

DATA REPORT MELANOMA IN MASSACHUSETTS 1982-2002

The Massachusetts Cancer Registry, Massachusetts Department of Public Health

May, 2006

PURPOSE

This report provides descriptive information about the incidence of and mortality from cutaneous malignant melanoma in Massachusetts residents, using data from the Massachusetts Cancer Registry (MCR). The data in this report can be used in conjunction with other materials to provide a comprehensive overview about this cancer.

INFORMATION INCLUDED

This melanoma report is based on data reported to the MCR between 1982 and 2002. Malignant melanoma cases are classified by sex, age, and stage at diagnosis. *In situ* cases are only included in analyses of incidence by stage. All other analyses use only invasive melanoma. Trends in age-adjusted incidence and mortality rates for 1982 through 2002 are compared to national rates from the National Cancer Institute's Surveillance, Epidemiology and End Results (SEER) Program. Age-specific incidence rates are compared using two sets of five-year time periods, 1982-1986 and 1998-2002. Age-adjusted rates by race/ethnicity, and case distribution by stage, are also presented for Massachusetts for the period 1998-2002.

DATA SOURCES

The Massachusetts Cancer Registry (MCR):

State data on cancer incidence are from the Massachusetts Cancer Registry, which is part of the Massachusetts Department of Public Health (MDPH). The MCR is a population-based cancer registry that was established by state law in 1980 and began collecting data in 1982. The MCR collects reports of newly diagnosed cancer cases from all Massachusetts acute care hospitals and one medical practice association (76 reporting facilities in 2002). In 2001, the MCR began to collect reports from 230 dermatologists' offices and 2 dermatopathology laboratories. In addition, the MCR identifies cancers

noted on death certificates that were not previously reported to the MCR. The North American Association of Central Cancer Registries (NAACCR) has estimated that MCR case ascertainment is over 95% complete. Like other state and federal cancer registries, the MCR does not collect information on skin cancers other than melanoma (i.e., basal and squamous cell carcinomas of the skin) (1). The most recent year of Massachusetts cancer incidence data available at this time is 2002.

Surveillance, Epidemiology and End Results (SEER):

National data on cancer incidence and mortality are from the National Cancer Institute's SEER Program, an authoritative source of cancer incidence data in the United States. The twenty-one year comparison was done using data from 9 areas (Atlanta, Connecticut, Detroit, Hawaii, Iowa, New Mexico, San Francisco-Oakland, Seattle-Puget Sound, and Utah) that have been collecting collaborative data since 1975, and that cover about 14% of the United States population. 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 less than 25 cases for the time interval. SEER rates were available to the year 2002 at the time of this publication (2).

Registry of Vital Records and Statistics:

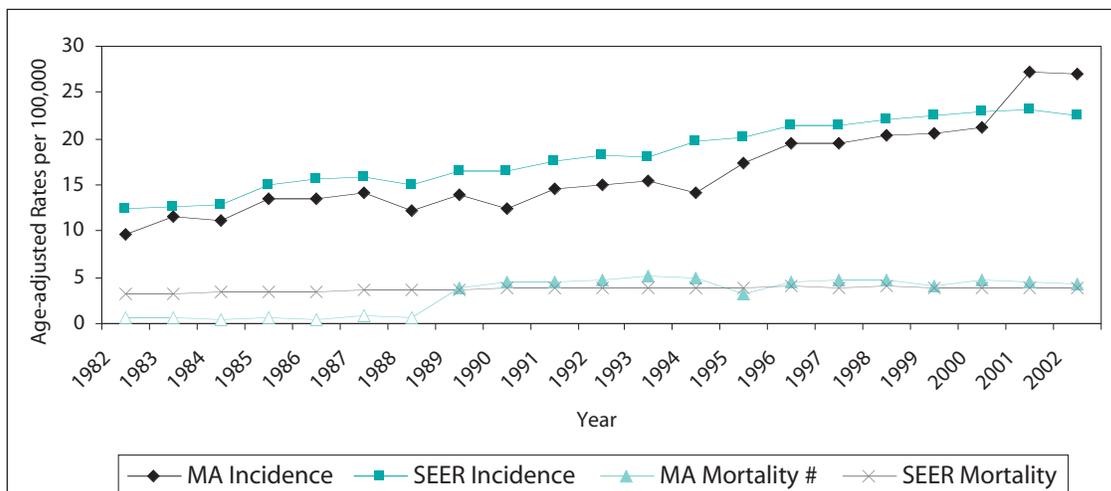
All Massachusetts cancer death data are from the Massachusetts Department of Public Health Registry of Vital Records and Statistics, which has legal responsibility for collecting and reporting deaths of Massachusetts residents. The most recent year of Massachusetts cancer mortality data available at this time is 2002 (3, 4).

