
DATA REPORT:
CERVICAL AND UTERINE CANCERS IN MASSACHUSETTS
1982-2007

Bureau of Health Information, Statistics,
Research, and Evaluation

Massachusetts Department of Public Health

August 2011



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DATA REPORT: Cervical and Uterine Cancers in Massachusetts, 1982-2007

INTRODUCTION

Cancers of the cervix and uterus are distinct malignant tumors occurring in women, yet both arise from the same organ, the uterus. Cervical cancer develops from the lower portion of the uterus which connects the body of the uterus to the vagina, also known as the cervix uteri. (Figure A) In contrast, cancer of the uterus arises from the body of the uterus (corpus) and is sometimes referred to as cancer of the corpus uteri. Cervical and uterine cancers differ in known risk factors and screening tests; however, these cancers have similar, recognizable, signs and symptoms that allow them to be diagnosed at an early stage and successfully treated (1-7).

Published data for the period 2003 through 2007 showed cancer of the cervix as the fifteenth leading cancer diagnosed and the eighteenth leading cause of cancer deaths in Massachusetts women, with an average of 211 cases and 54 deaths per year (8). Compared with national rates for this same time period, both the incidence and mortality of cervical cancer in Massachusetts were lower (5.9 cases and 1.4 deaths per 100,000 Massachusetts females and 8.1 cases and 2.4 deaths per 100,000 U.S. females, respectively) (9).

As also seen nationally, uterine cancer was the fourth leading cancer diagnosed and the eighth leading cause of cancer deaths among Massachusetts females from 2003 through 2007. An average of 1,119 cases and 174 deaths from uterine cancer occurred annually in the state (8). In contrast to cervical cancer, Massachusetts women had a higher incidence rate of uterine cancer than women nationally (29.1 per 100,000 and 23.5 per 100,000, respectively) but mortality rates were comparable (10).

Cervical cancer screening through use of the Papanicolaou test or Pap smear has decreased the incidence and deaths from this cancer. Since its introduction after World War II, death rates from cervical cancer in the U.S. have declined 70 percent (11). In contrast to cervical cancer, there is no screening test to diagnose uterine cancer in women without symptoms. (7) Although prevention of cancer development is the ultimate goal, the earlier cervical or uterine cancer is diagnosed, the better the outcome. Based on the most recent data available from the National Cancer Institute, the five-year relative survival rate for 1999-2006 (with follow-up through 2007) for cervical cancer diagnosed at a localized, regional or distant stage was 91.2%, 57.8%, and 17.0%, respectively. For uterine cancer, the survival rate for patients diagnosed at a localized, regional or distant stage was 95.5%, 67.5% and 17.1%, respectively (9,10).

This report is based on data reported to the Massachusetts Cancer Registry (MCR) between 1982 and 2007. Cervical and uterine cancer cases are presented by age, race/ethnicity, stage at diagnosis, and histology. *In situ* cases are only included in analyses of incidence by stage for uterine cancer. All other analyses use only invasive cervical and uterine cancer cases. Trends in age-adjusted incidence and mortality rates for 1982 through 2007 are analyzed using

joinpoint analysis. Finally, the probability of diagnosis with or death from cervical and uterine cancer is presented for Massachusetts females. The intent of this report is to further assess the burden of these cancers on women in Massachusetts and identify those at greatest risk of developing and dying from these cancers. Information from this report can be used to target cancer prevention and control efforts to those women at greatest need.

DATA SECTION

Data Highlights

Invasive Cervical Cancer

- Age-adjusted incidence and mortality rates for cervical cancer declined slowly until 1995, and then declined more rapidly through 2007. (Figure 1)
- The cervical cancer age-specific incidence rates for 2003-2007 fluctuated between 10.1 and 13.9 per 100,000 for women 40-84 years. (Figure 2)
- Hispanic females had the highest incidence rate and black, non-Hispanic females had the highest mortality rates of cervical cancer among race/ethnicity groups. (Figure 3)
- 52.6% of cervical cancer cases were detected at the localized stage. (Figure 4)
- Squamous cell tumors make up 63.0% of the cervical cancer cases. (Figure 5)
- The probability of developing cervical cancer over the lifespan (0-85 years) was 0.6% for females. (Table 1)
- The probability of dying from cervical cancer over the lifespan (0-85 years) was 0.2% for females. (Table 2)

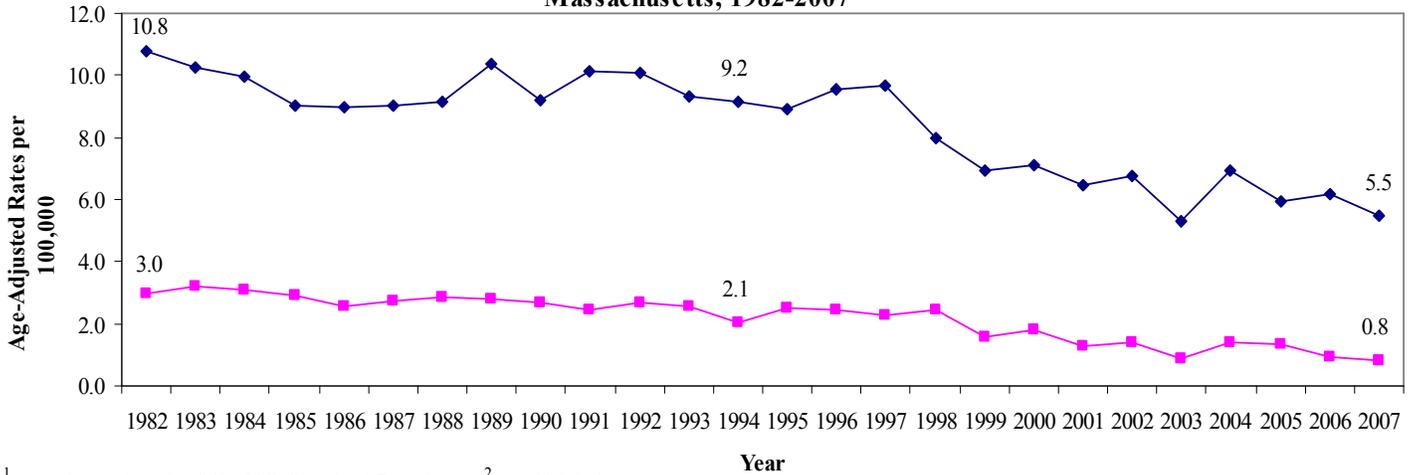
Uterine Cancer

- Age-adjusted incidence rates for uterine cancer increased slowly, while mortality rates remained relatively stable, between 1982 and 2007. (Figure 6)
- The uterine cancer age-specific incidence rates for 2003-2007 increased rapidly beginning with women 40-44 years, and then declined beginning with women 65-69 years. (Figure 7)
- White, non-Hispanic females had the highest incidence rates and black, non-Hispanic females had the highest mortality rates of uterine cancer among race/ethnicity groups. (Figure 8)
- 68.8% of uterine cancer cases were detected at the localized stage. (Figure 9)
- Adenocarcinoma tumors make up 83.4% of the uterine cancer cases. (Figure 10)
- The probability of developing uterine cancer over the lifespan (0-85 years) was 3.2% for females. (Table 3)
- The probability of dying from uterine cancer over the lifespan (0-85 years) was 0.6% for females. (Table 4)

Data Section for Invasive Cervical Cancer

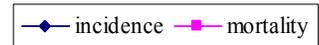
Overall Incidence and Mortality Trends

FIGURE 1
AGE-ADJUSTED¹ CERVICAL CANCER INCIDENCE AND MORTALITY RATES² FOR FEMALES
Massachusetts, 1982-2007



¹ age-adjusted to the 2000 U.S. Standard Population ² per 100,000

Sources: Massachusetts Cancer Registry and Surveillance, Epidemiology, and End Results (SEER) Program



Age-adjusted rates of cervical cancer incidence and mortality for Massachusetts females for 1982 to 2007 are presented in Figure 1. Both incidence and mortality declined over this time period.

