers for Disease Control and Prevention’s National Program of Cancer Registries under Public Law 102-515. This program was authorized to establish standards for data collection (completeness,

quality, and timeliness of reporting), and provide information for cancer prevention and control programs at the local, state, and national levels.

The North American Association of Central Cancer Registries (NAACCR) began certifying central cancer registries in 1997 as a means of recognizing achievements in case completeness, timeliness of reporting, and quality of data. WSCR has been recognized with NAACCR certification each year since 1997.

Data Collection

The cancer reporting rules (246-102 WAC) currently define reportable cancers as "any malignant neoplasm, with the exception of basal and squamous cell carcinoma of the skin." Also, specifically included are: 1) basal and squamous cell carcinoma of the external genital organs (vulva, labia, clitoris, prepuce, penis, anus, scrotum); 2) malignant and non-malignant intracranial and central nervous system tumors; 3) cancer in situ, except cancer in situ of the uterine cervix; and 4) certain hematopoietic conditions that have been recognized as potentially transforming into a malignancy. The **legally required** (*Public Law 102-515, RCW 70.54.230, 246-102 WAC*) data for cancer reporting includes patient demographics (age and sex) and medical information (type of cancer and date and stage at diagnosis and initial treatment) for all newly diagnosed cancers. Copies of Washington's cancer reporting legislation and regulations are available at http://apps.leg.wa.gov/rcw/ and http://apps.leg.wa.gov/wac/.

Cancer cases are collected through a variety of methods. Health care facilities, such as hospitals, independent laboratories, radiation/oncology treatment centers, ambulatory surgery centers, and health care providers are responsible for reporting cases to WSCR directly or indirectly. Washington State has agreements with other states to receive information on Washington residents who are diagnosed or treated in other states. The majority of Washington's out-of-state cases are reported by Oregon and Idaho, followed by Texas and Arizona. WSCR is responsible for merging the data from multiple reporting sources, conducting quality assurance in accordance with national standards, and disseminating de-identified cancer information to assist with cancer prevention and control efforts statewide and nationally.

Report Contents

This report includes chapters summarizing incidence and mortality for all cancers combined and for the 25 cancer sites most frequently diagnosed in Washington residents and Hodgkin lymphoma (See Introduction). In addition to the chapters for each site, there are introductory charts showing the relative frequency of the leading causes of cancer incidence and mortality. Appendices include technical notes, and sources of information on the epidemiology and prevention of cancer.

This report focuses on cases of cancer newly diagnosed between January 1, 2013 and December 31, 2013 and reported to WSCR as of December 2015. For some sections, other years of cancer incidence data are used, as well. Cancer incidence information is for residents of the entire state and includes new cases of cancer among Washington residents diagnosed in other states. Mortality statistics focus on deaths among Washington residents that occurred in 2013 where the underlying cause of death was cancer. The cancer may have been diagnosed before 2013. As with incidence, some sections use mortality data from additional years. Mortality data include deaths of Washington residents who die out-of-state.

The following material briefly describes the tables, graphs and charts presented in the chapters for each of the 26 cancer sites. It includes short discussions of the statistical methods used to produce each table, graph or chart, and special considerations for interpreting the data.

Tables, Charts and Graphs

Data Definitions and Sources

The Washington State Cancer Registry provides the number of new cases (incidence) of cancer identified as described above. Based on estimates of the expected number of cancer cases, the registry includes more than 95 percent of cases. Beginning in 2001, each cancer was coded to an International Classification of Diseases Oncology Third Edition (ICD-O-3) code. Data from earlier years was converted to the ICD-O-3 code. The transition from ICD-O-2 to ICD-O-3 recognized and addressed advancements in diagnosing cancers, allowing pathologists to provide detailed information previously unavailable for certain cancers. The most significant of these changes was in the coding for lymphoma and leukemia. The data definition provides the ICD-O-3 primary site and histology codes used in each section. We have used definitions (http://seer.cancer.gov/siterecode/icdo3_dwhoheme/index.html) that are consistent with those used by the national Surveillance, Epidemiology and End Results (SEER) program.