INCIDENCE AND MORTALITY RATES, 1982-2002

Incidence and Mortality Rates over Time

Figure 1A

Age-adjusted¹ Melanoma Incidence and Mortality Rates² in Massachusetts and SEER areas, 1982-2002, Males



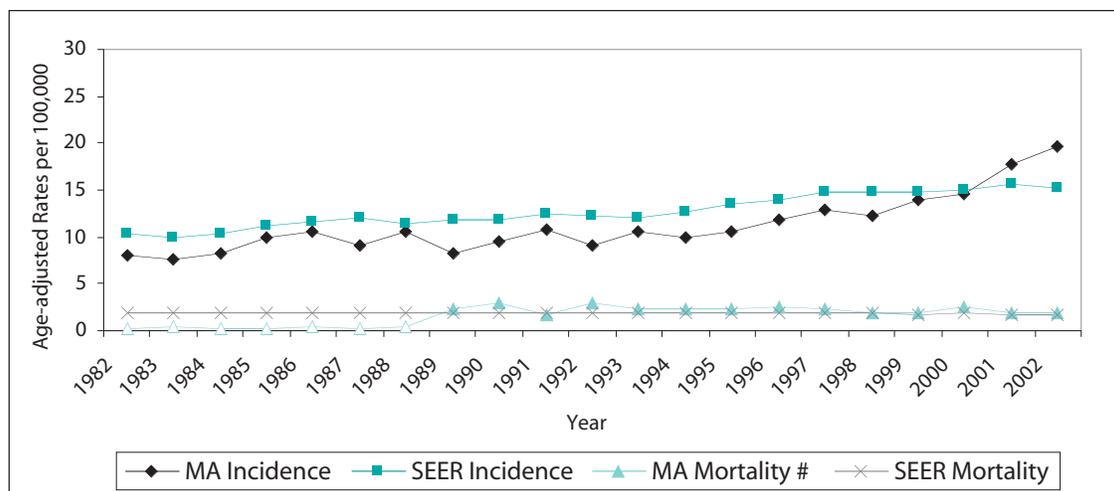
¹age-adjusted to the 2000 U.S. Standard Populations ²per 100,000

[#]Mortality rates represented by hollow triangles have less than 20 cases, and do not provide reliable results. They are presented in the graphs for continuity of the data.

Data sources: Massachusetts Cancer Registry and Surveillance, Epidemiology, and End Results

Figure 1B

Age-adjusted¹ Melanoma Incidence and Mortality Rates² in Massachusetts and SEER areas, 1982-2002, Females



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

[#]Mortality rates represented by hollow triangles have less than 20 cases, and do not provide reliable results. They are presented in the graphs for continuity of the data.

Data sources: Massachusetts Cancer Registry and Surveillance, Epidemiology, and End Results

Table 1
Average Annual Age-adjusted¹ Incidence Rates² for Melanoma and 95% Confidence Intervals Estimates for Rates in Massachusetts and SEER Areas, 1982-2001

	MA data			SEER data		
	lower CI ³	Rate	upper CI	lower CI	Rate	upper CI
Males	14.15	15.44	16.73	17.80	18.00	18.20
Females	9.50	10.47	11.44	12.40	12.50	12.70

