

Cancer in Massachusetts by Race and Ethnicity, 2011-2015



Massachusetts Cancer Registry
The Office of Data Management and Outcomes Assessment
Massachusetts Department of Public Health
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EXECUTIVE SUMMARY

Cancer in Massachusetts by Race and Ethnicity, 2011-2015 provides in depth data on the incidence of and mortality due to cancer from 2011-2015 among residents of Massachusetts, specifically focusing on disparities by race/ethnicity for white non-Hispanic (NH); black NH; Asian NH; and Hispanic. In addition to age adjusted incidence and mortality rates, cancer staging and age at diagnosis data are presented. When numbers were sufficient, incidence rates were calculated for specified ethnicities within these groups. Any differences between groups that are highlighted represent a statistically significant difference.

Asian non-Hispanic:

Females:

- From 2011-2015, there were 309 invasive cancer cases per 100,000 Asian NH females, a rate significantly lower than the other groups; and 80 cancer deaths per 100,000 , a rate significantly lower than white and black NH females.
- Asian NH females were diagnosed at a younger age for all invasive cancers and invasive breast cancer than white NH females and were more likely to be diagnosed at an early stage for liver cancer and a late stage for lung cancer than white NH females.
- South Asians had a significantly higher breast cancer rate compared to Chinese and Vietnamese.

Males:

- From 2011-2015, there were 314 invasive cancer cases per 100,000 Asian NH males, a rate significantly lower than the other three race/ethnicity groups; and 120 cancer deaths per 100,000, a rate significantly lower than white and black NH males.
- Asian NH males were diagnosed at a significantly younger age for all invasive cancers and had a significantly higher rate of liver cancer than white NH males.
- Vietnamese males had a significantly higher rate of all invasive cancers, lung cancer, and liver cancer compared to Chinese and South Asian males while South Asians and Chinese males had significantly higher rates of prostate cancer.

Black non-Hispanic:

Females:

- From 2011-2015, there were 403 invasive cancer cases per 100,000 among black NH females, a significantly higher rate than Asian NH and Hispanic females but significantly lower than white NH females; and 135 cancer deaths per 100,000, a rate significantly higher than Asian NH and Hispanic females.
- Black NH females were diagnosed at a significantly younger age for all invasive cancers and invasive breast cancer than white NH females.
- While black NH females had non-significantly and significantly lower incidence rates of breast and uterine cancer, respectively, than white NH females, they were significantly more likely to be diagnosed at a late stage for both cancers. There were, however, no differences in mortality rates for these two cancers compared to white NH females.
- Incidence for all invasive cancers, breast cancer, and lung cancer were significantly lower for Haitian females compared to all black NH females.

Males:

- From 2011-2015, there were 514 invasive cancers per 100,000 among black NH males, a rate significantly higher than Asian NHs and Hispanic; and 199 cancer deaths per 100,000, a rate significantly higher than Asian NHs and Hispanics. Both incidence and mortality rates significantly decreased as well from 2011-2015.
- The prostate cancer incidence and mortality rates for black NH males were significantly elevated compared to the other three race/ethnicity groups.
- All invasive cancers as well as prostate cancer were diagnosed at a significantly younger age for black NH males compared to white NHs.
- The incidence rate for prostate cancer for Haitian males was significantly elevated compared to all black NH males.

Hispanic:

Females:

- From 2011-2015, there were 324 invasive cancers per 100,000 Hispanic females, a rate significantly lower than white and black NHs; and 86 cancer deaths per 100,000, a rate also significantly lower than white and black NHs.
- The median age at diagnosis for all invasive cancers and invasive breast cancer diagnosis was significantly younger among Hispanic females than white NH females.
- The incidence rate of colorectal cancer was significantly higher for Puerto Rican than Dominican females.

Males:

- From 2011-2015, there were 373 invasive cancers per 100,000 among Hispanic males, a significantly higher rate than Asian NHs, but significantly lower than white and black NH males. The incidence rate significantly decreased from 2011-2015. There were 123 deaths per 100,000, a rate significantly lower than white NH and black NH males.
- Hispanics were diagnosed at a significantly younger age and had a significantly higher incidence rate of liver cancer compared to white NH males.
- Compared to Puerto Ricans, Dominican males had a significantly elevated prostate cancer incidence and a significantly lower lung and liver cancer incidence.

White non-Hispanic:

Females:

- From 2011-2015, there were 468 invasive cancers per 100,000 white NH females, a significantly higher rate compared to the other three race/ethnicity groups; and 139 cancer deaths per 100,000, a significantly higher rate than Asian NH and Hispanic females. The mortality rate decreased significantly from 2011-2015.
- The incidence rates for breast, lung, and bladder cancer and melanoma among white NH females were significantly higher than the other three race/ethnicity groups.

Males:

- From 2011-2015, there were 499 invasive cancers per 100,000 white NH males, a significantly higher rate compared to Asian NH and Hispanic males; and 191 cancer deaths per 100,000, a significantly higher rate compared to Asian NH and Hispanic males.
- The incidence rates for bladder cancer and melanoma among white NH males were significantly higher than the other three race/ethnicity groups.

Cancer in Massachusetts by Race and Ethnicity, 2011-2015

The Massachusetts Cancer Registry, Massachusetts Department of Public Health

PURPOSE

Cancer in Massachusetts by Race and Ethnicity, 2011-2015 provides in depth data on the incidence of and mortality due to cancer from 2011-2015 among residents of Massachusetts, specifically focusing on disparities by race/ethnicity. It presents data not included in the annual report (<https://www.mass.gov/lists/cancer-incidence-statewide-reports>). In addition to incidence and mortality rates, this report presents Massachusetts cancer staging and age at diagnosis data for four main race/ethnicities: white non-Hispanic; black non-Hispanic; Asian/Pacific Islander non-Hispanic; and Hispanic. For the sake of simplicity, non-Hispanic will be represented as NH throughout the report. This report includes a description of the racial and ethnic groups in Massachusetts, data on the number of cancers and incidence rates, median ages at diagnosis and stage at diagnosis by race/ethnicity. When case counts are sufficient for data analysis, the most common cancers for selected Asian NH, Hispanic, and black NH ethnic groups are presented. Causes and prevention of these cancers are not presented in this report. Please refer to the American Cancer Society <https://www.cancer.org/> for this information.

BACKGROUND

Race and Ethnicity in Massachusetts

Whites are defined as people having origins in any of the original peoples of Europe, the Middle East, or North Africa.¹ White NH includes whites who are not “persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin.”¹ According to 2011-2015 American Community Survey (ACS) estimate, white NHs constituted 74.3% of the Massachusetts population and 62.3% of the United States population. In Massachusetts, the predominant white NH ancestries from these ACS estimates were Irish (22.2%), Italian (13.6%), English (10.3%), French (7.5%), and German (6.2%).

Blacks or African Americans are defined as people having origins in any of the black racial groups of Africa.¹ While the vast majority of blacks in Massachusetts were born in the United States (65%), there are significant numbers who were born in Haiti (9%), other Caribbean nations (6%), and the African continent, particularly the nations of West Africa (8%). Black NHs are blacks who are not “persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin.”¹ According to the 2011-2015 ACS estimates, black NHs constituted 6.5% of the general population in Massachusetts and 12.3% of the United States population.

Asians are defined as people having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent.¹ Despite being part of the Asian continent, Arab people from the Middle East are, for the majority, counted as white NH as are Arabs from North Africa. According to the 2011-2015 ACS estimates, Asian NHs constituted 5.9% of the general population in Massachusetts and 5.1% of the United States population. The 2011-2015 ACS estimated Massachusetts Asian population is composed primarily of Chinese (37%), South Asians (22%), Vietnamese (12%), Cambodians (8%), Koreans (7%), Filipinos (3%), and Japanese (2%).

Hispanics are defined as “persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin regardless of race.”¹ According to the 2011-2015 ACS estimates, Hispanics constituted 10.6% of the general population in Massachusetts and 17.1% of the United States population. The estimated Massachusetts Hispanic population is composed primarily of Puerto Ricans (42%), Central and South Americans (27%), Dominicans (19%), Mexicans (6%), and Cubans (2%).