The Washington State Department of Health, Center for Health Statistics provides information from death certificates on the number and causes of death. According to the National Center for Health Statistics, more than 99 percent of all deaths occurring in the United States are registered in the death certificate system. Accuracy of reporting specific causes of death varies since classification of disease conditions is a medical-legal opinion subject to the best information available to the physician, medical examiner, or coroner certifying the cause of death. WSCR obtained the number of cancer deaths from the Vital Registration System Annual Statistical Files, Washington State Deaths 1980–2013 issued August 2014.

From 1980–1998, the underlying cause of death was coded using the International Classification of Diseases, 9th Revision (ICD-9) coding system. Consistent with national requirements, the Department of Health began using the International Classification of Diseases, 10th Revision (ICD-10) beginning with deaths occurring in 1999. While the change from the ICD-9 to the ICD-10 resulted in substantive changes in rates for some causes of death, the effect of the coding change is small for cancer. Information on the comparability of ICD-9 and ICD-10 codes is available from the National Center for Health Statistics (http://www.cdc.gov/nchs/data/nvsr/nvsr49/nvsr49_02.pdf).

The data definition provides the ICD-10 codes used in each section. We have used definitions (http://seer.cancer.gov/codrecode/1969+_d04162012/index.html) that are consistent with those used by the national Surveillance, Epidemiology and End Results (SEER) program. **For some types of cancer, including, colorectal, endometrial, leukemia, lung, myeloma and thyroid, the SEER coding differs from the National Center for Health Statistics coding.** Before comparing information from different reports, one must be sure that the definitions are consistent.

Population data necessary for calculating rates are from the Washington State Office of Financial Management, March 2015. These include intercensal interpolations for 1992–

1999, and 2001–2009, U.S. Census data for 2000 and 2010, and postcensal estimates for 2011–2013.

Incidence and Mortality Summary

These tables provide the number of new cases of cancer and the number of cancer deaths for Washington State residents in 2013. Since the numbers of new cases and deaths depend, in part, on the size of the population, the numbers are converted to rates; i.e., the number of cases per 100,000 people, so that they may be compared among different regions or populations. For diseases, such as cancer, where incidence varies with age, the rates are age-adjusted to minimize the effect of different age distributions when comparing two geographic regions or populations.

Following national standards, we have age-adjusted rates to the 2000 U.S. standard population. **When making comparisons, one must be careful to compare age-adjusted rates that are adjusted to the same standard population and are calculated in the same manner.** Following the National Cancer Institute's standard method, WSCR uses 19 age groups to age-adjust. This is different from the standard 11 age groups used by the National Center for Health Statistics. For this reason, the rates in this report may differ slightly from those published in other state or national reports. Appendix A provides detail on the age-adjustment method.

The final row of the incidence tables provides age-adjusted incidence rates from the 18 National Cancer Institute's SEER regions. These rates are from SEER*Stat version 8.2.1 client-server mode public use file, April 2015. The final row of the mortality tables provides age-adjusted mortality rates for the United States. These rates are available for the total U.S. population through SEER*Stat version 8.2.1 client-server mode public use file. SEER obtains these data from the National Center for Health Statistics. The SEER programs do not yet include data for 2013. Since cancer incidence and mortality rates do not change rapidly, 2012 national data is provided for comparison.

Stage at Diagnosis

Stage at diagnosis refers to how far a cancer has spread from its site of origin when it is diagnosed. The stages, in order of increasing spread, are in situ, local, regional and distant. Cancers staged as local, regional, distant, or unstaged are referred to as invasive. The reader should note that many publications of the National Cancer Institute and the Centers for Disease Control and Prevention report rates of invasive cancer only. Thus, caution must be exercised when comparing incidence rates contained in different reports.

The WSCR data contain the stage of disease at diagnosis coded according to the national guidelines. This report uses the derived SEER summary stage 2000 staging information that is calculated using the collaborative staging algorithm to provide the frequency distribution of cases according to their stage at diagnosis. The five different stage groups (in situ, localized, regional, distant and unstaged) are defined below.