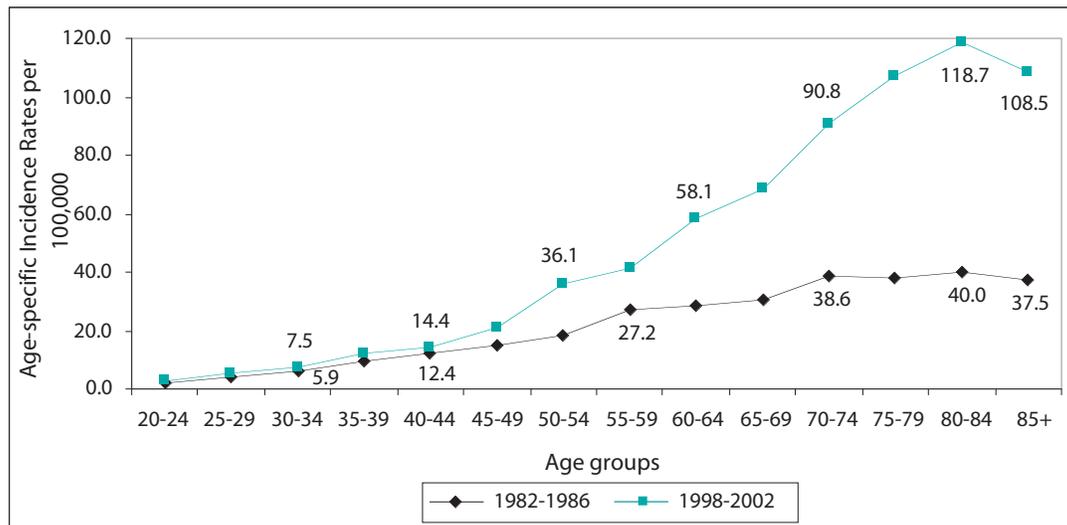
¹age-adjusted to the 2000 U.S. Standard Populations ²per 100,000

³CI= Confidence Intervals

Data sources: Massachusetts Cancer Registry and Surveillance, Epidemiology, and End Results

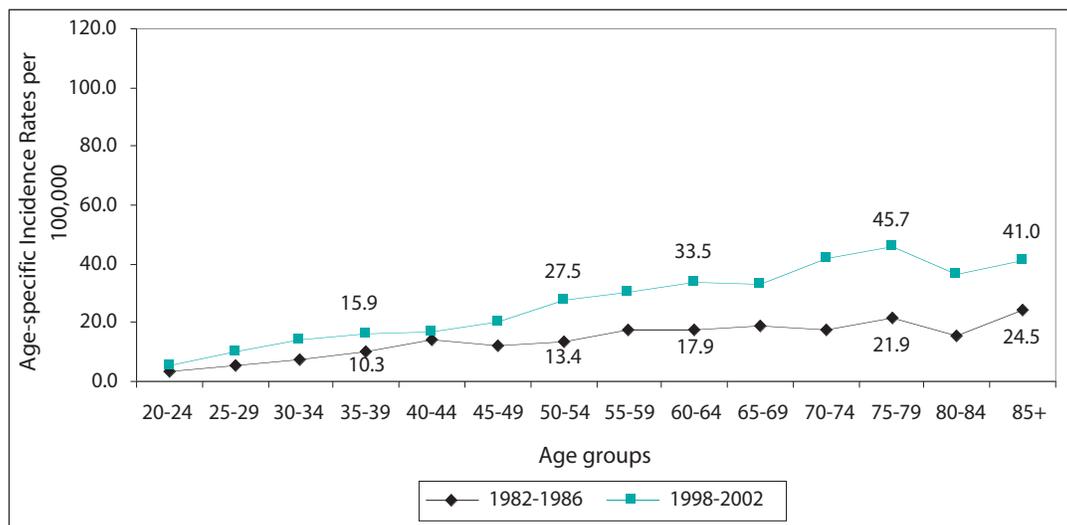
- ◆ Figures 1A and 1B demonstrate how melanoma incidence and mortality rates have changed over time in Massachusetts, and how these rates compare with national rates for 1982-2002.
- ◆ Massachusetts and SEER melanoma incidence rates for 1982 through 2001 were similar in how the rates rose over the time period. The Massachusetts and SEER mortality rates for 1989 through 2001 remained stable. (See Figures 1A and 1B footnotes for mortality rates prior to 1989.)
- ◆ Massachusetts melanoma incidence rates were consistently lower than the SEER rates until 2001, when Massachusetts rates increased for both males and females.
- ◆ Massachusetts and SEER melanoma incidence rates for males were consistently higher than for females throughout the time period.
- ◆ Melanoma incidence rates for both sexes rose gradually through the twenty-one year period, beginning in 1982 for males and 1989 for females. A trend analysis confirmed the visual interpretation using the estimated annual percentage change (EAPC) (5). The EAPC showed an increase by 4.2% for males and 3.2% for females. Both of these increases were statistically significant (p<0.05).
- ◆ A spike in melanoma incidence rates in Massachusetts was seen beginning in 2001. This could have been due to the addition of melanoma cases being reported by dermatologists' offices and dermatopathology laboratories. Consequently, this may not be a true increase in incidence rates for males and females, but rather an artifact of changes in data collection.
- ◆ These data will need to be collected for several additional years in order to determine if there is a true increase in trend after 2001 (see discussion, page 9).
- ◆ The Massachusetts average annual melanoma incidence rates were statistically significantly lower than the SEER rates for both males and females (p<0.05). The rates were calculated using 1982-2001 data (see Table 1).
- ◆ Melanoma mortality rates remained low and stable over time for both sexes in Massachusetts and SEER areas. Mortality rates for males were two times higher than those for females (average annual rate of 4 per 100,000 versus 2 per 100,000).

