CANCER INCIDENCE IN MASSACHUSETTS 2006 – 2010:

CITY AND TOWN SUPPLEMENT

Office of Data Management and Outcomes Assessment

Massachusetts Department of Public Health

November 2014 (revised tables November 2015)

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CITY AND TOWN SUPPLEMENT

Deval L. Patrick, Governor
John W. Polanowicz, Secretary of Health and Human Services
Cheryl Bartlett, Commissioner of Public Health

Thomas Land, Director, Office of Data Management and Outcomes Assessment
Susan T. Gershman, Director, Massachusetts Cancer Registry, Office of Data Management and Outcomes Assessment

Massachusetts Department of Public Health

November 2014 (revised tables November 2015)

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Massachusetts Cancer Registry Staff

Susan T. Gershman, MS, MPH, PhD, CTR, *Director*

Bruce Caldwell, *Research Analyst/Geocoder*
Nancy Donovan, MA, CTR, *Cancer Registrar*
Patricia J. Drew, CTR, *Cancer Registrar/Quality Assurance Coordinator*
Loi Huynh, *Software Developer*
Richard Knowlton, MS, *Epidemiologist*
Ann MacMillan, MPH, *Epidemiologist*
Mary Mroszczyk, CTR, *Geocoding/ Special Projects Coordinator*
Jeremiah Nesser, *Technical Assistant to Non-Hospital Reporting*
Jayne Nussdorfer, CTR, *Cancer Registrar*
Barbara J. Rhodes, CMA, CTR, *Cancer Registrar/Death Clearance Coordinator*
Pamela Shuttle, CTR, RHIT, *Cancer Registrar/Non-Hospital Reporting Coordinator*
Hung Tran, *Software Developer*

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Larissa Nekhlyudov, MD, MPH
Al Ozonoff, MA, PhD
Paul C. Shroy, MD, MPH
Ingrid Stendhal, CTR
Susan Sturgeon, DrPH, MPH
Carol Rowan-West, MPH

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For further information, please contact the following:

Massachusetts Cancer Registry…… (617) 624-5646
Research and Epidemiology…… (617) 624-5635
Occupational Health Surveillance…… (617) 624-5626
Bureau of Environmental Health…… (617) 624-5757
Cancer Prevention and Control Initiative…… (617) 624-5484
Massachusetts Department of Public Health website……...www.mass.gov/dph

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INTRODUCTION

Content

The purpose of this report is to provide an estimate of cancer incidence for each of the 351 cities and towns of Massachusetts for the five-year time period 2006 through 2010. For each city and town, Standardized Incidence Ratios (SIRs) are presented for twenty-three types of invasive cancer and for all invasive cancer types combined. These ratios compare the cancer incidence experience of each city or town with the cancer experience of the state as a whole. The method involves comparing the number of cases that were observed for a city or town to the number of cases that would be expected if the city or town had the same cancer rates as the state as whole. The report is organized into the following sections:

METHODS PROVIDES a detailed explanation of the data collection, data processing, and statistical techniques employed in this report.

TABLES present data for selected types of cancer by city/town and sex.

APPENDIX I provides a listing of *International Classification of Diseases for Oncology* codes used in the preparation of this report.

APPENDIX II provides a listing of risk factors for selected cancer types and a listing of the individuals who reviewed the risk factor list.

APPENDIX III describes the Massachusetts Department of Public Health's current cancer control initiatives, and provides links to bureaus within the department that address some aspect of cancer. Links to resources for publications are also provided.

Comparison with Previous Reports

This report updates previous annual reports published by the Massachusetts Cancer Registry (MCR). It is available on line at http://www.mass.gov/dph/mcr. For questions about the report, contact the MCR at:

Massachusetts Cancer Registry
Office of Data Management and Outcomes Assessment
Massachusetts Department of Public Health
250 Washington Street, 6th floor
Boston, MA 02108-4619
telephone 617-624-5642; fax 617-624-5695

The preceding report, ***Cancer Incidence in Massachusetts 2005-2009: City and Town Supplement***, included data for diagnosis years 2005 through 2009. This report contains data for the diagnosis years 2006 through 2010. There have been no changes in this report's format from the previous report.

