



## DESCRIPTIVE EPIDEMIOLOGY OF CERVICAL CANCER IN MASSACHUSETTS

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### ABSTRACT

**Purpose:** The descriptive epidemiology of invasive cervical cancer in Massachusetts will provide information for the Massachusetts Department of Public Health's cancer control program to target cervical cancer screening programs for reducing cervical cancer incidence and mortality.

**Methods:** Invasive cervical cancer case counts and incidence rates for the period 2003-2007 were calculated and presented by year of diagnosis, age, race/ethnicity, stage, and histologic type. Annual percent changes (APC) in age-adjusted incidence and mortality rates were calculated for 1982-2007. Probabilities of developing and dying from cervical cancer were calculated for the period 1998-2007.

**Results:** Age-adjusted incidence and mortality rate trends (APC) decreased about 0.5% and 2.0% per year until 1996, then decreased 4.4% and 9.2% per year until 2007. Age-specific incidence rates fluctuated between 10.1 and 13.9 per 100,000 females for ages 40-84. Hispanics had the highest incidence rates; however, black, non-Hispanics had the highest mortality rates among racial/ethnic groups. The probability of developing and dying from cervical cancer over the lifespan (0-85 years) was 0.6% and 0.2%, respectively.

**Discussion:** Papanicolaou (Pap) smear screening, which is used to detect treatable cervical cancer precursors, is responsible for the decreased incidence and mortality of invasive cervical cancer. The use of human papillomavirus (HPV) vaccines could potentially reduce rates even further. Advocacy for cervical cancer screening needs to continue as a component of cancer control efforts.

### PURPOSE

The cervical cancer descriptive statistics will be used to assess the burden of cervical cancer in Massachusetts women, assess progress made in reducing state incidence and mortality rates, and identify those women at greatest risk of developing or dying from this disease so screening programs can be targeted for further reducing cases and deaths of this preventable cancer.

### BACKGROUND

For the period 2003-2007, the average annual age-adjusted incidence rate for invasive cervical cancer was 5.9 cases per 100.00 females. The age-adjusted mortality rate for cervical cancer was 1.4 deaths per 100,000 females. The national average annual age-adjusted incidence rate of invasive cervical cancer was 8.1 cases per 100,000 females for the period 2003-2007. The age-adjusted mortality rate of cervical cancer was 2.4 deaths per 100,000 females in the United States. The National Cancer Institute reports the five-year relative survival rates of cervical cancer by stage between 1999 and 2006 (with the follow-up of patients into 2007) as follows: 91.2%, 57.8%, 17.0% and 58.1% for localized, regional, distant and unstaged, respectively.

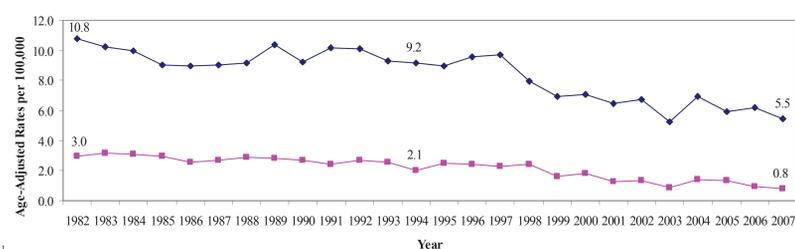
### METHODS

This poster is based on data reported to the Massachusetts Cancer Registry (MCR) between 1982 and 2007. Cervical cancer case counts and rates are presented by year of diagnosis, age, race/ethnicity, stage at diagnosis, and histology. All analyses include only invasive cervical cancer cases. The mortality data is reported to the Massachusetts Registry of Vital Records and Statistics between 1982 and 2007. Cervical cancer deaths are disseminated to Surveillance, Epidemiology, and End Results (SEER Program) and Massachusetts Community Health Information Profile (MassCHIP). The yearly death numbers are identical between SEER and MassCHIP. The cervical cancer death and rates are presented by the year of death and the race/ethnicity. The population estimates used were generated with 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.

Trends in age-adjusted incidence and mortality rates for 1982 through 2007 are analyzed using joinpoint analysis. Age-specific incidence rates, age-adjusted rates by race/ethnicity, case distribution by stage, and case distribution by histology are also presented for Massachusetts females for the period 2003-2007. Finally, the probability of diagnosis with or death from cervical cancer is presented for Massachusetts females.

The rates and counts were calculated using SAS 9.2. The trends were analyzed using the Joinpoint Regression Program version 3.3.1. The probabilities were calculated using Devcan or the Probability of Developing or Dying of Cancer Software Version 6.2.2.