Figure 2A
Massachusetts Age-specific Melanoma Incidence Rates, Males, 1982-1986 and 1998-2002¹



¹Ages below 20 had less than 20 cases, and are therefore not presented in the graphs.
 Data sources: Massachusetts Cancer Registry and Surveillance, Epidemiology, and End Results.

Figure 2B
Massachusetts Age-specific Melanoma Incidence Rates, Females, 1982-1986 and 1998-2002¹



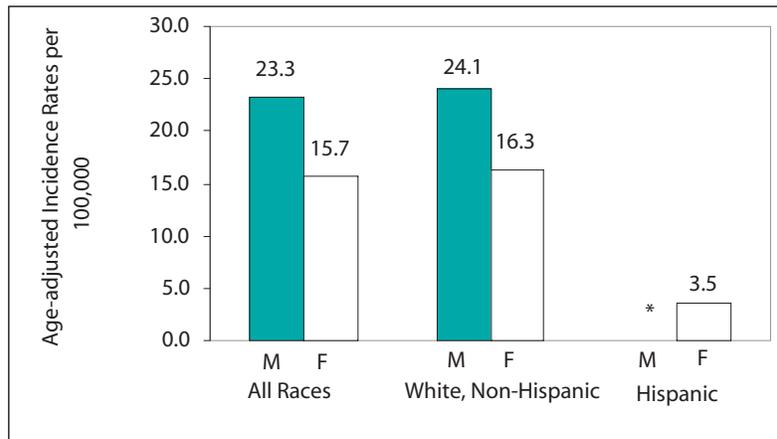
¹Ages below 20 had less than 20 cases, and are therefore not presented in the graphs.
 Data sources: Massachusetts Cancer Registry and Surveillance, Epidemiology, and End Results.

- ◆ Figures 2A and 2B demonstrate how melanoma incidence rates change with age, and how these rates have changed over time.

- ◆ Female melanoma incidence rates remained lower than male rates for all ages and for both calendar periods.
- ◆ During 1982-1986, male melanoma incidence rates were low below 40 years of age and then rose gradually with increasing age, starting at age 40. The rates started to plateau close to 38 per 100,000, starting at the age group 70-74.
- ◆ During 1998-2002, male melanoma incidence rates were low below 40 years of age and then rose sharply with increasing age, starting at age 40. The rates reached a peak of 118 per 100,000 in the age group 80-84.
- ◆ During 1982-1986, female melanoma incidence rates were also low below 40 years of age and then rose gradually with increasing age, starting at age 40. The rates fluctuates around 20 per 100,000 starting at the age group 65-69.
- ◆ During 1998-2002, female melanoma incidence rates were low below 40 years of age and then rose gradually with increasing age, starting at age 40. The rates reached 45 per 100,000 in the age group 75-79.

Incidence Rates by Sex and Race/Ethnicity

Figure 3
Massachusetts Age-adjusted¹ Melanoma Incidence Rates by Sex and Race/Ethnicity, 1998-2002



M=Male F=Female

¹age-adjusted to the 2000 U.S. Standard Populations

*Rates based on less than 20 cases are not calculated.

Data sources: Massachusetts Cancer Registry and Surveillance, Epidemiology, and End Results

- ◆ Figure 3 presents age-adjusted melanoma incidence rates by sex for all races combined and by race/ethnicity for the period 1998-2002.
- ◆ Melanoma incidence rates for white, non-Hispanics and all races combined were similar. The rate of melanoma was much higher for white, non-Hispanics than for other race/ethnicity groups.
- ◆ Melanoma rates for Asian, non-Hispanic and black, non-Hispanic groups were not presented because of the low incidence in these populations (less than 20 cases over the five-year period).
- ◆ Males tended to have higher incidence rates of melanoma than females, regardless of race/ethnicity.