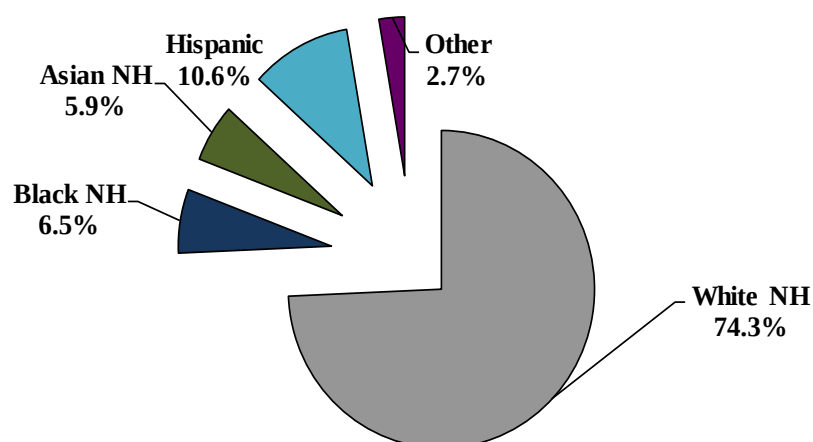
American Indians/Alaskan Natives refers to persons having origins in any of the original peoples of North and South America (including Central America) and who maintain tribal affiliation or community attachment. The 2011-2015 ACS estimate for Massachusetts was 13,189 or 0.2% of the population. Since there were only 158 invasive cancer cases from 2011-2015 among American Indians/Alaska Natives (69 female and 89 male), it was not possible to perform any meaningful analyses. Please refer to the CDC publication ‘Cancer among American Indians and Alaska Natives’ for more detailed national statistics.

https://www.cdc.gov/cancer/healthdisparities/what_cdc_is_doing/aian.htm

Multiracial refers to people who checked two or more categories in the race category on the census form. The 2011-2015 ACS estimates for Massachusetts for 2 or more races was 194,677 or 2.9% of the population. There were 193 cases in the MCR who indicated 2 or more races. For the purposes of analysis and due to the small number, these cases were limited to the first race indication in the MCR data.

In addition, there were 2,861(1.5%) cases reported without race/ethnicity information. These cases were excluded from race/ethnicity analyses in this report. Since the percent breakdowns for males and females are nearly identical across race/ethnicity, the racial/ethnic population breakdowns for all Massachusetts are presented in Figure 1.

Figure 1: Racial/Ethnic Distribution of the Massachusetts Population, 2011-2015 ACS Estimates



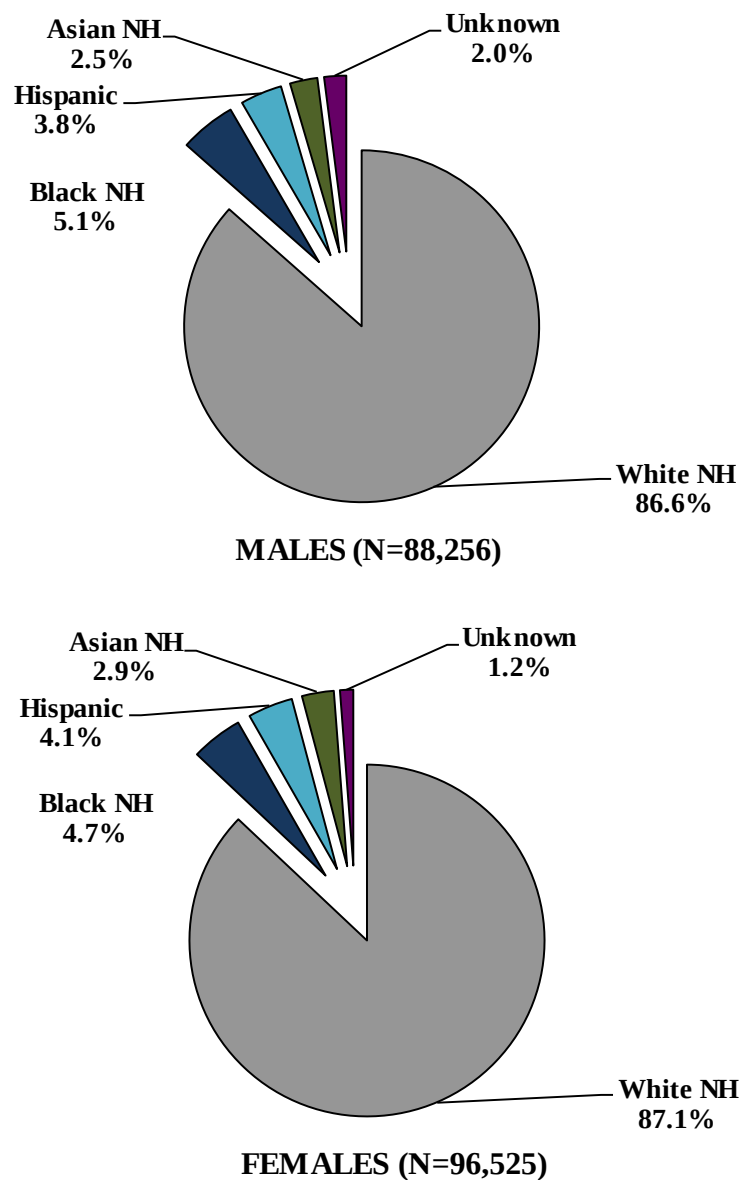
Data Source: ACS 2011-2015 estimates

CANCER INCIDENCE

Cancer Incidence among Males and Females:

- 88,256 invasive cancer cancers were diagnosed from 2011-2015 among male residents of Massachusetts, the majority among white NH males (87%) (Figure 2).
- 96,525 invasive cancer cases were diagnosed among Massachusetts female residents, the majority of cancers again occurred among white NH females (87%) (Figure 2).

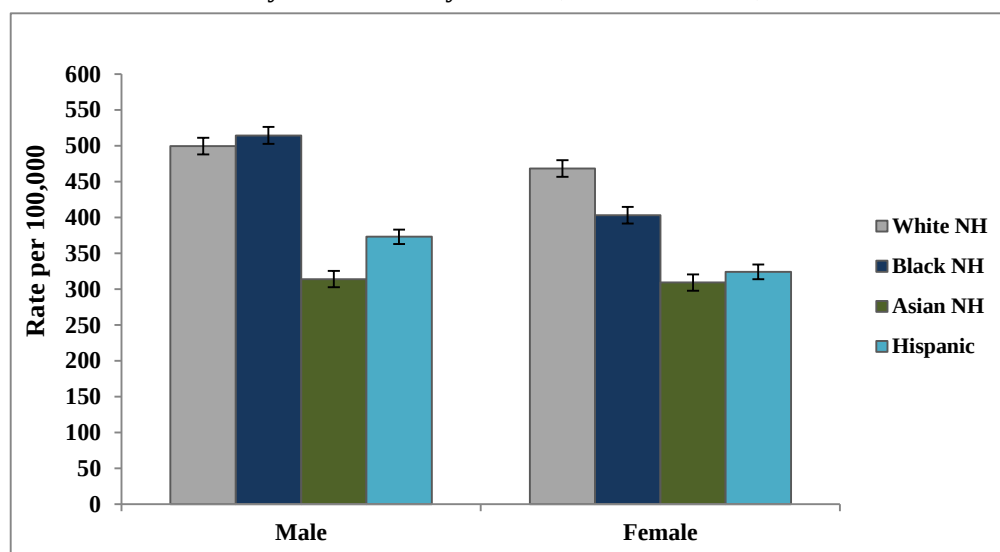
Figure 2. Percentage of all cancers by race/ethnicity, Massachusetts, 2011-2015



Data source: Massachusetts Cancer Registry

This report focuses on the major cancers diagnosed among Massachusetts residents of all age groups. Please see Appendices A and B for a complete listing of all invasive cancer counts by sex and race/ethnicity in Massachusetts from 2011-2015. Population estimates used to calculate incidence and mortality rates are found in Appendix F.

Figure 3. Age-adjusted* incidence rates per 100,000 and 95% confidence limits of all cancer sites combined by race/ethnicity and sex, Massachusetts, 2011-2015



	White NH	Black NH	Asian NH	Hispanic
Male	499.3	514.3	313.9	372.9
	(495.8-502.9)	(499.3-529.4)	(300.8-326.9)	(360.2-385.6)
Female	468.2	402.9	309.1	324.1
	(465.0-471.4)	(391.2-414.6)	(297.6-320.6)	(313.9-334.3)

* Age-adjusted to the 2000 U.S. Standard Population Data source: Massachusetts Cancer Registry

- Black NH males had the significantly highest age-adjusted incidence rate of all male cancer types combined with 514.3 cases per 100,000 males.
- Asian NH males had the lowest rate of all male cancer types combined with 313.9 cases per 100,000 for the years 2011-2015.
- The rates between white and black NH males did not differ significantly from each other but both differed significantly from Asian NH and Hispanics.
- White NH females had the highest incidence rate of all female cancer types combined, with 468.2 cases per 100,000 females, significantly higher than the other racial/ethnic groups.
- Asian NH females had the lowest incidence rate of all female cancer types combined with 309.1 cases per 100,000.
- For each racial/ethnic group, males had a significantly higher overall rate of cancer than females with the exception of Asian NHs.

Note: Throughout this report, cancer of the lung and bronchus will also be referred to as lung cancer, cancer of the colon/rectum as colorectal cancer, cancer of the liver and intrahepatic bile duct as liver cancer, cancer of the corpus uteri as uterine cancer, cancer of the urinary bladder as bladder cancer, cancer of the kidney/renal pelvis as kidney, cancer of the oral cavity/pharynx as oral, and non-Hodgkin lymphoma as NHL.