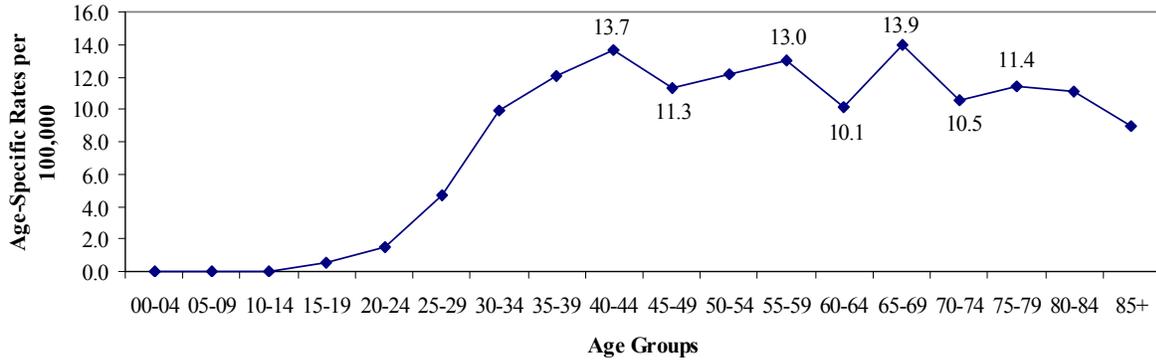
The long-term incidence and mortality trends for females were analyzed using a Joinpoint regression model as described in the *Statistical Notes* section of this report. The results of the analyses are as follows:

- The incidence rate for females declined 0.5% per year until 1997 then declined 4.4% per year until 2007.
- The mortality rate for females declined 2.0% per year until 1995 then declined 9.2% per year until 2007.

The trends were statistically significant for the 1996-2007 annual percentage change in incidence rates and the whole period for mortality rates.

Age-Specific Incidence Rates by Time Period

FIGURE 2
AGE-SPECIFIC CERVICAL CANCER INCIDENCE RATES¹ FOR FEMALES
Massachusetts, 2003-2007



¹per 100,000

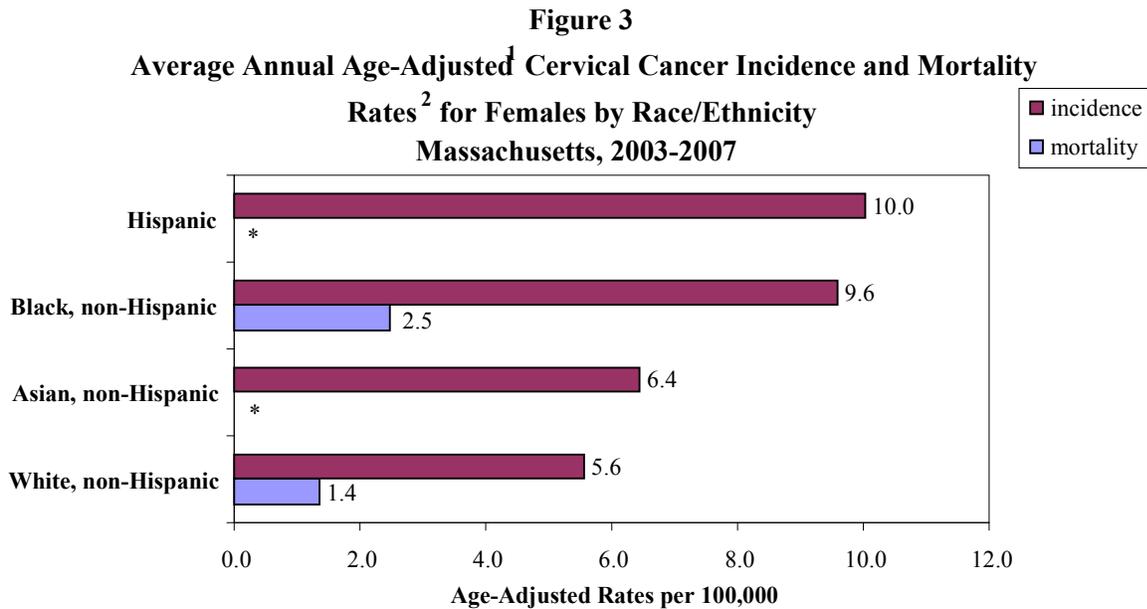
Source: Massachusetts Cancer Registry

—◆— 2003-2007

Figure 2 presents age-specific cervical cancer incidence rates for the 2003-2007 time period.

- Rates rose starting at the age of 20 with more dramatic increases after the age of 30.
- While the highest age specific incidence rates for 2003-2007, 13.9 per 100,000, occurred among women aged 65 to 69, the rates were at least 10 per 100,000 for women aged 30 and older.

Incidence and Mortality Rates by Race/Ethnicity



¹ age-adjusted to 2000 U.S. Standard Population ² per 100,000

* the age-adjusted mortality rate was not calculated since there were fewer than 20 deaths

Source: Massachusetts Cancer Registry and MassCHIP v300 r324

Figure 3 presents the average annual age-adjusted cervical cancer incidence rates by race/ethnicity for Massachusetts females.

- Hispanic females had the highest cervical cancer incidence rate.
- Hispanic females had an incidence rate similar to black, non-Hispanic females, 1.6 times higher than Asian, non-Hispanic females, and 1.8 times higher than white, non-Hispanic females.
- Black, non-Hispanic females had the highest cervical cancer mortality rate.
- Black, non-Hispanic females had a mortality rate 1.8 times higher than white, non-Hispanic females. The mortality rates for Hispanic and Asian, non-Hispanic females were not calculated because there were fewer than 20 deaths.

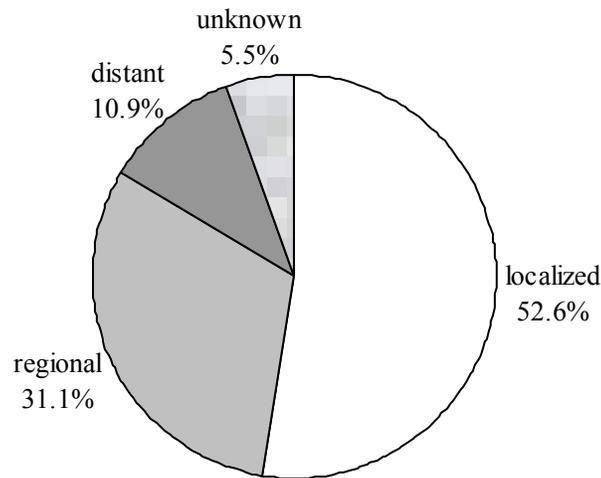
Incidence by Stage

Cervical cancer is classified into the following five stages, which help to determine treatment options and prognosis (15). Cervical cancer data does not include *in situ* data because the MCR stopped collecting *in situ* for cervical cancer starting in 1998 (16).