STAGING

The stage at which a cancer is diagnosed can be important in determining how best to treat the cancer. Melanomas are classified into the following five groups, based on clinical and pathological exams (3).

1. 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.

2. Localized (early stage)

The cancer is found only in the body part (organ) where it began; it hasn't spread to any other parts.

3. Regional (late stage)

The cancer has spread beyond the original point where it started to the nearest surrounding parts of the body (other tissues).

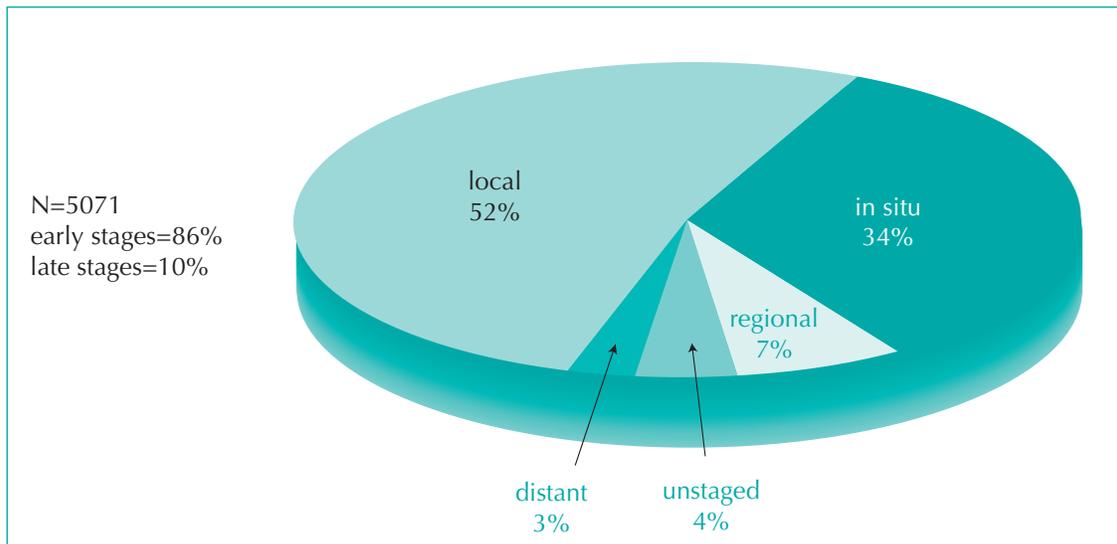
4. Distant (late stage)

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 through the body.

5. Unstaged

There is not enough information about the cancer to assign a stage.

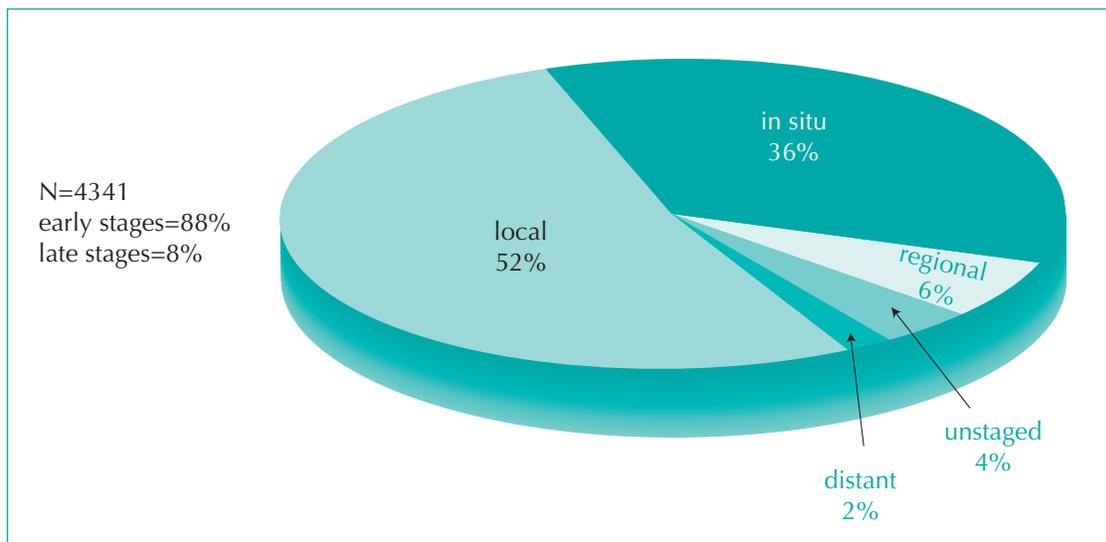
Figure 4A
Massachusetts Melanoma Incidence Cases by Stage at Diagnosis, 1998-2002, Males¹



¹In situ cases were only included in this staging section.