METHODS

Data Sources

Cancer Incidence

The MCR collects reports of newly diagnosed cancer cases from health care facilities and practitioners throughout Massachusetts. Facilities that reported the 2006-2010 diagnoses that comprise this report include 69 Massachusetts acute care hospitals, 5 radiation/oncology centers, 2 endoscopy centers, 2 surgical centers, 10 independent laboratories, 3 medical practice associations, and approximately 500 private practice physicians. The MCR signed the modified National Data Exchange Agreement on March 28, 2013. This is a single agreement that allows participating states to exchange data on cases diagnosed or treated in other areas. Together with states participating in the agreement, and states with individual agreements, the MCR now has reciprocal reporting agreements with 29 states and with Puerto Rico to obtain data on Massachusetts residents diagnosed out of state. Currently the MCR collects information on *in situ* and invasive cancers and benign tumors of the brain and associated tissues. The MCR does not collect information on basal and squamous cell carcinomas of the skin.

The MCR also collects information from reporting hospitals on cases diagnosed and treated in staff physician offices when this information is available. Not all hospitals report this type of case, however, some hospitals report such cases as if the patients had been diagnosed and treated by the hospital directly. Collecting these types of data makes the MCR's overall case ascertainment more complete. Some cancer types that may be reported to the MCR in this manner are melanoma, prostate, colon/rectum, and oral cancers.

In addition, the MCR identifies previously unreported cancer cases through review of death certificate data to further improve case completeness. This process is referred to as death clearance and identifies cancers mentioned on death certificates that were not previously reported to the MCR. In some instances, the MCR obtains additional information on these cases through follow-up activities with hospitals, nursing homes, hospice residences, and physicians' offices. In other instances, a cancer-related cause of death recorded on a Massachusetts death certificate is the only source of information for a cancer case. Thus these "death certificate only" cancer diagnoses are poorly documented and have not been confirmed by review of clinical and pathological information. Such cases are included in this report, but they comprise less than 3% of all cancer cases.

All case reports that provided the basis for this report were coded following the *International Classification of Diseases for Oncology, Third Edition* (ICD-O-3), which was implemented in North America with cases diagnosed as of January 1, 2001. (1) Please see Appendix A for the classification of cancers by ICD-O3 codes.

Each year, the North American Association of Central Cancer Registries (NAACCR) reviews cancer registry data for quality, completeness, and timeliness. The NAACCR certification results for the MCR for diagnosis years 2006-2010 are presented in Table A. For 2006-2010, the MCR's annual case count was estimated by NAACCR to be more than 95% complete for each year. The MCR has achieved the gold standard for this certification element as well as for six other certification elements for each case year since 1997. (See Table A.)

The Massachusetts cancer cases presented in this report are primary cases of cancer diagnosed among Massachusetts residents during 2006-2010 and reported to the MCR as of August 1, 2014. These data include some additional cases diagnosed in 2006-2009 that were not counted in the previous report, ***Cancer Incidence in Massachusetts 2005-2009: City and Town Supplement.*** The lag time between this report and the annual statewide report of 2006-2010 cancer cases is due to the fact that data for this city and town report needed to be cleaned for accuracy of residence within Massachusetts. The

statewide report presented data at the state level and did not require such accuracy of city and town of residence. The numbers presented in this report may change slightly in future reports, reflecting late reported cases or corrections based on subsequent details from the reporting facilities. Such changes might result in slight differences in numbers and rates in future reports of MCR data, reflecting the nature of population-based cancer registries that receive case reports on an ongoing basis.

Massachusetts cancer cases presented in this report are primary cases of cancer diagnosed among Massachusetts residents during 2006-2010. The Massachusetts data presented include invasive cancers only (except cancer of the urinary bladder, where *in situ* cancers are also included). Invasive cancers have spread beyond the layer of cells where they started and have the potential to spread to other parts of the body. *In situ* cancers are neoplasms diagnosed at the earliest stage, before they have spread, when they are limited to a small number of cells and have not invaded the organ itself. Typically, published incidence rates do not combine invasive and *in situ* cancers due to differences in the biologic significance, survival prognosis and types of treatment of the tumors. Cancer of the urinary bladder is the only exception, due to the specific nature of the diagnostic techniques and treatment patterns.

Presentation of Data

Each city and town in Massachusetts is listed alphabetically in the **TABLES** section. The observed number of cases, the expected number of cases, the standardized incidence ratios, and 95% confidence intervals are presented for twenty-three main types of cancer and for all cancer types combined. The "all cancers combined" category includes the twenty-three main types presented in this report and other malignant neoplasms. This category is meant to provide a summary of the total cancer experience in a community. As different cancers have different causes, this category does not reflect any specific risk factor that may be important for this community.