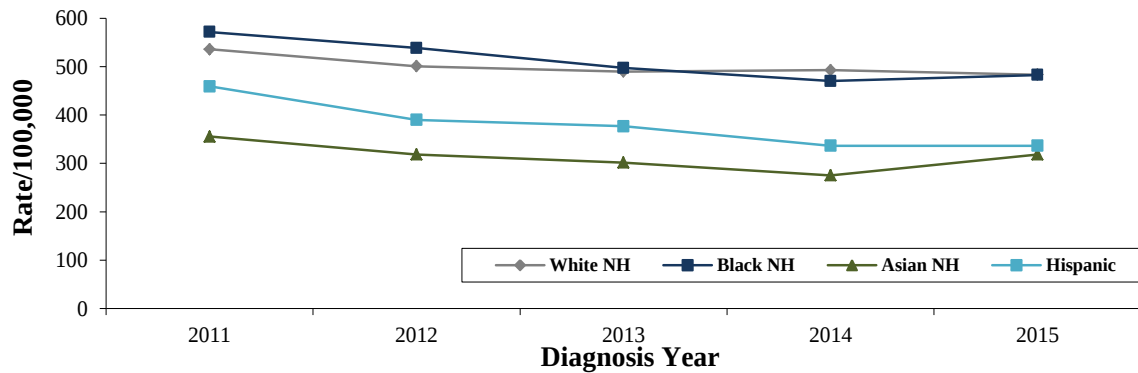
Table 1. Rank and age-adjusted* incidence rates per 100,000 of the ten leading cancers by race/ethnicity, Massachusetts males, 2011-2015

RANK	WHITE NH		BLACK NH		ASIAN NH		HISPANIC	
	Cancer	Rate (95% CL)	Cancer	Rate (95% CL)	Cancer	Rate (95% CL)	Cancer	Rate (95% CL)
1	Prostate	100.8 (99.3-102.3)	Prostate	182.8 (174.1-191.5)	Lung	57.9 (51.9-63.8)	Prostate	106.7 (99.7-113.6)
2	Lung	71.2 (69.8-72.5)	Lung	64.8 (59.1-70.4)	Prostate	57.3 (51.8-63.2)	Lung	38.1 (33.5-42.5)
3	Bladder+	42.8 (41.8-43.9)	Colorectal	46.9 (42.3-51.5)	Colorectal	32.4 (28.2-36.6)	Colorectal	34.7 (30.7-38.7)
4	Colorectal	42.0 (40.9-43.0)	Kidney	21.7 (18.7-24.7)	Liver	26.1 (22.4-29.8)	Liver	21.3 (18.4-24.3)
5	Melanoma	27.7 (26.8-28.5)	Liver	19.6 (16.8-22.3)	Bladder+	14.5 (11.5-17.6)	NHL	19.8 (17.0-22.6)
6	NHL	23.9 (23.2-24.7)	Bladder+	17.9 (14.9-20.9)	Oral	13.9 (11.3-16.5)	Bladder+	18.6 (15.4-21.7)
7	Kidney	23.0 (22.3-23.8)	Stomach	17.4 (14.5-20.3)	NHL	12.5 (10.0-15.0)	Kidney	18.5 (15.9-21.2)
8	Oral	18.3 (17.7-19.0)	NHL	17.6 (14.7-20.4)	Stomach	12.3 (9.7-15.0)	Oral	14.4 (11.9-16.9)
9	Leukemia	17.0 (16.3-17.6)	Pancreas	16.3 (13.5-19.1)	Thyroid	10.7 (8.7-12.8)	Stomach	14.2 (11.5-16.8)
10	Pancreas	14.8 (14.2-15.4)	Multiple Myeloma	14.3 (11.7-16.8)	Kidney	10.3 (8.0-12.5)	Leukemia	10.0 (8.0-11.9)

* Age-adjusted to the 2000 U.S. Standard Population. + Urinary Bladder includes *in situ* and invasive cases
Data source: Massachusetts Cancer Registry

- Prostate cancer was the most commonly diagnosed cancer for each of the race/ethnicity categories among Massachusetts males, except Asian NH. Black NH males had the highest age-adjusted incidence rate with 182.8 cases per 100,000, significantly higher than any other racial/ethnic group.
- Lung cancer was the leading cancer for Asian NH males and second for the other three male racial/ethnic groups. Hispanics had a significantly lower rate compared to the other groups.
- Colorectal cancer rates were significantly elevated for both white and black NH males compared to the other two racial/ethnic groups.
- The incidence rates for bladder cancer and melanoma were significantly elevated for white NH males compared to the other three groups whose melanoma rates were below 1.7/100,000 and not among the top ten.
- Black NH, Asian NH and Hispanic males had significantly elevated rates of liver cancer compared to white NHs.

Figure 4: Cancer Incidence Rates by Race/Ethnicity, Males, 2011-2015*



* Age-adjusted to the 2000 U.S. Standard Population. Data source: Massachusetts Cancer Registry

- Trends in incidence of all invasive cancers from 2011-2015 were analyzed for the four groups (Figure 4). The incidence rates for black NH males (APC= -2.2) and Hispanic males (APC= -7.4) decreased significantly.

Cancer Incidence Rates among Females

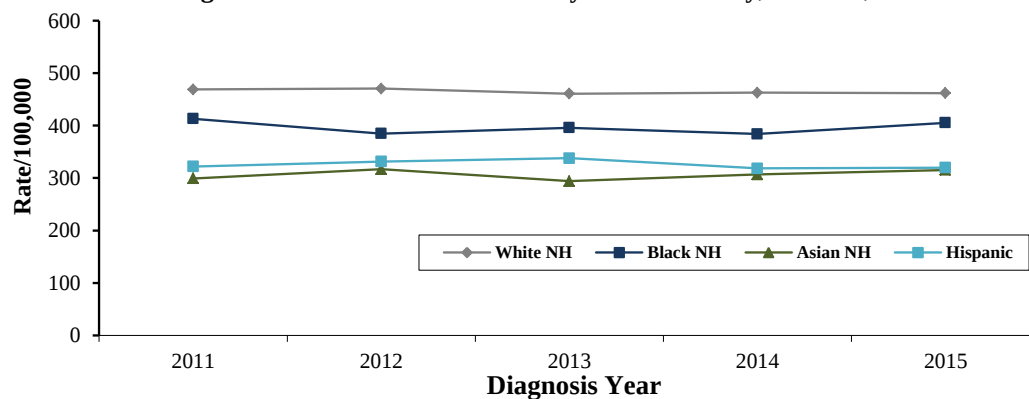
Table 2. Rank and age-adjusted* incidence rates per 100,000 of the ten leading cancers by race/ethnicity, Massachusetts females, 2011-2015

RANK	WHITE NH		BLACK NH		ASIAN NH		HISPANIC	
	Cancer	Rate (95% CL)	Cancer	Rate (95% CL)	Cancer	Rate (95% CL)	Cancer	Rate (95% CL)
1	Breast	143.7 (142.0- 145.5)	Breast	121.7 (115.3-128.1)	Breast	91.1 (85.1-97.2)	Breast	88.9 (83.6-94.1)
2	Lung	63.8 (62.6-64.9)	Lung	43.3 (39.4-47.2)	Lung	33.1 (29.1-37.2)	Thyroid	28.0 (25.3-30.6)
3	Colorectal	33.3 (32.5-34.2)	Colorectal	35.3 (31.8-38.8)	Thyroid	29.7 (26.4-33.0)	Lung	27.6 (24.3-31.0)
4	Uterine	30.4 (29.6-31.2)	Uterine	26.7 (23.7-29.7)	Colorectal	28.7 (25.0-32.3)	Colorectal	25.1 (22.1-28.1)
5	Thyroid	29.8 (28.9-30.7)	Thyroid	22.8 (20.1-25.6)	Uterine	15.5 (13.0-18.0)	Uterine	20.7 (18.1-23.2)
6	Melanoma	19.2 (18.6-19.9)	Multiple Myeloma	13.7 (11.5-16.0)	NHL	10.4 (8.2-12.5)	NHL	17.0 (14.6-19.4)
7	NHL	16.4 (15.8-17.0)	NHL	13.4 (11.3-15.5)	Ovary	9.4 (7.4-11.5)	Kidney	9.0 (7.4-10.7)
8	Bladder+	12.0 (11.5-12.4)	Pancreas	13.0 (10.9-15.2)	Stomach	9.1 (7.0-11.1)	Leukemia	8.1 (6.5-9.7)
9	Ovary	12.0 (11.5-12.5)	Kidney	11.3 (9.3-13.2)	Liver	9.2 (7.1-11.4)	Multiple Myeloma	8.1 (6.4-9.8)
10	Pancreas	11.6 (11.1-12.1)	Ovary	9.1 (7.4-10.8)	Pancreas	9.2 (7.0-11.4)	Pancreas	7.7 (6.0-9.4)

* Age-adjusted to the 2000 U.S. Standard Population. + Urinary Bladder includes *in situ* and invasive cases.
Data source: Massachusetts Cancer Registry

- Breast cancer was the most commonly diagnosed cancer for each of the race/ethnicity categories among Massachusetts females.
- Lung cancer ranked second for white NH, black NH, and Asian NH females, while thyroid cancer was second among Hispanic females.
- White NH females had significantly elevated incidence rates of breast and lung cancers compared to black NHs, Asian NHs, and Hispanics.
- White and black NH females had significantly elevated rates of uterine cancer compared to Asian NHs and Hispanics.
- The melanoma and bladder cancer rates were significantly elevated for white NH females compared to the other three groups whose rates were not in the top ten and were below 2.7/100,000 for melanoma and 7.6/100,000 for bladder.