Data sources: Massachusetts Cancer Registry and Surveillance, Epidemiology, and End Results

Figure 4B
Massachusetts Melanoma Incidence Cases by Stage at Diagnosis, 1998-2002, Females¹



¹In situ cases were only included in this staging section.

Data sources: Massachusetts Cancer Registry and Surveillance, Epidemiology, and End Results

- ◆ Figure 4A and 4B presents melanoma case distribution by stage and sex for the period of 1998-2002.
- ◆ Melanoma was detected at an early stage in 86% of males and 88% of females.
- ◆ While males had higher melanoma incidence rates than females, males and females generally had the same level of early stage detection.

DATA SUMMARY

- ◆ The incidence of melanoma increased over the last twenty-one years in Massachusetts, yet this incidence was still lower than SEER areas up until 2001. Males had overall higher incidence rates in both Massachusetts and SEER areas from 1982-2002.
- ◆ While melanoma incidence increased, the mortality rate remained stable over time. Massachusetts' mortality rates were comparable to the national rates.
- ◆ Age-specific melanoma incidence rates were substantially higher for the most recent time period 1998-2002, than for 1982-1986. These rates increased with age for both males and females in Massachusetts, starting at the age of 40.
- ◆ In Massachusetts for 1998-2002, white, non-Hispanics had the highest melanoma rates of all racial/ethnic groups.
- ◆ For both males and females in Massachusetts during 1998-2002, the majority of melanoma cases were found when the cancer was still at the *in situ* or localized stages.

DISCUSSION

In this report, average annual age-adjusted incidence rates of melanoma for Massachusetts were compared to those of SEER areas, demonstrating that Massachusetts' melanoma rates were lower than the national SEER rates up to 2001 (Figure 1A, Figure 1B and Table 1). In 2001, Massachusetts' rates surpassed national rates for the first time. One possible reason for this is the collection of data from additional facilities: in 2001, reporting requirements expanded to encompass dermatologists' offices and dermatopathology laboratories, which may diagnose cases of melanoma outside of a hospital setting. It has been previously reported that under-reporting of melanoma cancers in population-based registries ranges from 8% to 21% in the early years of data collection (6, 7). This spike seen in 2001 incidence rates for males and females may be caused by this increased reporting. Additional years of data will be required in order to assess whether this increase is significant and represents a change in the trend.

The age-specific incidence rates demonstrated a rise in cases of melanoma among the Massachusetts male population in recent years. There is also a higher

incidence of melanoma among the United States male population (7). Studies done to look at birth cohorts and melanoma deaths found a rising incidence of melanoma among a birth cohort of males born between 1935 and 1950, which corresponds to an increase in rates seen in Figure 2A (7). This birth cohort tended to work in manual labor jobs that exposed them to ultraviolet radiation sources throughout their work experience (8). These workers who had constant ultraviolet radiation exposure demonstrated a decrease risk of melanoma except on the head, face, and neck (9, 10). Males generally do not examine themselves for suspicious moles or use sunscreen regularly, which can help decrease the risk of developing melanoma (7). These are just a few factors that could attribute to the higher cases of Massachusetts males developing melanoma.

Among race/ethnicity groups, white, non-Hispanics had the most melanoma cases during the five-year period 1998-2002. Research is continually being done to determine how melanoma arises from the melanin pigment found in skin. White, non-Hispanics typically have less melanin pigment in their skin tone, and burn more easily with intermittent ultraviolet radiation exposure, putting them at increased risk of developing melanoma (11). Tanning with any ultraviolet radiation should be limited in order to prevent melanoma occurrences (12, 13, 14).