Observed and Expected Case Counts

The *observed* case count (**Obs**) for a particular type of cancer in a city/town is the actual number of newly diagnosed cases among residents of that city/town for a given time period.

A city/town's *expected* case count (**Exp**) for a certain type of cancer for this time period is a calculated number based on that city/town's population distribution[2] (by sex and among eighteen age groups) for the time period 2006-2010, and the corresponding statewide average annual age-specific incidence rates. The population data for the 2006 to 2010 period was calculated by adding 2005 city and town data with 2010 city and town data, dividing by two, and multiplying by five.

Standardized Incidence Ratios

A Standardized Incidence Ratio (SIR) is an indirect method of adjustment for age and sex that describes in numerical terms how a city/town's cancer experience in a given time period compares with that of the state as a whole.

- An SIR *of exactly 100* indicates that a city/town's incidence of a certain type of cancer is *equal to that expected* based on statewide average age-specific incidence rates.
- An SIR of *more than 100* indicates that a city/town's incidence of a certain type of cancer is *higher than expected* for that type of cancer based on statewide average annual age-specific incidence rates. For example, an SIR of 105 indicates that a city/town's cancer incidence is 5% higher than expected based on statewide average annual age-specific incidence rates.

- An SIR of *less than 100* indicates that a city/town's incidence of a certain type of cancer is *lower than expected* based on statewide average age-specific incidence rates. For example, an SIR of 85 indicates that a city/town's cancer incidence is 15% lower than expected based on statewide average annual age-specific incidence rates.

Statistical Significance and Interpretation of SIRs

The interpretation of the SIR depends on both how large it is and how stable it is. Stability in this context refers to how much the SIR changes when there are small increases or decreases in the observed or expected number of cases. Two SIRs may have the same size but not the same stability. For example, an SIR of 150 may represent 6 observed cases and 4 expected cases, or 600 observed cases and 400 expected cases. Both represent a 50 percent excess of observed cases. However, in the first instance, one or two fewer cases would change the SIR a great deal, whereas in the second instance, even if there were several fewer cases, the SIR would only change minimally. When the observed and expected numbers of cases are relatively small, their ratio is easily affected by one or two cases. Conversely, when the observed and expected numbers of cases are relatively large, the value of the SIR is stable.

A 95 percent confidence interval (CI) has been presented for each SIR in this report (when the observed number of cases is at least 5), to indicate if the observed number of cases is significantly different from the expected number, or if the difference is most likely due to chance. A confidence interval is a range of values around a measurement that indicates the precision of the measurement. In this report, the 95% confidence interval is the range of estimated SIR values that has a 95% probability of including the true SIR for a specific city or town. If the 95% confidence interval range *does not* include the value 100.0, then the number of observed cases is significantly different from the expected number of cases. "Significantly different" means there is at most a 5% chance that the difference between the number of observed and expected cancer cases is due solely to chance alone. If the confidence interval does contain the value 100, there is no significant difference between the observed and expected numbers. Statistically, the width of the interval reflects the size of the population and the number of events; smaller populations and smaller observed numbers of cases yield less precise estimates that have wider confidence intervals. Wide confidence intervals indicate instability, meaning that small changes in the observed or expected number of cases would change the SIR a great deal.

Examples:

- SIR = 137.0; 95% CI (101.6 - 180.6) – the confidence interval does not include 100.0 and the interval is above 100.0, indicating that the number of observed cases is *statistically significantly higher* than the expected number.

- SIR = 71.0; 95% CI (56.2 – 88.4) – the confidence interval does not include 100.0 and the interval is below 100.0, indicating that the number of observed cases is *statistically significantly lower* than the expected number.

- SIR = 108.8 95% CI (71.0-159.4) – the confidence interval DOES include 100.0 indicating that the number of observed cases is *NOT statistically significantly different* from what is expected, and the difference is likely due to chance. When the interval includes 100.0, then the true SIR may be 100.0.