**Figure 1**  
Age-Adjusted<sup>1</sup> Cervical Cancer Incidence and Mortality Rates By Year  
Massachusetts Females, 1982-2007



<sup>1</sup>Age-adjusted to the 2000 U.S. Standard Population

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

Cervical cancer was the fifteenth leading cancer diagnosed in females and the eighteenth leading cause of cancer death among females in Massachusetts between 2003 and 2007. The average number of cervical cancer cases and deaths for this period was 211 cases and 54 deaths per year.

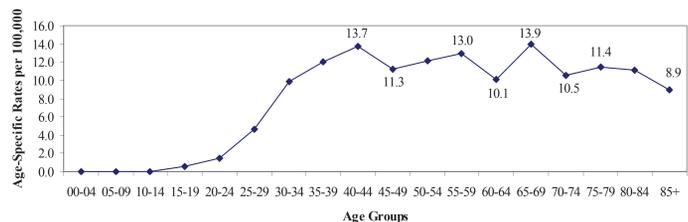
Age-adjusted incidence and mortality rates for Massachusetts females for the years 1982 to 2007 are presented in Figure 1. Both incidence and mortality rates slowly declined over this time period, with the most rapid decline occurring in the last decade.

The long-term incidence and mortality trends for females were analyzed using a Joinpoint regression model. The results of the analyses are as follows:

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

The decreasing trends in incidence and mortality rates were statistically significant for the periods 1996-2007 and 1982-2007, respectively.

**Figure 2**  
Average Annual Age-Specific Cervical Cancer Incidence Rates  
Massachusetts Females, 2003-2007



Source: Massachusetts Cancer Registry

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

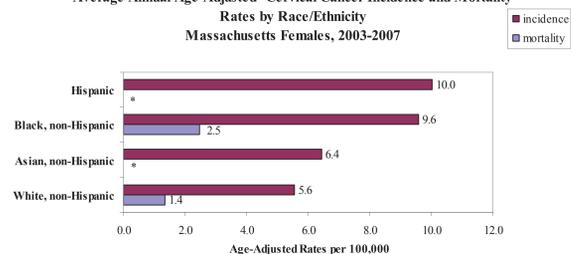
Rates were relatively low for young women and then began to rise rapidly starting with women 20-24 years until ages 40-44 years.

The rates for the period 2003-2007 peaked at 13.9 per 100,000 among women in the 65-69 age group. Rates fluctuated between 10.1 and 13.9 per 100,000 for women 40-84 years.

The percentages from Behavioral Risk Factor Surveillance. *A Profile of Health Among Massachusetts Adults, 2008*. Boston, MA: Massachusetts Department of Public Health; 2009.

The data from the Behavioral Risk Factor Surveillance Study (BRFSS) was compiled using the age groups 35-44, 45-54, 55-64, 65-74, and 75+. The age groups in order were found to have these percentages, 93.8%, 90.7%, 86.4%, 74.3%, and 50.6%, of respondents receiving a pap smear test within the past 3 years.

**Figure 3**  
Average Annual Age-Adjusted<sup>1</sup> Cervical Cancer Incidence and Mortality Rates by Race/Ethnicity  
Massachusetts Females, 2003-2007



<sup>1</sup>Age-adjusted to 2000 U.S. Standard Population

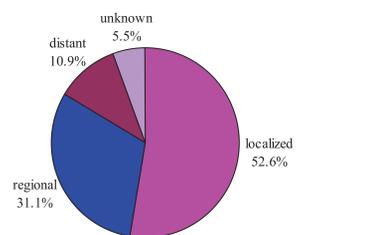
\*Age-adjusted mortality rate was not calculated since there were fewer than 20 deaths

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.

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



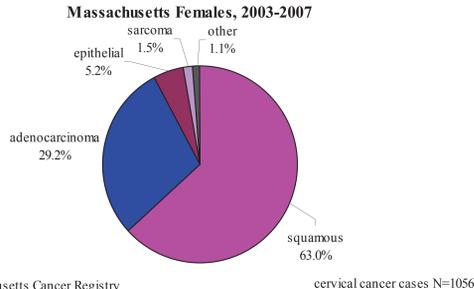
Source: Massachusetts Cancer Registry

cervical cancer cases N=1056

Figure 4 presents the distribution of invasive cervical cancer incident cases by stage at diagnosis for Massachusetts females for the years 2003-2007. In 1998, it was determined that *in situ* cervical cases (which includes pre-invasive cervical neoplasia, squamous intraepithelial neoplasia, and cervical intraepithelial neoplasia, Grade III or CIN III) would no longer be required to be collected by central registries.