The incidence of cutaneous malignant melanoma is rising faster than that of any other cancer (15). While melanoma accounts for about 4% of skin cancer cases, it causes about 79% of skin cancer deaths (16). The majority of melanoma cases in both males and females were found during the early stages of the disease, however. Thus, the nature of melanoma and easy removal makes this cancer an easier one to diagnosis while in the early stages (16).

TECHNICAL NOTES AND DEFINITIONS

Age-adjusted incidence/mortality rate:

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 population of 100,000 persons. The potential confounding effect of age is reduced when comparing age-adjusted rates for populations with different age structures. The 2000 U.S. Bureau of the Census population distribution was used as a standard. Rates were age-adjusted using 18 five-year age groups. Age-adjusted rates can *only* be compared if they are adjusted to the same standard population. It is also important to note that differences in methodologies used in calculating rates, such as number of age groups used, may cause slight variations in results.

Age-specific rate:

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 a given time frame. They are presented as rates per 100,000 residents and are sex-specific.

Estimated Annual Percent Change (EAPC):

The EAPC is a statistical method used for analyzing trends in cancer incidence and mortality rates. It shows how quickly or slowly cancer rate has increased or decreased over the observed period of time. This estimation assumes that the change in incidence or mortality rates is constant during the observed time period. The EAPC for a short time period (1982-2001 for this report) was calculated using SEER methods.

The $EAPC = 100 * (e^m - 1)$, where m is a slope of the linear regression line, which is an approximation of the function of the natural logarithm of the rates by the year of diagnosis (17). A positive EAPC corresponds to an increasing trend, while a negative EAPC corresponds to a decreasing trend. All of the EAPCs calculated in this report were statistically tested ($p <= 0.05$) against the hypothesis that they are equal to zero (i.e., the rate is neither increasing nor decreasing).

International Classification of Disease for Oncology (ICD-O):

Two versions of the ICD-O system were used to code cancer cases during the time period of this report.

The second edition (ICD-O-2) was used for cases diagnosed during 1982 to 2000, and the third edition (ICD-O-3) was used for cases diagnosed as of January 1, 2001 and after. Melanoma is defined as primary site codes C44.0 to C44.9, morphology codes 8720 to 8790, and behavior codes 2 (*in situ*) and 3 (malignant). When the coding changed over from ICD-O-2 to ICD-O-3, no modification was needed between editions.

Population estimates:

All of the population data were obtained from the Massachusetts Department of Public Health (MDPH) using the Massachusetts Community Health Information Profile (MassCHIP) demographic/census files. Census data were reallocated to create mutually exclusive race categories consistent with the race categories used to collect cancer incidence and cancer mortality data.

Race/ethnicity:

The race/ethnicity categories presented in this report are mutually exclusive. Cancer cases and deaths are only included in one race/ethnicity category. The race/ethnicity tables include the categories white, non-Hispanic and Hispanic (1).

Statistical significance:

Statistical significance is an estimate of the probability that the difference between two rates as large as the one we are observing (for example, the difference between the Massachusetts rate and the U.S. rate) is due to *chance alone*. Usually the level of statistical significance is stated by the p value. By convention, when a p value is less than or equal to 0.05 ($p <= 0.05$), the difference is considered statistically significant (18).

95% Confidence Intervals:

The confidence interval (CI) is a range of values within which the true value should lie. CIs are determined by the degree of variability of the data. The 95% confidence interval presented in this report means that 95 times out of 100, this range of values will contain the true one. The confidence interval indicates the precision of the rate calculation; the wider the interval, the less certain the rate. Statistically, the width of the interval reflects the size of the population and the number of events. Smaller populations and smaller number of cases yield less precise estimates, with wider confidence intervals (19).

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ACKNOWLEDGEMENTS

Thanks to Bertina Backus, MPH of the Massachusetts Cancer Registry and Helen Hawk, PhD of the Division of Research and Epidemiology for the preparation and coordination of this report. We would also like to thank the following people for their valuable input on the content of this report: Alan Geller, RN, MPH of the Department of Dermatology at the Boston University School of Medicine and the Department of Epidemiology at the Boston University School of Public Health, and Christine Judge, MS of the Division of Public Health Practice at the Harvard School of Public Health. We acknowledge the Centers for Disease Control and Prevention for its support of the staff and the printing of this report under cooperative agreement U55/CCU121937-03 awarded to the Massachusetts Department of Public Health. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the Centers for Disease Control and Prevention.