In Situ	A tumor that fulfills all microscopic criteria for malignancy but does not invade or penetrate surrounding tissue.
Localized	A tumor that is invasive but remains restricted to the organ of origin.
Regional	A tumor that has spread by direct extension to immediately adjacent organs or tissues and/or metastasized (spread

	through the blood stream) to regional lymph nodes, but appears to have spread no further.
Distant	A tumor that has spread by direct extension beyond the immediately adjacent organs or tissues and/or metastasized to distant lymph nodes or other distant tissues.
Unstaged	Insufficient information available to determine the stage of disease at diagnosis.

For most cancers, diagnosis at an early stage (in situ or local) results in improved survival. One standard measure of survival is the five-year survival rate that estimates the proportion of individuals with a given cancer who are living five years after diagnosis. We have not developed five-year survival rates for Washington State residents. This report, however, provides the SEER five-year survival rates by stage at diagnosis for each cancer. These statistics were obtained from SEER*Stat version 8.2.1 client server mode public-use file, April 2015. The SEER five-year relative survival rates are calculated for cancer cases diagnosed between 2007 and 2011, based on follow-up of patients through 2012. The National Cancer Institute defines the relative five-year survival rate as the likelihood that a patient will not die from causes associated with their cancer within five years. The SEER*Stat program calculates this rate using a procedure described by Ederer and Heise (SEER*Stat Ederer II method).[2]

Incidence and Mortality Rate Time Trends

These graphs provide incidence and mortality rates from 1992–2013 for Washington residents per 100,000 population, age-adjusted to the U.S. 2000 standard population. (See Incidence and Mortality Summary for a discussion of age-adjusted rates.) These graphs show changes in rates over time for all Washington residents and for males and females separately. Joinpoint software, version 4.2.0.2, developed by the National Cancer Institute was used to test for changes over time. This software calculates the annual percent change (APC). Following the method described by Ries et al. to interpret findings from the Joinpoint analyses,[3] we describe rates as level over time when the APC is not statistically significantly different from zero ($p \geq 0.05$). For statistically significant trends ($p<0.05$), the increase or decrease is described as slight if the APC is less than 1 percent, steady if the APC is between 1 to 3.9 percent and sharp if the APC is greater than or equal to 4 percent. As described in Data Definitions and Sources above, there were coding changes for new cancer cases in 2001 and for causes of death in 1999. For new cancer cases, the coding changes did not result in discontinuities from earlier data for the 26 cancer sites covered in this report. The same is true for death from cancer. Therefore, the 1992–2013 data are treated as a continuous series.

Incidence and Mortality Rates by County

This report includes average annual age-adjusted cancer incidence and mortality rates for Washington residents per 100,000 population by county. (See Incidence and Mortality Summary for a discussion of age-adjusted rates.) Because of the small size of many counties and the relative rarity of some types of cancer, the incidence and mortality rates based on one year of data are not stable; i.e., there is some random fluctuation in rates from year to year. Therefore, for county rates, we combine three years of data (2011–2013) to compute average annual age-adjusted rates for the three-year period.

The state rates and 95 percent confidence intervals are included for comparison purposes. While the incidence and death statistics in this report are not subject to sampling error, they may be affected by random variation. The confidence interval is used to describe the range of that variation.

When the confidence interval for the rate of interest does not overlap with the confidence interval for the comparison rate, the two rates are statistically significantly different; i.e., the difference between the two rates is more than that expected by random variation or chance. However, if WSCR is making many comparisons statistically significant differences may still be found just by chance. In fact, with a 95 percent confidence interval, it is expected that 5 percent of the comparisons will be statistically significant by chance. If, for example, we make 1014 comparisons (26 times 39) when comparing rates for 26 cancer sites in 39 counties to state rates. Just by chance alone, we expect statistically significant differences for about 50 (5 percent of 1014) of those comparisons.

If the confidence interval for the rate of interest (for example, a confidence interval around a county rate) includes the rate for the comparison area (such as the state), the rates are not statistically significantly different. When confidence intervals for the rate of interest and the comparison rate overlap, but the interval for the rate of interest does not include the rate for the comparison area, the differences might or might not be statistically significant and formal statistical testing is needed to determine statistical significance.

Even with a three-year average, rates may fluctuate widely when there are a small number of cases. Therefore, WSCR omits the count, rate and confidence intervals when there are nine or fewer cases for the three-year period. Details of our methods for calculating confidence intervals are in Appendix A.