- *In Situ (early stage)*: The earliest stage of cancer, before the cancer has spread, when it is limited to a small number of cells and has not invaded the organ itself.
- *Localized (early stage)*: The cancer is found only in the body part (organ) where it began; it has not spread to any other parts.

- Regional (*late stage*): The cancer has spread beyond the original point where it started to the nearest surrounding part of the body (other tissues).
- Distant (*late stage*): The cancer has spread to parts of the body far away from the original point where it began. This is the most difficult stage to treat, since the cancer has spread throughout the body.
- Unstaged (*unknown*): There is not enough information about the cancer to assign a stage.

Figure 4
Distribution of Invasive Cervical Cancer Incident Cases by Stage
Massachusetts, 2003-2007



Source: Massachusetts Cancer Registry

cervical cancer cases N=1056

Figure 4 presents the distribution of invasive cervical cancer incident cases by stage for Massachusetts females. In 1998, it was determined that any *in situ* cervical cases (which includes pre-invasive cervical neoplasia, squamous intraepithelial neoplasia, and cervical intraepithelial neoplasia, Grade III or CIN III) would not be collected by central registries (16).

- The majority of invasive cervical cases (52.6%) were diagnosed when the cancer was at a localized stage.
- 31.1% of the cases were diagnosed at a regional stage.
- 10.9% of the cases were diagnosed at a distant stage.
- 5.5% of the cases were reported to the registry without stage information.

Incidence by Histologic Type

Figure A
Female Reproductive System

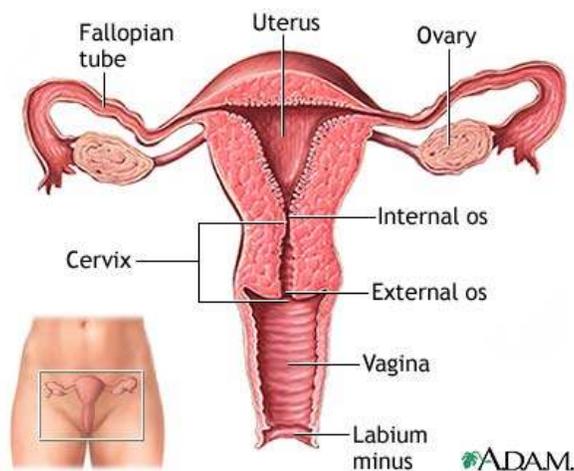


Figure A: Images of the female reproductive system. The insert shows the view of organ location. The enlargement includes labels of each organ and the orientation of the organs.

Histology refers to the study of the structure and function of the cells, tissues, and organs that make up a body. The organs, tissues, and cells are used to accurately locate any disease within the body including cancer. In a cancer diagnosis, the histology is important in defining the type of cancer, staging the cancer, and determining the best course of treatment (12).

The histologies of the uterus and cervix are similar with a narrow distinct zone of transition when the histological structures change from uterus to cervix. The majority of cervical cancers are squamous cell carcinomas with the rest being adenocarcinomas, epithelial tumors, sarcomas, and others (Figure 5) (9). The majority of uterine cancers are adenocarcinomas with the remainder being sarcomas, epithelial tumors, squamous, and others (Figure 10) (13,14).

The endometrial cancers are uterine cancers found in the inner layer of the uterus or mucosa. Most endometrial cancers (81%) are adenocarcinomas. (Figure 10).

- Sarcomas are uterine cancers found in the muscle or fibrous tissue that make up the uterine wall. There are three main types of sarcomas that account for over 75% of the overall number of uterine cancer sarcomas diagnosed in Massachusetts (14).
- Endometrial stromal sarcomas-a sarcoma that develops in the supporting connective tissue or stroma of the endometrium.
- Uterine leiomyosarcomas-a sarcoma that develops directly in the muscular wall of the uterus.
- Carcinosarcomas- a sarcoma that develops in the endometrium and contains features of both sarcomas and carcinomas.

Squamous cell tumors form from squamous cells that are located on the external outer surface (external os in Figure A) of the cervical opening or (exocervix).

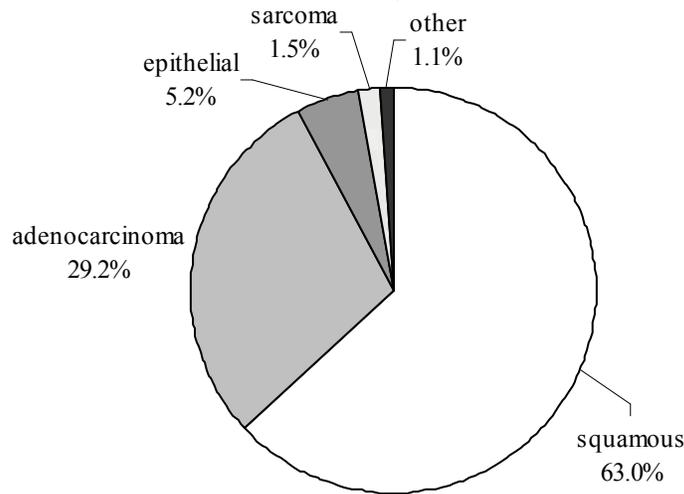
Adenocarcinomas form from the glandular or columnar cells located along the passageway connecting the vagina and uterine cavity or (endocervical canal) towards the internal outer surface (internal os in Figure A).

Epithelial tumors form from any of the surface cells of the cervix that are not specific to squamous or glandular cells.

Sarcomas form from the connective tissue of any part of the cervix (17).

See Figure A for a diagram of the cervix.

Figure 5
Distribution of Invasive Cervical Cancer Incident Cases by
Histology Type
Massachusetts, 2003-2007



Source: Massachusetts Cancer Registry

cervical cancer cases N=1056

Figure 5 presents the distribution of invasive cervical cancer incident cases by histology type for Massachusetts females. Histology codes used are listed in the Technical Notes section of the report, under Disease Coding.

- 63.0% of cervical cancers were squamous cell.
- 29.2% of cervical cancers were adenocarcinomas.
- 7.8% of cervical cancers were either epithelial cell, sarcomas, or other.

Probability of Developing or Dying from Cervical Cancer

To find the probability of developing cervical cancer or the probability of dying from cervical cancer for a female (F) of a certain age:

- Find the individual's age in the 'current age' column.
- Look across the row for the number that corresponds to the age of interest for the probability of developing cervical cancer or the probability of dying from cervical cancer.
- The percentage shown is the probability of developing or dying from cervical cancer for an alive and cancer-free female by the age of interest.

Example: For a 50-year-old woman, the probability for developing cervical cancer by the age of 70 is 0.2%.