Example of Calculation of an SIR and Its Significance

$$SIR = \frac{\text{OBSERVED CASES}}{\text{EXPECTED CASES}} \times 100$$

The following example illustrates the method of calculation for a hypothetical town for one type of cancer and one sex for the years 2004-2008:

Age Group	Town X Population	State Age-Specific Incidence Rate	Town X Expected Cases	Town X Observed Cases
	(A)	(B)	(C) = (A) x (B)	(D)
00-04	74,657	0.0001	7.47	11
05-09	134,957	0.0002	26.99	25
10-14	54,463	0.0005	27.23	30
15-19	25,136	0.0015	37.70	40
20-24	17,012	0.0018	30.62	30
UP TO 85+	6,337	0.0010	6.34	8
		Total:	**136.35**	**144**

$$SIR = \frac{\text{Observed Cases}}{\text{Expected Cases}} \times 100 = \frac{\text{(column D total)}}{\text{(column C total)}} \times 100 = \frac{144}{136.35} \times 100 \approx 106$$

Thus the SIR for this type of cancer in Town X is 106, indicating that the incidence of this cancer in Town X is 6% higher than the corresponding statewide average incidence for this cancer. However, the range for the 95% confidence interval (89.1-124.3) (calculation not shown) indicates that the true value may be as low as 89.1 or as high as 124.3 Also, since the range includes the value 100, it means that the observed number of cases is *not statistically significantly higher or lower* than what is expected.

Whenever the number of observed cases is less than five, the corresponding SIR is neither calculated nor tested for statistical significance. This is indicated with an (nc) ("not calculated"). However, the number of observed and expected cases is shown in these circumstances.

Notes about Data Interpretation

The SIR is a useful indication of the disease categories that have relatively high or low rates for a given community. These statistics, however, should be used with care. Such statistics provide a starting point for further research and investigation into a possible health problem, but they do not by themselves confirm or deny the existence of a particular health problem. Many factors unrelated to disease causation may contribute to an elevated SIR, including demographic factors, changes in diagnostic techniques, and changes in data collection or recording methods over time, as well as the natural variation in disease occurrence.

When reviewing the data tables, it is important to keep in mind that an SIR compares the observed cancer incidence in a particular community with the expected incidence based on statewide average annual age-specific incidence rates. This means that *valid comparisons can only be made between a community and the state as a whole*. *SIRs for different cities and towns* ***CANNOT*** and ***SHOULD NOT*** *be compared to each other*. (Comparisons between two communities would be valid only if there were no differences in the age and sex distributions of the two communities' populations.)

Another point to keep in mind when reviewing these data is the large number of statistical tests being performed in this report. For each of the 351 cities and towns, we evaluate 18 types of cancer that can occur in both males and females, 3 types that occur only in females and 2 types that occur only in males, resulting in 41 gender/cancer categories. This results in 14,391 possible calculations (351 cities and towns x 41 gender cancer categories). Note that gender/cancer categories with less than 5 observed cases are not evaluated for statistical significance, so the actual numbers of tests is slightly lower than 14,391. This is important for the reader because when multiple significance tests are performed, some will result in a significant finding due to chance alone. Based on the number of calculations in this report, we expect 720 significant findings to be due to chance alone. Half of these would be significant excesses (360) and half would be significant deficits (360). There are statistical techniques that can be used to reduce this number, however use of these techniques leads to the opposite problem – true significant differences that may be missed. We choose to err on the side of caution and identify more significant results, knowing that some will be due to chance alone.

Data Limitations

It should be emphasized that apparent increases or decreases in cancer incidence over time might reflect changes in diagnostic methods or case reporting rather than true changes in cancer incidence. Four other limitations must be considered when interpreting cancer incidence data for Massachusetts cities and towns: under-reporting in areas close to neighboring states; under-reporting for cancers that may not be diagnosed in hospitals; cases being assigned to incorrect cities/towns; and standardized incidence ratios based on small numbers of cases.

Border Areas and Neighboring States

Some areas of Massachusetts appear to have low cancer incidence, but this may be due to loss of Massachusetts resident cases who are diagnosed in neighboring or other states and not reported to the MCR. The MCR has reciprocal reporting agreements with 29 states and with Puerto Rico.