Cancer by Race and Ethnicity

Background on Race and Ethnicity

The concepts of race and ethnic group and the meaning assigned to these concepts have changed considerably over time. In this report, race and ethnicity refer to the social and cultural groups with which people identify. Individuals within each group are both biologically and culturally diverse. In spite of this heterogeneity, different groups have different patterns of cancer incidence and mortality. We present data by racial and ethnic groupings for two reasons. First, health care providers and community organizations often want this information, because they provide services for people who identify with one or more specific groups. Second, the federal Healthy People 2020 initiative includes goals of achieving health equity, eliminating health disparities and improving health of all groups, including groups defined by race and ethnicity. The Washington State Department of Health has adopted this goal as a priority. To achieve these goals for cancer, we must first assess patterns of disease by racial and ethnic grouping.

Beginning in 1997, the U.S. Office of Budget and Management (OMB) defined five races, including: American Indian or Alaska Native (AIAN), Asian, African-American or black, Native Hawaiian or other Pacific Islander (NHOPI) and white. This classification represents a change from the earlier standard that combined Asians and Native Hawaiians and other Pacific Islanders into one group called Asians or Pacific Islanders (API). The OMB guidelines called for adopting the new classification system by January 1, 2005. The 1997 guidelines also specified that people could identify with more than one racial group, whereas previously, one race had been the standard. The 1997 OMB

defined ethnicity as Hispanic or non-Hispanic and guidelines called for information on Hispanic origin to be collected separately from race. While OMB issued detailed standards for collecting data, advice on displaying data was less prescriptive.

The cancer reporting rules require that the information in the medical record on race and Hispanic origin be included in the data provided to WSCR. WSCR also links with data from the Indian Health Service, the Northwest Portland Area Indian Health Board and Seattle Indian Health Board to improve reporting of AIAN and follows back with facilities and health care professionals to assure reporting of Hispanic ethnicity.

Since 2004 WSCR has followed the 1997 OMB standard for collecting data, however, the WSCR Annual Report from 2004 to 2009 continued to group Asians and NHOPIs for data presentation. Grouping Asians and NHOPIs allowed us to include people who reported more than one race following National Cancer Institute's recommended method for assigning people reporting more than one race to a single racial category.

Beginning with 2010 WSCR data, we report cancer statistics for Asians and NHOPIs separately. This change also requires providing data for people who report a single race only. We made this change because differences between Asians and NHOPIs are much larger than the differences for race groups when we include those who report only one race or include everyone by assigning those reporting more than one race to a single racial category. See Appendix 4 at http://www.doh.wa.gov/Portals/1/Documents/5500/RaceEthnGuidelines.pdf for detail.

Tables, Charts and Graphs by Race and Ethnicity by Site

This portion of the report contains data on all cancers combined and on the 5 most frequently diagnosed cancer sites for each racial and ethnic grouping, resulting in 9 separate sites. The numbers of AIAN, Asian, black, Hispanic and NHOPI Washington residents are relatively small and some types of cancer are not very common. With relatively small numbers, there is often year-to-year variation in rates that appears to be random. To minimize the impact of this variation, WSCR has combined data for 2011 – 2013 for race- and Hispanic origin-specific information. Additionally, this report does not include counts, rates and confidence intervals if there are nine or fewer cancers for the three-year period and does not present stage at diagnosis information when there are fewer than 15 cases for the three years. Information on data sources and definitions is provided in the previous section, Data Definitions and Sources.

For each cancer site, there are tables showing the average annual number of new diagnoses and deaths in Washington for each racial and ethnic grouping. For 2013, we have not included national comparison data by race, because current racial categories for national data do not correspond with our categories.

In addition to the tables, charts show the age-adjusted rates for Washington with the 95 percent confidence intervals. Technical notes applicable to these race- and ethnicity-specific tables and charts are available in Incidence and Mortality Summary, Stage at Diagnosis, and Incidence and Mortality Rate Time Trends. Additionally, Incidence and Mortality Rates by County covers issues related to small numbers and confidence intervals that are applicable to rates by race and ethnic group.

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[2] Ederer F, Heise H. Instructions to IBM 650 Programmers in Processing Survival Computations, Technical. End Results Evaluation Section, National Cancer Institute, 1959.