Table 1
PROBABILITY OF DEVELOPING CERVICAL CANCER BY A SPECIFIC AGE FOR
FEMALES
Massachusetts, 1998-2007
Percent Estimate of Developing Cervical Cancer by a Certain Age

current age	F	30 F	35 F	40 F	45 F	50 F	55 F	60 F	65 F	70 F	75 F	80 F	85 F
0-85 yrs	0	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.5	0.6
5 yrs	1	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.5	0.6
10 yrs	2	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.5	0.6
15 yrs	3	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.5	0.6
20 yrs	4	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.5	0.6
25 yrs	5	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.5	0.6
30 yrs	6	0.0	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.5
35 yrs	7	X	0.0	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.4	0.5	0.5
40 yrs	8	X	X	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.4	0.5
45 yrs	9	X	X	X	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.4	0.4
50 yrs	10	X	X	X	X	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.4
55 yrs	11	X	X	X	X	X	0.1	0.1	0.2	0.2	0.2	0.3	0.3
60 yrs	12	X	X	X	X	X	X	0.1	0.1	0.2	0.2	0.2	0.3
65 yrs	13	X	X	X	X	X	X	X	0.1	0.1	0.1	0.2	0.2
70 yrs	14	X	X	X	X	X	X	X	X	0.1	0.1	0.1	0.2
75 yrs	15	X	X	X	X	X	X	X	X	X	0.1	0.1	0.1
80 yrs	16	X	X	X	X	X	X	X	X	X	X	0.0	0.1
85 yrs	17	X	X	X	X	X	X	X	X	X	X	X	0.1

Source: Massachusetts Cancer Registry

Based on the 1998-2007 incidence data for cervical cancer, there was a less than 0.1% chance of developing cervical cancer in females before the age of 25. Therefore, those age segments are not included in this table. The overall probability of developing cervical cancer over the lifespan (0-85 years) was 0.6% for females.

Table 2
PROBABILITY OF DYING OF CERVICAL CANCER BY A SPECIFIC AGE FOR FEMALES
Massachusetts, 1998-2007

Percent Estimate of Dying from Cervical Cancer by a Certain Age

current age	F	50 F	55 F	60 F	65 F	70 F	75 F	80 F	85 F
0-85 yrs	0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
5 yrs	1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2
10 yrs	2	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2
15 yrs	3	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2
20 yrs	4	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2
25 yrs	5	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2
30 yrs	6	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
35 yrs	7	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2
40 yrs	8	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2
45 yrs	9	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.2
50 yrs	10	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
55 yrs	11	X	0.0	0.0	0.1	0.1	0.1	0.1	0.1
60 yrs	12	X	X	0.0	0.0	0.1	0.1	0.1	0.1
65 yrs	13	X	X	X	0.0	0.0	0.1	0.1	0.1
70 yrs	14	X	X	X	X	0.0	0.0	0.1	0.1
75 yrs	15	X	X	X	X	X	0.0	0.0	0.1
80 yrs	16	X	X	X	X	X	X	0.0	0.1
85 yrs	17	X	X	X	X	X	X	X	0.0

Source: Massachusetts Cancer Registry

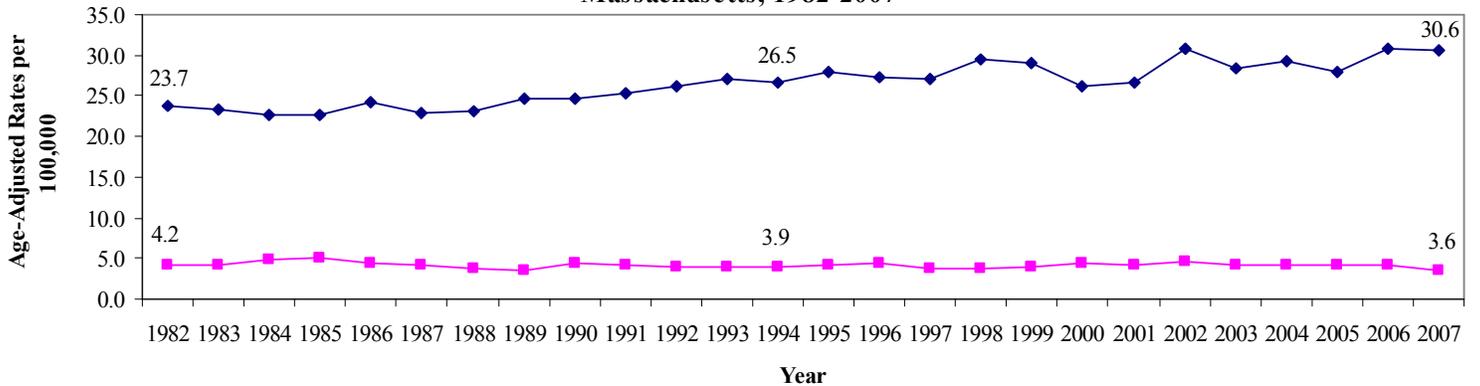
Based on the 1998-2007 incidence data for cervical cancer, there was a less than 0.1% chance of dying from cervical cancer in females before the age of 45. Therefore, those age segments were not included in this table.

The overall probability of dying from cervical cancer over the lifespan (0-85 years) was 0.2% for females.

Data Section for Uterine Cancer

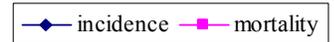
Overall Incidence and Mortality Trends

FIGURE 6
AGE-ADJUSTED¹ UTERINE CANCER INCIDENCE AND MORTALITY RATES² FOR
FEMALES
Massachusetts, 1982-2007



¹age-adjusted to the 2000 U.S. Standard Population ²per 100,000

Sources: Massachusetts Cancer Registry and Surveillance, Epidemiology, and End Results (SEER) Program



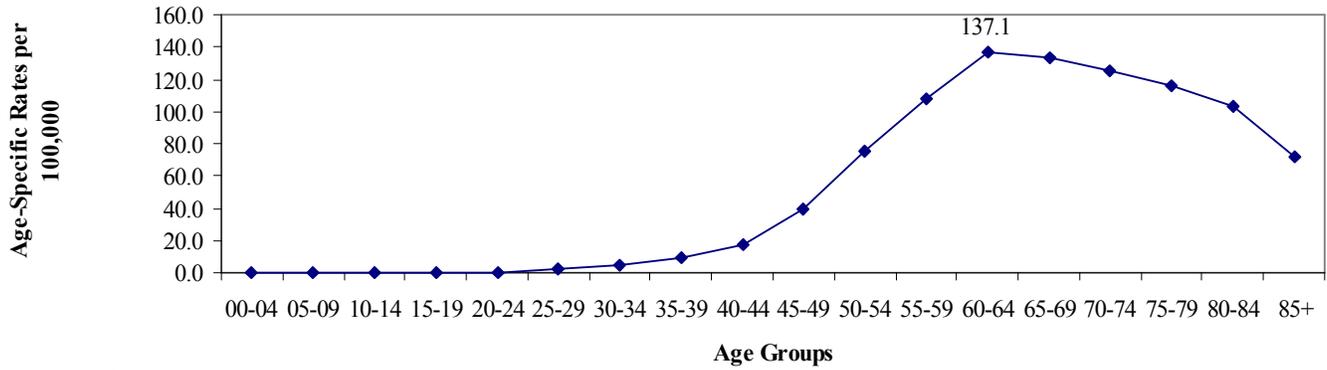
The age-adjusted rates for uterine cancer incidence and mortality uterine in Massachusetts females for 1982 to 2007 are presented in Figure 6. The incidence trend increased over this time period while the mortality trend remained stable.