Cases Diagnosed in Non-Hospital Settings

During the time period covered by this report, the MCR's primary information source for most newly diagnosed cases of cancer was hospitals. In addition the MCR collected information from reporting hospitals on cases diagnosed and treated in staff physician offices, when this information was available. Other reporting sources include dermatologists and dermatopathology laboratories, urologists' offices and a general laboratory. Some types of cancer in this report may be under-reported because they are diagnosed primarily by private physicians, private laboratories, health maintenance organizations, radiotherapy centers that escape identification systems used by hospitals. The most common types of cancer diagnosed or treated outside of the hospital include melanoma and prostate cancer. The exact extent of this under-reporting has not been determined, but cases included in this report represent the great majority of cases statewide and provide an essential basis for evaluating statewide cancer incidence patterns.

City/Town Misassignment

In accordance with standard central cancer registry procedures, each case reported to the MCR ideally should be assigned to the city/town in which the patient lived at the time of diagnosis, based on the address provided by the reporting hospital. In practice, however, a patient may provide the hospital with his/her mailing address (e.g., a post office box located outside the patient's city/town of residence); a business address; a temporary address (e.g., the patient is staying with a relative while receiving treatment and reports the relative's address as his/her own); or a locality or post office name (e.g., "Chestnut Hill" rather than "Boston," "Brookline," or "Newton"). In addition, if a patient has moved since being diagnosed, the hospital may report the patient's current address. Because of the large number of cases reported to the MCR, and because data are reported to the MCR via electronic media, most city/town case assignments are performed by an automated computer process. This simplified matching process may misassign some cases based on the reported locality name. When MCR staff become aware of such misassignments, they manually correct the errors. Furthermore, in order to minimize such errors, cases from fifty geographic localities prone to city/town misassignment are reviewed manually.

Small Numbers of Cases

Standardized incidence ratios based on small numbers of cases result in estimates that are very unstable. This situation is common when the population of a city or town is small or if the particular cancer type is rare. SIRs and statistical significance are not calculated when the number of observed cases for a specific category is less than five. In these instances, the observed and expected cases are presented in the tables *for qualitative comparison only*.

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T A B L E S

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A P P E N D I C E S

APPENDIX I: INTERNATIONAL CLASSIFICATION OF DISEASES FOR ONCOLOGY (THIRD EDITION)
CODES USED FOR THIS REPORT [1]

Cancer Site / Type	Primary Site Codes	Histologic Type Codes [2]
Bladder, Urinary	C67.0 - C67.9	all except 9590 - 9989
Brain and Other Nervous System	C70.0 - C72.9	all except 9590 - 9989
Breast	C50.0 - C50.9	all except 9590 - 9989
Cervix Uteri	C53.0 - C53.9	all except 9590 - 9989
Colon / Rectum	C18.0 - C18.9, C19.9, C20.9, C26.0	all except 9590 - 9989
Esophagus	C15.0 - C15.9	all except 9590 - 9989
Hodgkin Lymphoma	C00.0 - C80.9	9650 - 9667
Kidney and Renal Pelvis [3]	C64.9, C65.9	all except 9590 - 9989
Larynx	C32.0 - C32.9	all except 9590 - 9989
Leukemia	C00.0 - C80.9 C42.0, C42.1, C42.4	9733, 9742, 9800 - 9820, 9826, 9831 - 9948, 9963, 9964 9823, 9827
Liver and Intrahepatic Bile Ducts	C22.0, C22.1	all except 9590 - 9989
Lung and Bronchus	C34.0 - C34.9	all except 9590 - 9989
Melanoma of Skin	C44.0 - C44.9	8720 - 8790
Multiple Myeloma	C00.0 - C80.9	9731, 9732, 9734
Non-Hodgkin Lymphoma	C00.0 - C80.9 all except C42.0, C42.1, C42.4	9590 - 9595, 9670 - 9729 9823, 9827
Oral Cavity and Pharynx	C00.0 - C14.8	all except 9590 - 9989
Ovary	C56.9	all except 9590 - 9989
Pancreas	C25.0 - C25.9	all except 9590 - 9989
Prostate	C61.9	all except 9590 - 9989
Stomach	C16.0 - C16.9	all except 9590 - 9989
Testis	C62.0 - C62.9	all except 9590 - 9989
Thyroid	C73.9	all except 9590 - 9989
Uteri, Corpus and Uterus, NOS	C54.0 - C54.9, C55.9	all except 9590 - 9989
All Sites / Types	C00.0 - C80.9	8000 - 9989

[1] includes codes added to the *International Classification of Diseases for Oncology, Third Edition* since its publication.