Figure 5: Cancer Incidence Rates by Race/Ethnicity, Females, 2011-2015*

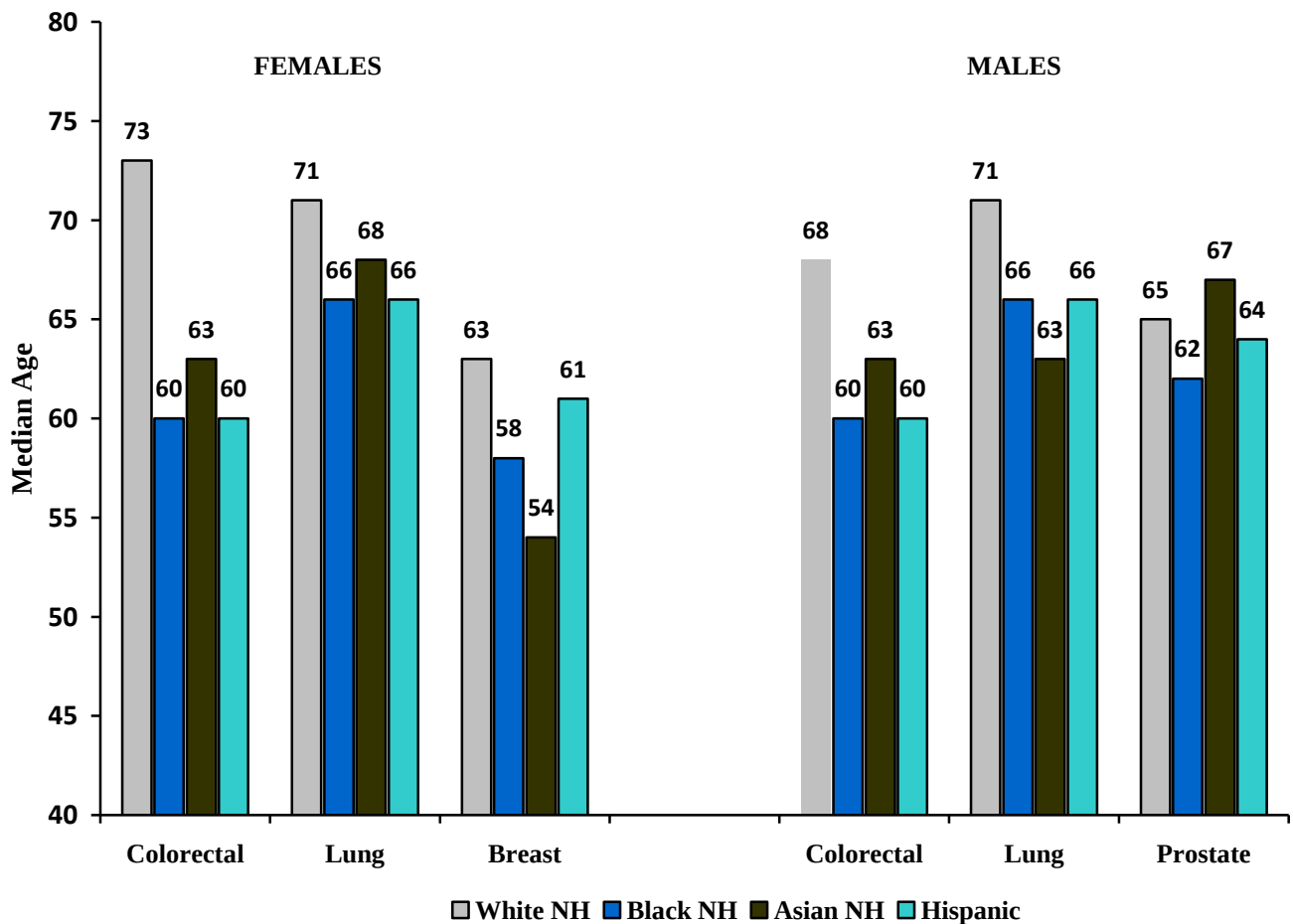


* Age-adjusted to the 2000 U.S. Standard Population. Data source: Massachusetts Cancer Registry

- There were no significant increases or decreases in cancer incidence among the four female racial/ethnic groups from 2011-2015 (Figure 5).

MEDIAN AGE AT CANCER DIAGNOSIS

Figure 6. Median age at diagnosis of leading cancers by race/ethnicity, Massachusetts, 2011-2015



Data source: Massachusetts Cancer Registry

- The median age at diagnosis for all invasive cancers among males was significantly younger for black NHs (62), Asian NHs (64), and Hispanics (61) compared to white NHs (67) (data not shown).
- The median age at diagnosis for all invasive cancers was similarly significantly younger for black NH females (61), Asian NH females (58), and Hispanics (56) compared to white NH females (66) (data not shown).
- Colorectal cancer was diagnosed at a significantly older median age for white NH males (68) and females (73) compared to the other groups.
- White males and females were diagnosed with lung cancer at a significantly older median age than black NHs, Hispanics, and Asian NH females but not males.
- Breast cancer was diagnosed at a significantly younger median age for black NH females (58), Asian NHs (54), and Hispanic females (61) compared to white NHs (63).
- Prostate cancer was diagnosed at a significantly younger age for black NH males (62) compared to Asian NH males (67) and white NH males (65) for prostate cancer.

STAGE AT DIAGNOSIS

The stage at which a cancer is diagnosed can be important in determining how to best treat the cancer and can be indicative of how early in the disease process a person is diagnosed. Cancers are staged based on clinical and pathological exams. For the purposes of this report, regional and distant stages were combined into a late stage category and compared with the local stage.

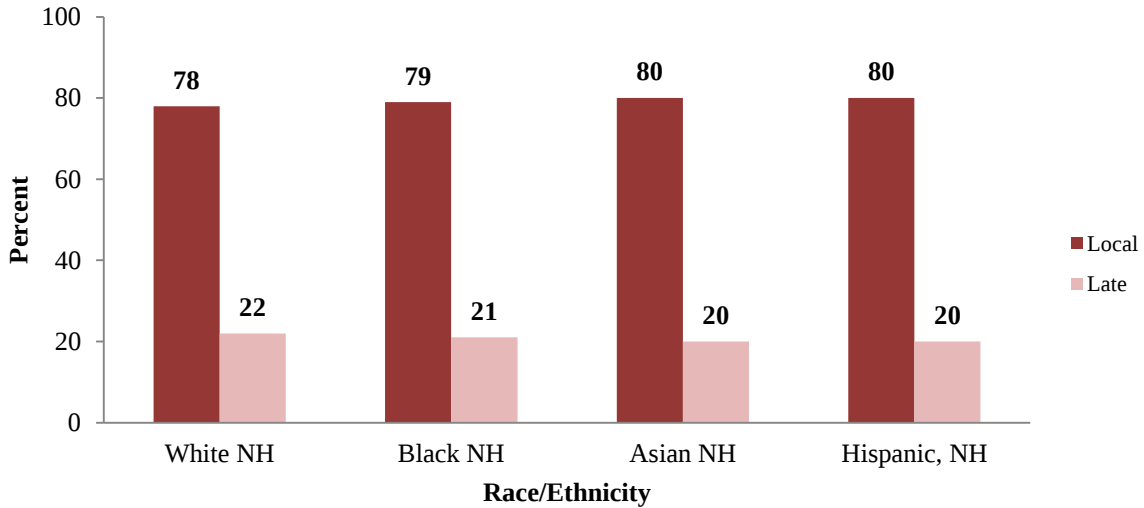
Stages of cancer:

- ***In situ*** – In this stage of cancer, the cancer is confined to a small group of malignant cells that have not yet invaded surrounding tissue. Other than urinary bladder cancer, this stage is not considered an invasive cancer and not part of this report.
- **Localized (early stage)** – This is the early stage of an invasive cancer. Cancer is found only in the body part (organ) where it began; it hasn't spread to any other parts.
- **Regional (late stage)** – In this stage, the cancer has spread beyond the original point where it started to the surrounding parts of the body (other tissues).
- **Distant (late stage)** – In this final 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.
- **Unstaged** – This cancer was reported to the MCR without enough information to assign a stage.