The long-term incidence and mortality trends for females were analyzed using a Joinpoint regression model as described in the *Statistical Notes* section of this report. The results of the analyses are as follows:

- The incidence rate for females increased statistically significantly with an APC of 1.2% per year from 1982 to 2007.
- The mortality rate for females decreased non-significantly with an APC of 0.3% per year for 1982-2007.

Age-Specific Incidence Rates by Time Period

FIGURE 7
AGE-SPECIFIC UTERINE CANCER INCIDENCE RATES¹ FOR FEMALES
Massachusetts, 2003-2007



¹per 100,000

Source: Massachusetts Cancer Registry

—◆— 2003-2007

Figure 7 presents age-specific uterine cancer incidence rates for the 2003-2007 time period.

- Age specific incidence rates rose starting at 35 with more dramatic increases occurring from 45 to 64.
- The rates for 2003-2007 rose to a peak of 137.1 per 100,000 among females aged 60 to 64 and then began to decrease after age 65.

Incidence and Mortality Rates by Race/Ethnicity

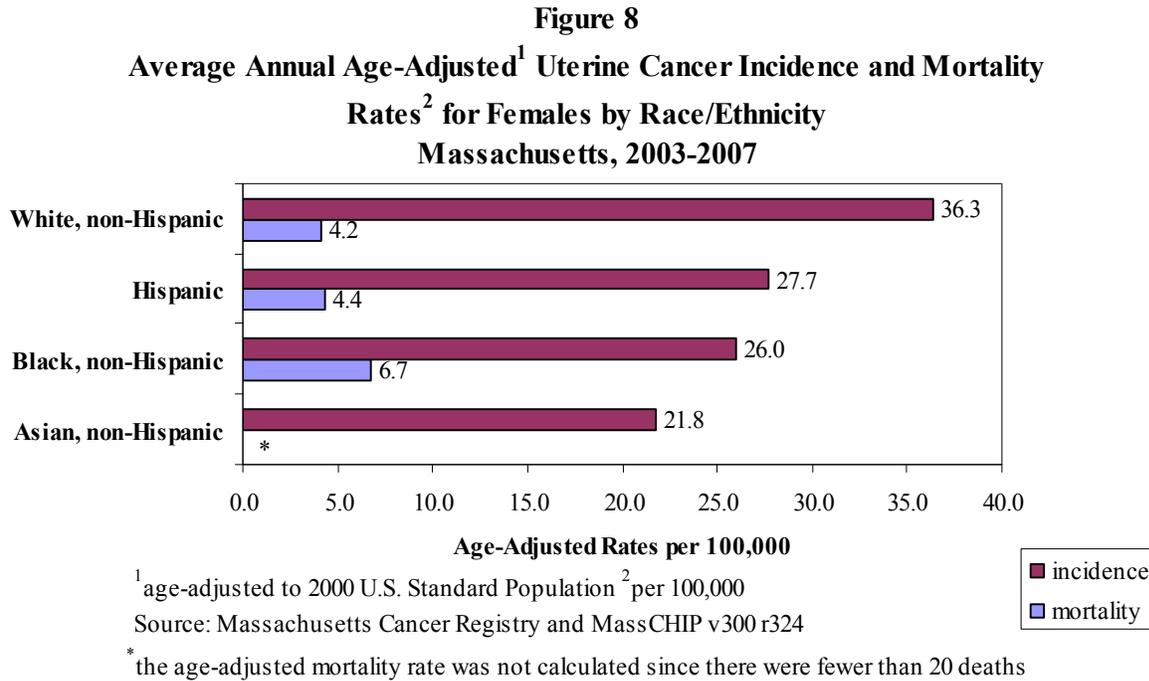


Figure 8 presents the average annual age-adjusted uterine cancer incidence rates by race/ethnicity for Massachusetts females.

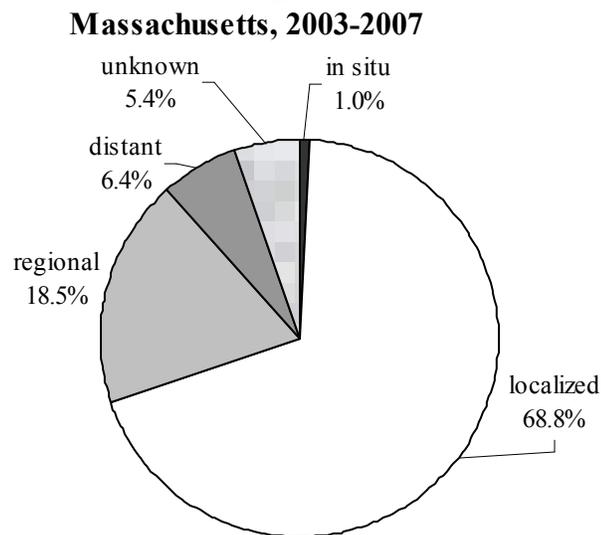
- White, non-Hispanic females had the highest uterine cancer incidence rate.
- White, non-Hispanic females had an incidence rate 1.3 times higher than Hispanic females, 1.4 times higher than black, non-Hispanic females, and 1.7 times higher than Asian, non-Hispanic females.
- Black, non-Hispanic females had the highest uterine cancer mortality rate.
- Black, non-Hispanic females had a mortality rate 1.5 times higher than Hispanic females and 1.6 times higher than white, non-Hispanic females. The mortality rate for Asian, non-Hispanic females was not calculated because there were fewer than 20 deaths.

Incidence by Stage

Uterine cancer is classified into the following stages, which help to determine treatment options and prognosis (15).

- *In Situ* (*early stage*): The earliest stage of cancer, before the cancer has spread, when it is limited to a small number of cells and has not invaded the organ itself.
- *Localized* (*early stage*): The cancer is found only in the body part (organ) where it began; it has not spread to any other parts.
- *Regional* (*late stage*): The cancer has spread beyond the original point where it started to the nearest surrounding part of the body (other tissues).
- *Distant* (*late stage*): The cancer has spread to parts of the body far away from the original point where it began. This is the most difficult stage to treat, since the cancer has spread throughout the body.
- *Unstaged* (*unknown*): There is not enough information about the cancer to assign a stage.

Figure 9
Distribution of *In Situ* and Invasive Uterine Cancer Incident Cases
by Stage



Source: Massachusetts Cancer Registry

uterine cancer cases N=5659

Figure 9 presents the distribution of *in situ* and invasive uterine cancer incident cases by stage for Massachusetts females.

- The majority of uterine cases (68.8%) were diagnosed when the cancer was at a localized stage.
- 18.5% of the cases were diagnosed at a regional stage.
- 6.4% of the cases were diagnosed at a distant stage.
- 5.4% of the cases were reported to the registry without stage information.

Incidence by Histologic Type

Adenocarcinomas form in the glandular cells located in the uterus.

Sarcomas form in the connective tissue of the uterus.