- The majority of invasive cervical cases (52.6%) were diagnosed 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 had unknown, unstageable, or unspecified stage.

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



Source: Massachusetts Cancer Registry

cervical cancer cases N=1056

Figure 5 presents the distribution of invasive cervical cancer incident cases by histologic type for Massachusetts females.

- 63.0% of cervical cancers were of the squamous cell type.
- 29.2% of cervical cancers were of the adenocarcinoma cell type.
- Only 7.8% of cervical cancers were either epithelial cell, sarcoma, or other.

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

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

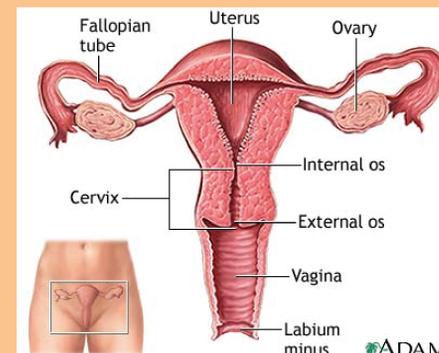
### Probability of Developing or Dying from Cervical Cancer

Analysis of the probability of developing and dying from cervical cancer by a specific age for Massachusetts females from 1998-2007:

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

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

### FEMALE REPRODUCTIVE SYSTEM



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

### DISCUSSION

#### Data Review

Cervical cancer screening programs are behind the decreasing trends found in cervical cancer incidence and mortality rates because screening allows the cancer to be found before it becomes invasive (Figure 1).

Cervical screening programs may explain why the age-specific incidence rates are fluctuating. Screening allows cells that exhibit pre-malignant changes to be removed prior to becoming cancerous. The BRFSS data reveals a high percentage of women receiving pap smear tests in the last three years, specifically in the age groups 35-44, 45-54, and 55-64, with over 85% of the respondents receiving a pap smear test. Small numbers of cases in some of the 5-year age groups result in wide variability in the age-specific rates from age 40-79 (Figure 2).

The incidence and mortality rates among all the racial/ethnic groups identify that the cervical screening programs may not be reaching the subset of the population that stopped using or have not utilized the medical systems in Massachusetts (Figure 3).

The success of screening is really apparent when over 50% of invasive cervical cancers were found at the localized stage (Figure 4). Annual screening not only leads to the reduction of mortality from cervical cancer, it can help diagnosis the invasive cervical cancers at earlier stages when the treatment options are better tolerated by the patients.

#### Papanicolaou (Pap) Smear Screening

Cervical cancer is a public health success story with respect to prevention since there is a very reliable screening test and a definitive risk factor in the form of a virus.

The Pap smear was developed by Dr. George Papanicolaou in the 1930s and it has been one of the most effective screening tools for cancer in medical history.

This simple but effective screening tool was introduced after World War II.

Since that time death rates from cervical cancer have decreased 70% in the U.S.

#### Recommendations for Annual Pap Smear Screening

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.

#### Human Papillomavirus (HPV) and Vaccination

Cervical cancer is the first screened cancer that can be linked to a virus, human papillomavirus (HPV). The ability to link a virus to a cancer has had a major impact on the effort to decrease incidence of cervical cancer.

HPV was discovered to be the etiological agent of cervical cancer in 1983 and the first HPV test was approved in 1999 in cervical cancer screening.

The HPV test can be used with the Pap smear to screen for cervical cancer in women who are 30 years or older and can be used to provide more information when the Pap smear results are not clear.

There are over 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 the cervical cancer cases.

In 2006, the FDA approved the first vaccine against the HPV types 16 and 18. In 2009, this vaccine was approved for boys, girls, young men, and young women ages 9 through 26 for HPV types 6, 11, 16, and 18.

### CONCLUSION

The cervical data highlights the positive effect screening has had on the number of invasive cervical cancers detected and how early the invasive cancer are found. Even so, approximately 200 new cases and 50 deaths occur annually in Massachusetts from this completely preventable cancer.

The current generations of girls and women have benefited from a simple screening and allowed many of them to lead healthier lives.

The addition of a HPV vaccine can only enhance the prevention of cervical cancer when combined with cervical cancer screening for future generations of women.

The way to continue low cervical cancer numbers is to bring knowledge to the future generations of girls and their families about the current recommendations for cervical screenings and prevention methods.