The four racial/ethnic groups were analyzed by stage at diagnosis for the following cancers: female breast, prostate, colorectal, lung, uterine, stomach, pancreas, liver, thyroid and kidney. The percentage of cancers that were missing stage data did not vary significantly by race/ethnicity (1-5% depending on cancer), and were omitted from the analyses. Since white NH was the largest group, staging of the other race/ethnicity groups was compared to it. Figures 7 and 8 show the differences in stage at diagnosis for prostate and breast cancer, the number one cancer diagnosed for males and females, respectively. Staging data for other cancers are shown in Appendix C and summarized below.

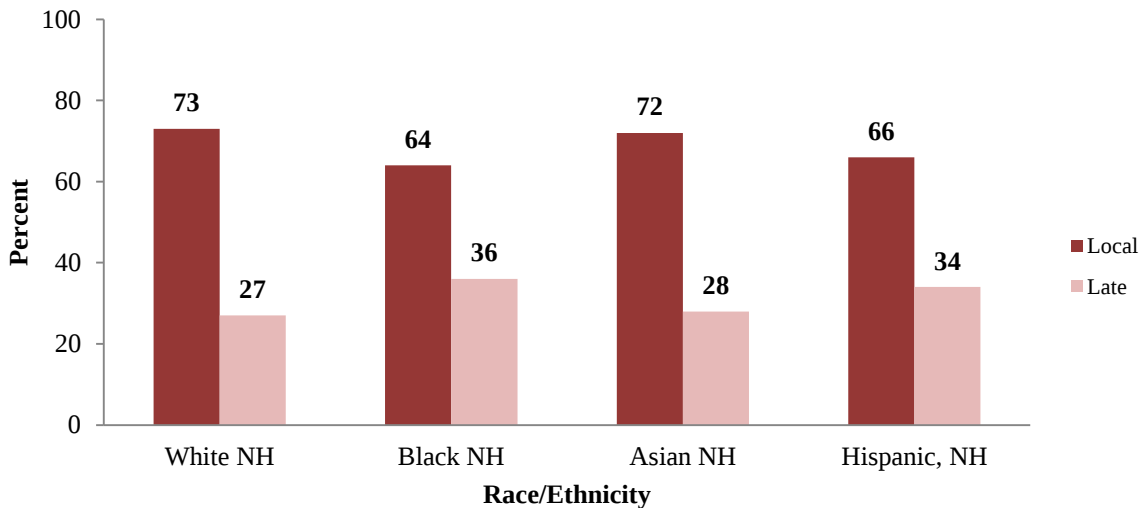
- **Prostate Cancer:** There were no significant differences in stage at diagnosis for prostate between white NH males and the other three racial/ethnic groups.
- **Breast Cancer:** Black NH and Hispanic females were significantly more likely to be diagnosed at a later stage of breast compared to white NH females.

Figure 7: Stage at Diagnosis by Race/Ethnicity in Massachusetts Males, Prostate Cancer, 2011-2015



Data source: Massachusetts Cancer Registry

Figure 8: Stage at Diagnosis by Race/Ethnicity in Massachusetts Females, Breast Cancer, 2011-2015



Data source: Massachusetts Cancer Registry

There were significant differences in stage at diagnosis by race for the following cancers (see Appendix C for more detail):

- **Kidney Cancer:** Black NH males and females (79.3%, 79.5%) and Hispanic males and females (75.8%, 82.1%) were significantly more likely to be diagnosed at the local stage of kidney cancer compared to white, NH males and females (68.3%, 70.5%).
- **Liver Cancer:** Asian NH females were significantly more likely to be diagnosed at a local stage of liver cancer compared to white NH females (41.0% v. 62.9%).
- **Lung Cancer:** Asian NH females were significantly more likely to be diagnosed at a distant stage of lung cancer compared to white NH females (85.5% v. 71.3%).
- **Pancreatic Cancer:** Black NH females were significantly more likely to be diagnosed at the local stage of pancreatic cancer compared to white NH females (9.7%, 20.3%).
- **Thyroid Cancer:** Black NH males and females (83.3%, 85.3%) were significantly more likely to be diagnosed at the local stage of thyroid cancer compared to white NH males and females (66.4%, 76.3%).
- **Uterine Cancer:** Black NH females were significantly more likely to be diagnosed at a late stage of cancer compared to white NH females (41.0% v. 27.1%).

CANCER INCIDENCE BY SELECTED ETHNIC GROUPS

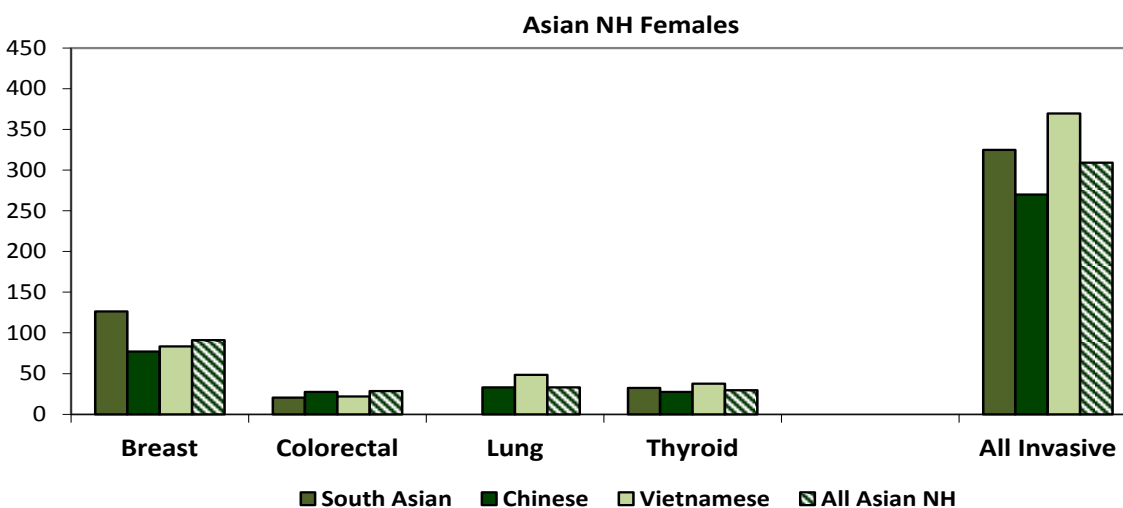
Adjustment for Not Otherwise Specified Cases (NOS):

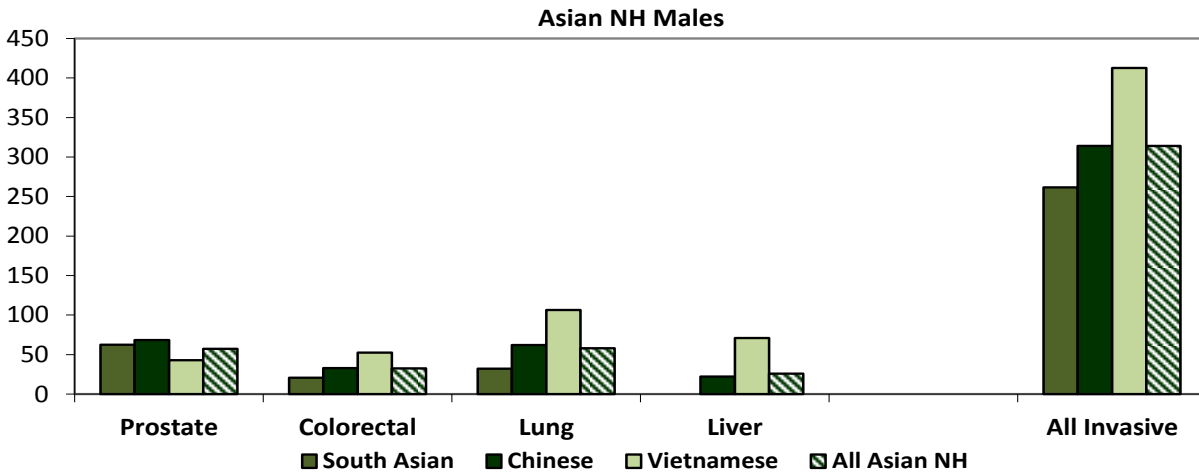
Although the MCR collects data on multiple Asian ethnicities (Chinese, Japanese, Filipino, Korean, Indian, Pakistani, Laotian, Hmong, Cambodian, Thai, and Vietnamese among others) and multiple Hispanic ethnicities (Puerto Rican, Mexican, Cuban, Dominican, and Latin American), approximately 9% of Asian and 15% of Hispanic cases were reported without a specific ethnicity and classified as NOS, or specific ethnicity not otherwise specified. For this report, we wanted to analyze incidence rates among the Asian ethnicities (South Asian (Indian and Pakistani), Chinese, and Vietnamese) and the Hispanic ethnicities (Puerto Rican and Dominican) with the highest frequency of cases.