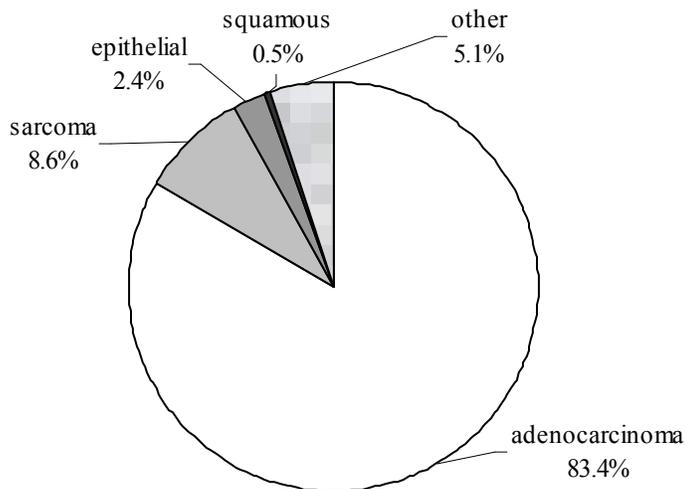
Epithelial tumors form from any of the surface cells of the uterus that are not specific to squamous or glandular cells.

Squamous cell tumors form from squamous cells that are located throughout the surface of the uterus (17).

When a lesion is located in the lower segment of the uterus at the transition zone to the cervix (or endocervix), the identification of the organ the lesion represents in the transition zone affects prognosis and staging for that cancer.

See Figure A on page 9 for the diagram of the uterus.

Figure 10
Distribution of Invasive Uterine Cancer Incident Cases by
Histology Type
Massachusetts, 2003-2007



Source: Massachusetts Cancer Registry

uterine cancer cases N=5604

Figure 10 presents the distribution of invasive uterine cancer incident cases by histology type for Massachusetts females. Histology codes used are listed in the Technical Notes section of the report, under Disease Coding.

- 83.4% of uterine cancers are of the adenocarcinoma type.
- 8.6% of uterine cancers are of the sarcoma type.
- Only 8.0% of uterine cancers are either epithelial cell, squamous cell, or other.

Probability of Developing or Dying from Uterine Cancer

To find the probability of developing uterine cancer or the probability of dying from uterine cancer for a female (F) of a certain age:

- Find the individual's age in the 'current age' column.
- Look across the row for the number that corresponds to the age of interest for the probability of developing uterine cancer or the probability of dying from uterine cancer.
- The percentage shown is the probability of developing or dying from uterine cancer for an alive and cancer-free female by the age of interest.

Example: For a 50-year-old woman, the probability for developing uterine cancer by the age of 70 is 2.2%.

Table 3
PROBABILITY OF DEVELOPING UTERINE CANCER BY A SPECIFIC AGE FOR FEMALES
Massachusetts, 1998-2007

current age	Percent Estimate of Developing Uterine Cancer by a Certain Age											
	F	35 F	40 F	45 F	50 F	55 F	60 F	65 F	70 F	75 F	80 F	85 F
0-85 yrs	0	0.1	0.1	0.3	0.6	1.0	1.5	2.0	2.4	2.7	3.0	3.2
5 yrs	1	0.1	0.1	0.3	0.6	1.0	1.5	2.0	2.4	2.7	3.0	3.2
10 yrs	2	0.1	0.1	0.3	0.6	1.0	1.5	2.0	2.4	2.7	3.0	3.2
15 yrs	3	0.1	0.1	0.3	0.6	1.0	1.5	2.0	2.4	2.7	3.0	3.2
20 yrs	4	0.1	0.1	0.3	0.6	1.0	1.5	2.0	2.4	2.8	3.0	3.2
25 yrs	5	0.1	0.1	0.3	0.6	1.0	1.5	2.0	2.4	2.8	3.0	3.2
30 yrs	6	0.1	0.1	0.3	0.6	1.0	1.5	2.0	2.4	2.8	3.0	3.2
35 yrs	7	0.0	0.1	0.3	0.6	1.0	1.5	2.0	2.4	2.7	3.0	3.2
40 yrs	8	X	0.1	0.2	0.5	1.0	1.5	2.0	2.4	2.7	2.9	3.2
45 yrs	9	X	X	0.2	0.5	0.9	1.4	1.9	2.3	2.7	2.9	3.1
50 yrs	10	X	X	X	0.3	0.8	1.3	1.8	2.2	2.5	2.8	3.0
55 yrs	11	X	X	X	X	0.4	1.0	1.5	1.9	2.3	2.5	2.7
60 yrs	12	X	X	X	X	X	0.5	1.1	1.5	1.9	2.1	2.3
65 yrs	13	X	X	X	X	X	X	0.5	1.0	1.4	1.6	1.9
70 yrs	14	X	X	X	X	X	X	X	0.5	0.9	1.2	1.4
75 yrs	15	X	X	X	X	X	X	X	X	0.4	0.8	1.1
80 yrs	16	X	X	X	X	X	X	X	X	X	0.4	0.7
85 yrs	17	X	X	X	X	X	X	X	X	X	X	0.5

Source: Massachusetts Cancer Registry

Based on the 1998-2007 incidence data for uterine cancer, there was a less than 0.1% chance of developing uterine cancer in females before the age of 30. Therefore, those age segments are not included in this table.

The overall probability of developing uterine cancer over the lifespan (0-85 years) was 3.2% for females.

Table 4
PROBABILITY OF DYING OF UTERINE CANCER BY A SPECIFIC AGE FOR FEMALES
Massachusetts, 1998-2007
Percent Estimate of Dying from Uterine Cancer by a Certain Age

current age	F	55 F	60 F	65 F	70 F	75 F	80 F	85 F
0-85 yrs	0	0.1	0.1	0.2	0.3	0.4	0.4	0.6
5 yrs	1	0.1	0.1	0.2	0.3	0.4	0.4	0.6
10 yrs	2	0.1	0.1	0.2	0.3	0.4	0.5	0.6
15 yrs	3	0.1	0.1	0.2	0.3	0.4	0.5	0.6
20 yrs	4	0.1	0.1	0.2	0.3	0.4	0.5	0.6
25 yrs	5	0.1	0.1	0.2	0.3	0.4	0.5	0.6
30 yrs	6	0.1	0.1	0.2	0.3	0.4	0.5	0.6
35 yrs	7	0.1	0.1	0.2	0.3	0.4	0.5	0.6
40 yrs	8	0.1	0.1	0.2	0.3	0.4	0.5	0.6
45 yrs	9	0.1	0.1	0.2	0.3	0.4	0.5	0.6
50 yrs	10	0.1	0.1	0.2	0.3	0.4	0.5	0.6
55 yrs	11	0.0	0.1	0.2	0.3	0.4	0.4	0.6
60 yrs	12	X	0.1	0.1	0.2	0.3	0.4	0.5
65 yrs	13	X	X	0.1	0.2	0.3	0.4	0.5
70 yrs	14	X	X	X	0.1	0.2	0.3	0.5
75 yrs	15	X	X	X	X	0.1	0.2	0.4
80 yrs	16	X	X	X	X	X	0.1	0.3
85 yrs	17	X	X	X	X	X	X	0.3

Source: Massachusetts Cancer Registry

Based on the 1998-2007 incidence data for uterine cancer, there was a less than 0.1% chance of dying from uterine cancer in females before the age of 50. Therefore, those age segments were not included in this table.

The overall probability of dying from uterine cancer over the lifespan (0-85 years) was 0.6% for females.