[3] Ries LAG, Wingo PA, Miller BF, Miller DS, Howe Hl et al. The annual report to the nation on the status of cancer, 1973-1997, with a special section on colorectal cancer. Cancer, 2000, 88:2398-2424.

Appendices

Appendix A: Technical Notes

Appendix B: Sources of Additional Information

Appendix A: Technical Notes

Age-Adjustment

Age-adjusted incidence rates were developed using the direct method. They were standardized to the age distributions of the United States 2000 standard population. Following the age-adjustment procedures used by the National Cancer Institute we used 19 age groups in calculating age-adjusted rates. The age distribution of the 2000 US standard population is shown below.

US Standard Population Proportions

age group	2000 proportion
<1	0.013818
1 - 4	0.055317
5 - 9	0.072532
10 - 14	0.073032
15 - 19	0.072168
20 - 24	0.066478
25 - 29	0.064530
30 - 34	0.071044
35 - 39	0.080762
40 - 44	0.081851
45 - 49	0.072118
50 - 54	0.062716
55 - 59	0.048454
60 - 64	0.038793
65 - 69	0.034264
70 - 74	0.031773
75 - 79	0.027000
80 - 84	0.017842
85+	0.015508

Direct method of age adjustment

Multiply the age-specific rates in the target population by the age distribution of the standard population.

$$\hat{R} = \sum_{i=1}^{m} s_i (d_i / P_i) = \sum_{i=1}^{m} w_i d_i$$

Where m is the number of age groups, d_i is the number of events in age group i, P_i is the population in age group i, and s_i is the proportion of the standard population in age group i. This is a weighted sum of Poisson random variables, with the weights being (s_i / P_i).

Confidence Intervals

Confidence intervals for the age-adjusted rates were calculated with a method based on the gamma distribution (Fay and Feuer, 1997). This method produces valid confidence intervals even when the number of cases is very small. When the number of cases is large the confidence intervals produced with the gamma method are equivalent to those produced with the more traditional methods, as described by Chiang (1961) and Brillinger (1986). The formulas for computing the confidence intervals are given below. Although the derivation of this method is based on the gamma distribution, the relationship between the gamma and Chi-squared distributions allows the formulas to be expressed in terms of quantiles of the Chi-squared distribution, which can be more convenient for computation.

$$\text{Lower Limit} = \frac{v}{2y}\left(\chi^2\right)^{-1}_{\frac{2y^2}{v}}\left(\alpha/2\right)$$

$$\text{Upper Limit} = \frac{v + w_M^2}{2(y + w_M)}\left(\chi^2\right)^{-1}_{\frac{2(y+w_M)^2}{v+w_M^2}}\left(1-\alpha/2\right)$$

where y is the age-adjusted rate, v is the variance as calculated as shown below, w_M is the maximum of the weights $s_i P_i$, $1-\alpha$ is the confidence level desired (e.g., for 95% confidence intervals, α = 0.05), and $\left(\chi^2\right)^{-1}_x$ is the inverse of the χ^2 distribution with x degrees of freedom.

$$v = \sum_{i=1}^{m} d_i\left(s_i/P_i\right)^2$$

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Chiang, C. L. Standard error of the age-adjusted death rate. *Vital Statistics, Special Reports* 47:271-285, USDHEW, 1961.

Fay, M.P. and Feuer, E.J. Confidence intervals for directly rates: a method based on the gamma distribution. *Stat Med*16:791-801, 1997.

Appendix B: Sources of Additional Information

For more information on cancer, risk factors or prevention strategies please refer to the following resources:

1-800-4-CANCER: A cancer information service of the National Cancer Institute

American Cancer Society, Great West Division: 1-800-729-1151
American Cancer Society, Cancer Facts and Figures
American Cancer Society website, http://www.cancer.org/

Centers for Disease Control and Prevention website: http://www.cdc.gov/cancer/index.htm

Fred Hutchinson Cancer Research Center website: http://www.fhcrc.org/en/diseases.html

National Cancer Institute. Cancer Net: A Service of the NCI, http://cancernet.nci.nih.gov/

National Program of Cancer Registries website: http://www.cdc.gov/cancer/index.htm

American College of Surgeons National Cancer Database website: http://www.facs.org

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