Since having such a large number of NOS cases would lead to an underestimate of incidence rates for these ethnic groups, we recoded the NOS cases for this report. It should be noted that while some people may identify as Asian or Hispanic without a specific ethnicity, we assumed for this analysis that specific ethnicity data was not in the medical record. We recoded the NOS to a specific Asian or Hispanic ethnicity code based on the distribution of cancer types among cases with a specified ethnicity. For example, among Hispanic males with a specified ethnicity, 36% of prostate cases were Puerto Rican, 34% were Dominican, and 30% were other. Prostate cancer cases among Hispanic NOS males were then recoded as 36% Puerto Rican, 34% Dominican, and 30% other. This same procedure was done for Asian cases. The estimated incidence rates compared to the actual rates for all Asians and Hispanics are presented in the following two sections. Both Figures 9 and 10 reflect the diversity of cancer incidence within the Asian NH and Hispanic categories. Please refer to appendix E for the data associated with these graphs.

Asian NH Ethnicities:

Figure 9. Top Cancer Incidence Rates by Asian Origin in Massachusetts, 2011-2015





Data Source: Massachusetts Cancer Registry; no bar indicates fewer than 20 cases.

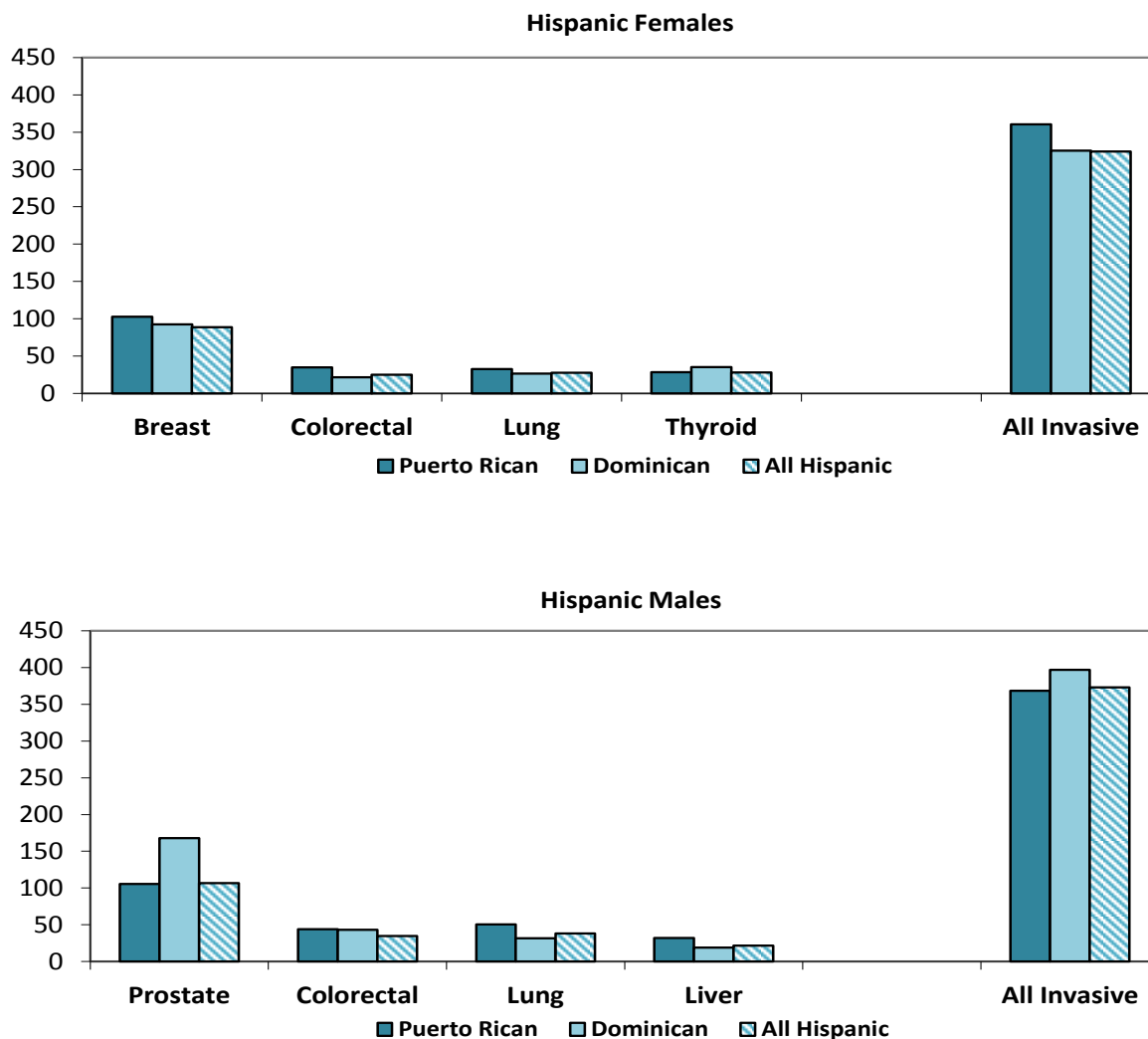
South Asians and Vietnamese females had significantly elevated rates of all invasive cancers compared to Chinese females. South Asian females had a significantly elevated breast cancer rate.

- Vietnamese males had a significantly elevated rate of all invasive cancers compared to Chinese and South Asian males.
- Vietnamese males had a significantly elevated liver cancer rate compared to Chinese males and a significantly elevated rate of colorectal cancer compared to South Asian males.
- South Asian and Chinese males had a significantly higher rate of prostate cancer compared to Vietnamese males.
- Compared to South Asian males, Chinese and Vietnamese males had significantly elevated rates of lung cancer. Vietnamese males in turn had a significantly elevated rate compared to Chinese males.

Hispanic Ethnicities:

Among Dominicans, 80% were reported as having been born in the Dominican Republic, though 16% had missing data for birth country. Among Puerto Ricans, 61% were reported as having been born in Puerto Rico, with 29% missing place of birth.

Figure 10. Estimated Cancer Incidence Rates of the Most Common Cancers among Puerto Ricans and Dominicans, Massachusetts, 2011-2015



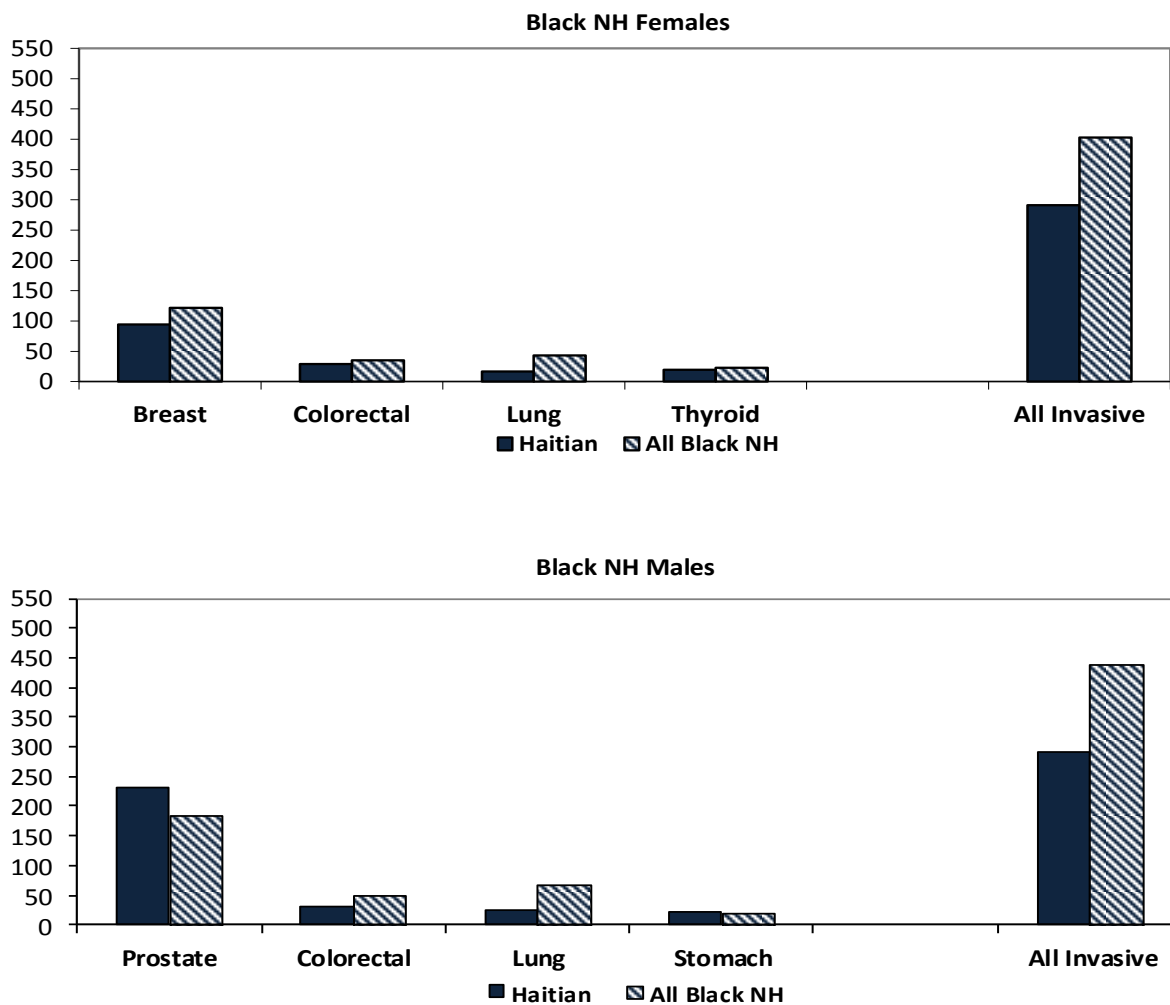
Data source: Massachusetts Cancer Registry.