[2] Only invasive cancers (those with invasive behaviors) are included in this publication except Bladder, Urinary, which includes invasive and *in situ* behaviors. Non-invasive (*in situ*) cancers are not included.

[3] Massachusetts hospital coding conventions may have assigned some cases to a "not otherwise specified" site category that is not included in this cancer type.

APPENDIX II: SELECTED RESOURCES FOR INFORMATION ON CANCER

This Appendix contains a listing of selected resources for additional information on cancer. Cancers are complex diseases, many of which have multiple factors that may contribute to their development.

For information on cancer risk factors or prevention, you may wish to contact the following:

Cancer Information Service (National Cancer Institute): 1-800-4-CANCER (1-800-422-6237)

Cancer Response Line (American Cancer Society): 1-800-ACS-2345 (1-800-227-2345)

In addition, the following selected Internet websites provide information on cancer. Many of these also provide links to other sites (not listed) which may be of interest.

Massachusetts Department of Public Health: http://www.mass.gov/dph

American Cancer Society: http://www.cancer.org

Centers for Disease Control and Prevention

Home Page: http://www.cdc.gov

Cancer Prevention and Control Program: http://www.cdc.gov/cancer

Fruits and Veggies More Matters™ Campaign (nutrition – formerly 5-A-Day Program): http://www.FruitsandVeggiesMatter.gov

National Cancer Institute

Information: http://www.cancer.gov

Cancer Literature in PubMed: http://www.cancer.gov/search/cancer_literature

Surveillance, Epidemiology, and End Results (SEER) Program data: http://seer.cancer.gov

Your Cancer Risk (Siteman Cancer Center at Barnes-Jewish Hospital and Washington University School of Medicine; formerly at Harvard Center for Cancer Prevention): http://www.yourdiseaserisk.wustl.edu

OncoLink (Abramson Cancer Center of the University of Pennsylvania): http://www.oncolink.upenn.edu

Cancerquest (Emory University – Winship Cancer Institute): www.cancerquest.org

Cancer News on the Net® (information on diagnosis and treatment for cancer patients and their families): http://www.cancernews.com

National Coalition for Cancer Survivorship: http://www.canceradvocacy.org

APPENDIX III: MDPH CANCER PREVENTION AND CONTROL INITIATIVES

The Massachusetts Department of Public Health is working to reduce the incidence and mortality of cancer in the Commonwealth. Partnerships between MDPH programs, researchers, healthcare providers and nonprofit organizations collect information about cancer, lead quality improvement projects, coordinate evidenced-based workshops for managing living with chronic disease (including cancer), provide education for health professionals and bring shared messages to the public. Our collaborated efforts focus on reducing cancer risk, incidence and mortality through healthy lifestyles, early diagnosis, and increased access to care. The Department's programs address the impact of tobacco, alcohol, nutrition, and physical activity on cancer prevention, along with environmental and occupational hazards for cancer. Throughout all of our efforts there is an emphasis on reducing disparate health outcomes and unequal access to cancer care.

MDPH Bureaus and Programs:
Bureau of Environmental Health, www.mass.gov/dph/environmental_health
Bureau of Substance Abuse Services, www.mass.gov/dph/bsas
Comprehensive Cancer Prevention and Control Program, www.mass.gov/compcancer
Men's Health/Women's Health/Care Coordination Program
Tobacco Cessation and Prevention Program, www.mass.gov/dph/mtcp
Occupational Health Surveillance Program, www.mass.gov/dph/ohsp
Office of Healthy Aging, www.mass.gov/dph/healthyaging
Oral Health Program, www.mass.gov/dph/oralhealth
Division of Prevention and Wellness www.mass.gov/dph/healthpromotion

MDPH publications on cancer prevention and screening are available at the Massachusetts Health Promotion Clearinghouse, www.maclearinghouse.com.

Massachusetts Cancer Registry Publications are available through the Massachusetts Cancer Registry, telephone: 617-624-5642 and on the web at www.mss.gov/dph/mcr.

REFERENCES

1. Fritz A, Percy C, Jack A, et al. (eds). *International Classification of Diseases for Oncology, 3rd Ed.* Geneva: World Health Organization, 2000.

2. The city and town population data for this report are from the United State Census Bureau's city and town 2005 and 2010 population estimates. The website is: http://www.census.gov/popest/estimates.html