DISCUSSION

The decline in cervical cancer is a public health success story resulting from implementation of an effective screening tool, the Pap smear. In Massachusetts, cervical cancer incidence and mortality rates declined 4.4% and 9.2% per year, respectively, during the recent decade ending in 2007. However, despite these declines, total eradication of these preventable cancer cases and deaths has not occurred in Massachusetts, where annually, an average of 211 women are newly diagnosed and 54 die from this disease.

Women 40-79 years old had the highest rates although some fluctuations were apparent due to small numbers in some age-groups. Additionally, Hispanic and black non-Hispanic women in Massachusetts had nearly two-fold higher cervical cancer incidence than white, non-Hispanic women; a similar excess in mortality was also seen in black, non-Hispanic women. The differences in incidence and mortality rates among racial/ethnic and age groups suggest that cervical cancer screening programs may not be reaching all groups uniformly or that there may be differential utilization of medical care for some women. Despite the disparities in incidence for some groups of women, the overall success of screening in Massachusetts is supported by the fact that over 50% of invasive cervical cancers were found at the localized stage when the cancer can be successfully treated and nationally, the five-year survival is over 90 percent (9).

The U.S. Preventive Services Task Force recommends that cervical cancer screening begin three years after sexual activity starts or age 21, whichever comes first. The test should be done at least every 3 years after the first test. The screening may stop after a woman has reached sixty-six years of age with normal screening tests from previous years and if she is not at high risk for cervical cancer (18, 19).

In addition to the Pap test for identifying precancerous or early cervical cancer, a screening test for the human papillomavirus (HPV) can be used with the Pap smear to screen for cervical cancer in women who are 30 years or older or can be used to provide more information when the Pap smear results are not clear (20). Cervical cancer is the first screened cancer that has been linked to a virus, HPV. HPV was discovered to be the etiological agent of cervical cancer in 1983 and the first HPV test for screening was approved in 1999. There are more than 100 types of HPV, with approximately 40 types known to be sexually transmitted. Two types of HPV, 16 and 18, are responsible for approximately 70 percent of cervical cancer cases (21). In 2006, the FDA approved the first vaccine against the HPV types 16 and 18¹. This ability to link a virus to a cancer and subsequent development of a vaccine has positively impacted efforts to decrease and ultimately prevent the occurrence of cervical cancer.

¹ Since the first clinical trials for this vaccine, the FDA has expanded the approval of this vaccine to include vulvar and vaginal cancer prevention. This vaccine is used for the prevention of cervical, vulvar and vaginal cancers caused by HPV types 16 and 18; genital warts caused by HPV types 6 and 11; and precancerous or dysplastic lesions caused by HPV types 6, 11, 16, and 18 in girls and young women 9 through 26 years of age in 2008 (22). In 2009, the FDA approved the use of this vaccine for the prevention of genital warts (condyloma acuminata) due to HPV types 6 and 11 in boys and men, ages 9 through 26 (23).

Vaccination and screening are not the only preventative measures needed for reducing cervical cancer incidence. Knowledge of cervical cancer and cultural attitudes toward utilizing these preventative measures also play a key role (24). Additionally, reduction of other key risk factors such as smoking can impact incidence; women who smoke are twice as likely to develop cervical cancer as non-smokers (4).

The cervical cancer data in this report highlights the positive effect screening has had on the number and rate of invasive cervical cancers detected in Massachusetts and how early the invasive cancers are diagnosed. Continued education of girls and their families and women about the current recommendations for cervical screening and prevention methods will be required to continue the decline in invasive cervical cancer.

In contrast to cervical cancer, the incidence of uterine cancer in Massachusetts has steadily increased over the last 25 years, approximately one percent annually, and mortality has remained nearly level. These patterns differ from those reported nationally (10). The reasons for the increase over time are not known but the increased use of estrogen as part of hormone replacement therapy, the use of other drugs containing estrogen such as oral contraceptives, the use of Tamoxifen, an estrogen blocker used for both prevention of breast cancer recurrence and reduction of breast cancer occurrence, and increases in obesity may have played a role (27). The age-specific patterns in uterine cancer incidence showed that rates increased rapidly beginning with women in their mid to late 40's and peaked among those 60-64 years, most likely reflecting hormonal changes in menopausal women and use of postmenopausal estrogen therapy. Reasons for the increase in the incidence of uterine cancer among white, non-Hispanic women and deaths among black, non-Hispanic women compared with other groups of Massachusetts women also are not known but differences in various risk factors or differential access to care may offer some explanations for these findings. In addition to obesity and use of postmenopausal estrogen, oral contraceptives with estrogen only and Tamoxifen, other factors that increase the risk of uterine cancer include a high-fat diet, nulliparity (never having children), early menarche and late menopause, polycystic ovarian syndrome and hereditary nonpolyposis colon cancer (25).

Uterine cancer tends to have the same signs as cervical cancer; these include unusual bleeding, vaginal discharge, and pain (7). Since a screening test for uterine cancer is not available, prompt medical follow-up of women with these signs can lead to an early stage at diagnosis. Two-thirds of uterine cancers in Massachusetts women were diagnosed at an early stage, increasing their chance of successful treatment and long-term survival. Continued education of women about the risk factors and the early warning signs of uterine cancer is needed so they may seek medical care before the cancer advances. Additionally, multiple clinical trials of improved treatment methods, evaluation of quality of life and other survivorship issues and studies of tissue banking for diagnostics or biomarkers are underway to reduce the impact of this cancer (26).

TECHNICAL NOTES

Statistical Notes

Age-Adjusted Incidence/Mortality Rates – An age-adjusted incidence or mortality rate is a weighted average of the age-specific rates, where the weights are the proportions of persons in the corresponding age groups of a standard 100,000 population. The potential confounding effect of age is reduced when comparing age-adjusted rates for populations with different age-structures. The 2000 U.S. Census Bureau population distribution was used as a standard. Rates were age-adjusted using eighteen age groups. Age-adjusted rates can only be compared if they are adjusted to the same standard population.

Age-Specific Rates – Age-specific rates were calculated by dividing the number of people in an age group who were diagnosed with cancer or died of cancer in a given time frame by the number of people in that same age group overall in that time frame. They are presented as rates per 100,000 persons and are site- and sex-specific.

Joinpoint Regression Analysis of Cancer Trends – These trend analyses were calculated using the Joinpoint Regression software developed by SEER (27). The software calculates the number and location (in time) of points where trends change direction (*joinpoints*). At each joinpoint, the trend may change in different ways. The joinpoint regression model describes the trend as a sequence of linear segments between corresponding joinpoints, so that each segment has an associated annual percent change positive trend, negative trend, or no trend.

Probability of Being Diagnosed with or Dying from Cancer – These probabilities were calculated using the DevCan software developed by SEER (28). The results are presented in a table showing the probability (as a percentage) of a person of a specified age group and sex being diagnosed with a cancer within a specific number of years or within his or her remaining lifetime. The lifetime was restricted to age 85 in these analyses.

Race/Ethnicity Classification

The MCR uses an algorithm developed by the North American Association of Central Cancer Registries (NAACCR) called the NAACCR Hispanic Identification Algorithm (NHIA) to help classify Hispanic ethnicity. A modified algorithm for Massachusetts is only applied to cases with an unknown Spanish/Hispanic origin or cases that have been classified as Hispanic based on a Spanish surname only. The algorithm uses last name, maiden name, birthplace, race, and sex to determine the ethnicity of these cases.