- Among females, Puerto Ricans had significantly higher rates of colorectal cancer rates compared to Dominicans.
- Among males, Dominicans had significantly higher rates of prostate cancer while Puerto Rican males had significantly higher rates of lung and liver cancer. It should be noted that 38% of Dominican males identified as black Hispanic and prostate cancer rates are higher among black non-Hispanics.

Black non-Hispanic with Haitian Ethnicity:

While data are collected on black NH cancer cases in people born in Africa, the numbers were not large enough for meaningful analyses, but the numbers were large enough for Haitians. Haitian ethnicity was based on birth country and was likely underreported due to birth country not always being available in the medical record. Rates were calculated using the ACS estimates for the Haitian population in Massachusetts. The top four cancer rates were compared for Haitians and black NHs as a whole. Haitians were included in the black NH as a whole category since it was not possible to find denominator data on non-Haitian black NHs. The overall rates for black NH males and females were significantly higher than those of Haitians. Breast and lung cancer were rates were also significantly higher for all black NH females. Among males, only prostate cancer was significantly higher for Haitian males (Figure 11).

Figure 11. Haitian Birth Country Top Four Cancer Rates by Sex Compared to Total Black NH Rates, Massachusetts, 2011-2015



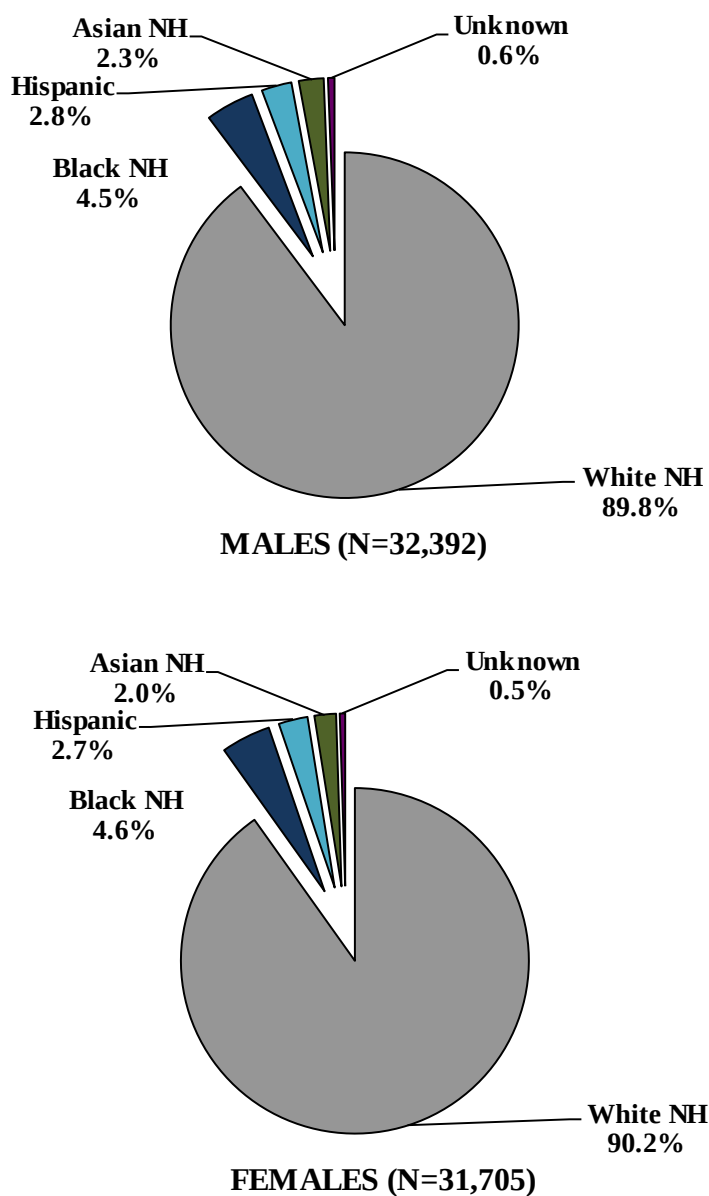
Data source: Massachusetts Cancer Registry. -Black NH includes Haitian cases.

CANCER MORTALITY

Cancer Mortality among Males and Females:

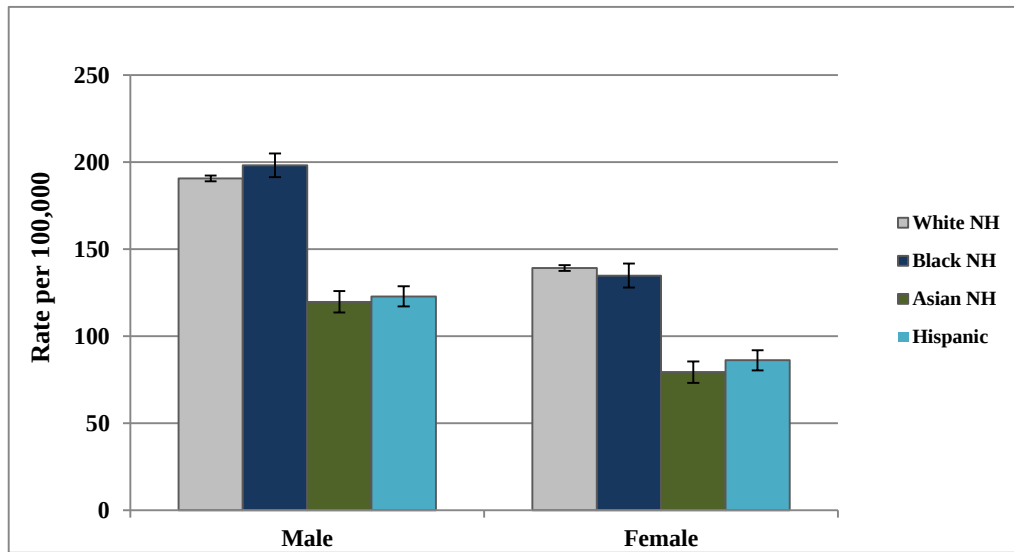
- 32,392 cancers deaths occurred from 2011-2015 among male residents of Massachusetts, the majority among white NH males (90%) (Figure 12).
- 31,705 cancer deaths occurred from 2011-2015 among female residents of Massachusetts, the majority again occurred among white NH females (90%) (Figure 12).

Figure 12. Percentage of all cancer deaths by race/ethnicity and sex, Massachusetts, 2011-2015



Data source: Massachusetts Registry of Vital Records and Statistics

Figure 13. Age-adjusted* mortality rates per 100,000 and 95% confidence limits of all cancer sites combined by race/ethnicity and sex, Massachusetts, 2011-2015



	White NH	Black NH	Asian NH	Hispanic
Male	190.7 (188.5-192.9)	198.2 (188.1-208.3)	119.8 (111.2-128.4)	122.9 (114.9-131.0)
Female	139.2 (137.6-140.9)	134.9 (128.0-141.7)	79.4 (73.2-85.6)	86.2 (80.4-92.0)

* Age-adjusted to the 2000 U.S. Standard Population

Data source: Massachusetts Registry of Vital Records and Statistics

- For each racial/ethnic group, males had significantly higher mortality rates compared to females.
- White and black NH males and females had significantly higher mortality rates compared to the other two racial/ethnic groups.

The top ten leading causes of cancer deaths were compared for racial/ethnic groups. Rates were not calculated when there were fewer than 20 deaths for a specific cancer by race/ethnicity.