The race/ethnicity categories presented in this report are mutually exclusive. Cases and deaths are only included in one race/ethnicity category. The race/ethnicity tables include the categories white, non-Hispanic; black, non-Hispanic; Asian, non-Hispanic; and Hispanic. The total population in Massachusetts also includes persons of unknown race/ethnicity and American Indians. As a result, the number of cases for the total population is not the sum of cases by race/ethnicity.

Population Estimates

All of the population estimates used for this report were generated using the Massachusetts Community Health Information Profile (MassCHIP). The Research and Epidemiology division of the Bureau of Health Information, Statistics, Research, and Evaluation provides these data to MassCHIP using the Modified Age-Race-Sex (MARS) file from the National Center for Health Statistics (NCHS) in collaboration with the Census Bureau's Population Estimation Program. The NCHS reallocates the multiple race categories from the Census Bureau population estimates file to create four mutually exclusive race categories that are consistent with the race categories used to collect cancer incidence and cancer mortality data.

Data Sources

Massachusetts Cancer Registry: The MCR collects reports of newly diagnosed cancer cases from health care facilities and practitioners throughout Massachusetts. Facilities reporting to the MCR in 2007 included 69 Massachusetts acute care hospitals, 1 medical practice association, 14 independent laboratories, 1 radiation/oncology center, 3 endoscopy centers, 7 radiation centers, 4 surgical centers and approximately 500 private practice physicians. Reports from dermatologists' offices and dermatopathology laboratories, particularly on cases of melanoma, have been collected by the MCR since 2001. Reports from urologists' offices have been collected by the MCR since 2002. 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.

Surveillance, Epidemiology and End Results (SEER) Program: National data on cancer mortality are from the National Cancer Institute's SEER Program, an authoritative source of cancer data in the United States. The mortality database that was used in generating trend age-adjusted rates was provided by National Center for Health Statistics (NCHS), generated through the National Cancer Institute (NCI), Division of Cancer Control and Population Sciences (DCCPS), Surveillance Research Program, Cancer Statistics Branch and released for use on June 2010. The database includes all causes of death that can be aggregated by state and United States as a whole for the period 1969-2007 and included the population adjustment for migration after the Katrina/Rita hurricanes. Cause of death for 1969-1978 was coded according to International Classification of Disease, eighth edition (ICD-8); for 1979-1998, ICD-9 was used; beginning with deaths in 1999, ICD-10 was used (29). The mortality data generated for the uterine and cervical cancer report, only pertained to cervical and uterine deaths among females for the 1982-2007 time period in Massachusetts. The years were calculated individually to obtain rates for a mortality trend over that time period. SEER rates are presented per 100,000 persons and are age-adjusted to the 2000 United States standard population. SEER does not report rates with fewer than 5 cases for a time interval. SEER rates were available to the year 2007 at the time of this publication.

Official Citation:

Surveillance, Epidemiology, and End Results (SEER) Program (www.seer.cancer.gov)
SEER*Stat Database: Mortality - All COD, Aggregated With State, Total U.S. (1969-2007)
<Katrina/Rita Population Adjustment>, National Cancer Institute, DCCPS, Surveillance

Research Program, Cancer Statistics Branch, released June 2010. Underlying mortality data provided by NCHS (www.cdc.gov/nchs).

Massachusetts Registry of Vital Records and Statistics: Massachusetts death data were obtained from the Massachusetts Registry of Vital Records and Statistics, which has legal responsibility for collecting reports of deaths in this state. Death reports from 2003 to 2007 were coded using the International Classification of Diseases, Tenth Revision (ICD-10) (30). The cancer site/type groups for deaths in this report were based on cancer site/type categories from the SEER Program. These SEER cancer site/type definitions are the standard categories commonly used by cancer registries.

Disease Coding

Incidence Data

Any comparison of annual incidence rates between the year 2000 and 2001 (or comparison of the rates presented in this report with previous reports) should take into the account the changes described below.

International Classification of Disease for Oncology, Third Edition (ICD-O-3) Implementation:

The International Classification of Diseases for Oncology, Third Edition (ICD-O-3) (31), was implemented in North America with cases diagnosed as of January 1, 2001. Cancer cases diagnosed before this date were classified according to the International Classification of Diseases for Oncology, Second Edition (ICD-O-2). With the advances in diagnostic techniques over the past decade, the International Agency for Research on Cancer (IARC) and the cancer division of the World Health Organization (WHO) found it necessary to revise and update the ICD-O-2. As a result, the new edition (ICD-O-3) contains more specific information about certain cancers. The most important changes between the second and the third editions include:

- Certain hematopoietic diseases are now considered to be “malignant,” whereas previously they were classified as “uncertain whether benign or malignant.”
- Some neoplasms (mainly ovarian tumors) previously coded as “malignant” now revert to “uncertain whether benign or malignant.”

All cancer cases in the Massachusetts Cancer Registry database that were diagnosed prior to January 1, 2001 and coded using ICD-O-2 were converted to ICD-O-3, following SEER conversion rules.

The following ICD-O-3 primary site codes were used in preparing this report:

Cancer Site/Type	ICD-0-3
cervical cancer	C53.0-C53.9 except 9590-9989
uterine cancer	C54.0-C54.9 except 9590-9989

The following ICD-O-3 histologies were used in preparing Figure 5:

Cervical cancer

Epithelial:	8000-8046
Squamous:	8050-8084
Adenocarcinoma:	8140-8384, 8480-8482, 8560, 8570
Sarcoma:	8800-8805, 8890-8910, 8933-8980
Other:	8098, 8120, 8441, 8460, 8490, 8720, 9110

The following ICD-O-3 histologies were used in preparing Figure 10:

Uterine cancer

Epithelial:	8000-8045
Squamous:	8050-8071
Adenocarcinoma:	8140-8383, 8560-8574
Sarcoma:	8800-8805, 8890-8910, 8930-8990
Other:	8120, 8440-8490, 8830, 9100, 9110, 9364, 9473

Mortality Data

International Classification of Disease, 9th edition (31) (ICD-9) and International Classification of Disease, 10th edition (33) (ICD-10):

The Surveillance, Epidemiology, and End Results (SEER) Program annually obtains from the National Center for Health Statistics (NCHS) an annual a file containing information on all deaths occurring in the US by calendar year, with death data supplied by v. Vital records departments from all the states in the United States provides data to NCHS.. Each state vital records department is responsible for coding the mortality data, which includes information on each death including age at death, sex, geographic area of residence, and underlying and contributing causes of death. For this report, only the underlying cause of death is used in the calculation of death rates. Cause of death for 1969-1978 was coded according to International Classification of Disease, eighth edition (ICD-8); for 1979-1998, ICD-9 was used; beginning with deaths in 1999, ICD-10 was used (29).

The following ICD-9 and ICD-10 mortality codes were used in preparing this report:

Cancer Site/Type	ICD-9	ICD-10
cervical cancer	180	C53
uterine cancer	179, 182	C54-C55

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Pictures & Images :

Figure A Female Reproductive System. All Refer Health – Uterus – Hysterectomy Pictures & Images. Available at <http://health.allrefer.com/health/hysterectomy-uterus.html>. Accessed July 28, 2010.