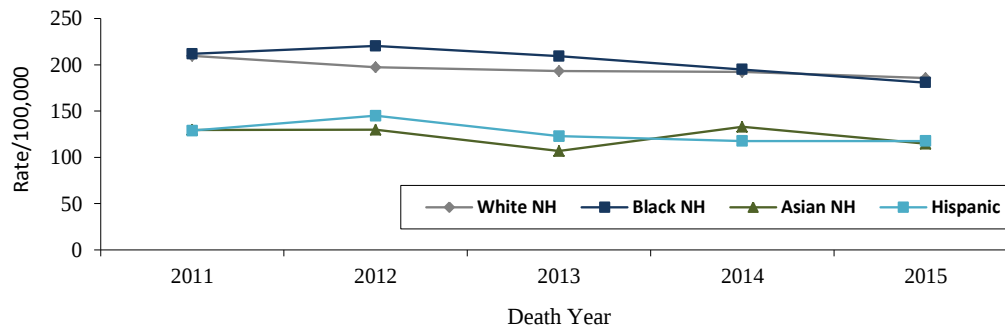
Table 6. Mortality rates per 100,000* for the ten leading cancers among Massachusetts males by race/ethnicity, 2011-2015

RANK	WHITE NH		BLACK NH		ASIAN NH		HISPANIC	
	Cancer	Rate (95% CL)	Cancer	Rate (95% CL)	Cancer	Rate (95% CL)	Cancer	Rate (95% CL)
1	Bronchus & Lung	50.0 (48.9-51.1)	Bronchus & Lung	46.6 (41.7-51.5)	Bronchus & Lung	35.4 (30.6-40.2)	Bronchus & Lung	23.3 (19.8-26.9)
2	Prostate	17.9 (17.2-18.6)	Prostate	36.4 (31.5-41.2)	Liver	19.6 (16.2-22.9)	Prostate	15.5 (12.3-18.8)
3	Colon/Rectum	15.0 (14.4-15.6)	Colon/Rectum	16.0 (13.2-18.8)	Colon/Rectum	9.2 (6.8-11.5)	Liver	12.9 (10.5-15.3)
4	Pancreas	12.7 (12.2-13.3)	Liver	14.5 (12.1-17.0)	Prostate	7.2 (4.8-9.6)	Colon/Rectum	9.9 (7.5-12.4)
5	Esophagus	9.1 (8.6-9.6)	Pancreas	12.7 (10.1-15.3)	Pancreas	5.7 (3.9-7.6)	Stomach	8.1 (6.1-10.1)
6	Leukemia	8.8 (8.3-9.2)	Multiple Myeloma	7.4 (5.4-9.4)	Stomach	5.6 (3.9-7.4)	Pancreas	7.4 (5.5-9.3)
7	Liver	8.7 (8.3-9.2)	Stomach	7.4 (5.4-9.4)	Esophagus	4.3 (2.5-6.1)	Leukemia	5.6 (4.0-7.2)
8	Bladder	8.4 (7.9-8.9)	Leukemia	6.4 (4.5-8.2)	Leukemia	4.2 (2.6-5.8)	Non-Hodgkin Lymphoma	4.5 (3.0-6.0)
9	Non-Hodgkin Lymphoma	6.9 (6.5-7.3)	Esophagus	5.8 (4.1-7.5)	Non-Hodgkin Lymphoma	3.0 (1.7-4.4)	Multiple Myeloma	4.3 (2.6-5.9)
10	Brain & CNS	5.7 (5.3-6.1)	Kidney	4.9 (3.3-6.5)	Oral/Pharynx	3.0 (1.7-4.2)	Oral/Pharynx	3.7 (2.3-5.1)

* Age-adjusted to the 2000 U.S. Standard Population. Data source: Massachusetts Registry of Vital Records and Statistics

- Black NH and white NH males had significantly elevated overall cancer mortality rates and lung cancer rates compared to Asian NH and Hispanic males.
- White NH and black NH males also had a significantly elevated colon/rectum cancer mortality rate compared with Asian NH and Hispanic males.
- Black NH males had a significantly elevated mortality rate for prostate cancer compared to white NH, Asian NH, and Hispanic males.
- The mortality rate for liver cancer was significantly elevated in black NH, Asian NH, and Hispanic males compared to white NH males.
- Black NH, Asian NH, and Hispanic males had a significantly elevated liver cancer mortality rate compared to white NH males.

Figure 14: Cancer Mortality Rates by Race/Ethnicity, Males, 2011-2015*



* Age-adjusted to the 2000 U.S. Standard Population. Data source: Massachusetts Registry of Vital Records and Statistics

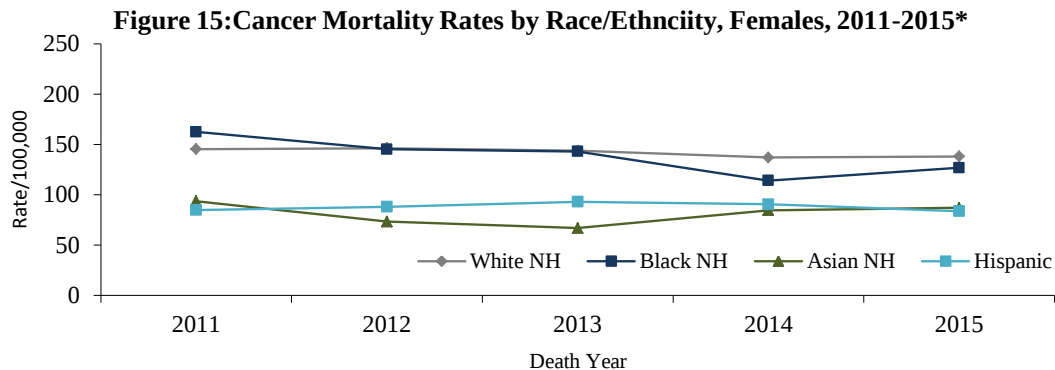
- Trends in mortality from 2011-2015 of all cancers were analyzed for the four groups (Figure 14). The mortality rates for black NH males (APC= -4.3) and white NH males (APC= -2.3) decreased significantly.

Table 7. Mortality rates per 100,000* for the ten leading cancers among Massachusetts females by race/ethnicity, 2011-2015

RANK	WHITE NH		BLACK NH		ASIAN NH		HISPANIC	
	Cancer	Rate (95% CL)	Cancer	Rate (95% CL)	Cancer	Rate (95% CL)	Cancer	Rate (95% CL)
1	Bronchus & Lung	38.5 (37.7-39.4)	Bronchus & Lung	28.0 (24.8-31.1)	Bronchus & Lung	18.3 (15.2-21.3)	Bronchus & Lung	12.0 (9.8-14.3)
2	Breast	18.7 (18.1-19.3)	Breast	20.7 (18.0-23.3)	Colon/Rectum	8.9 (6.7-11.0)	Breast	10.8 (8.9-12.7)
3	Colon/Rectum	10.6 (10.2-11.0)	Colon/Rectum	12.8 (10.7-14.9)	Breast	7.6 (5.8-9.4)	Colon/Rectum	9.1 (7.2-11.0)
4	Pancreas	10.1 (9.6-10.5)	Pancreas	9.5 (7.6-11.3)	Pancreas	7.6 (5.6-9.7)	Pancreas	5.0 (3.7-6.4)
5	Ovary	7.8 (7.4-8.2)	Uterus	8.6 (6.9-10.4)	Liver	5.3 (3.7-6.9)	Non-Hodgkin Lymphoma	4.5 (3.0-5.9)
6	Leukemia	4.8 (4.5-5.1)	Ovary	6.4 (5.0-7.9)	Stomach	4.0 (2.6-5.4)	Liver	4.3 (3.0-5.6)
7	Uterus	4.4 (4.1-4.7)	Multiple Myeloma	6.2 (4.7-7.7)	Ovary	3.1 (1.9-4.2)	Uterus	3.9 (2.7-5.2)
8	Non-Hodgkin Lymphoma	4.3 (4.0-4.5)	Leukemia	5.0 (3.6-6.3)	Non-Hodgkin Lymphoma	3.1 (1.8-4.4)	Leukemia	3.9 (2.7-5.1)
9	Brain & CNS	3.8 (3.5-4.0)	Liver	4.0 (2.8-5.2)	Uterus	2.6 (1.5-3.7)	Stomach	3.4 (2.3-4.4)
10	Liver	3.3 (3.0-3.5)	Stomach	4.0 (2.8-5.2)	Brain & CNS	2.2 (1.2-3.1)	Ovary	2.6 (1.7-3.6)

* Age-adjusted to the 2000 U.S. Standard Population. Data source: Massachusetts Registry of Vital Records and Statistics

- The overall cancer mortality rates for white NH and black NH females were comparable and significantly elevated compared to Asian NH and Hispanic females.
- Breast cancer mortality rates were similarly significantly elevated for black NH and white NH females compared to the other two groups.
- The lung cancer mortality rate was significantly elevated for white NH females compared to the other three racial/ethnic groups.
- The uterine cancer mortality rate was significantly elevated for black NH females compared to the other three racial/ethnic groups.



* Age-adjusted to the 2000 U.S. Standard Population. Data source: Massachusetts Registry of Vital Records and Statistics

- Trends in mortality from 2011-2015 of all cancers were analyzed for the four groups (Figure 15). The mortality rates for white NH females (APC=-1.7) decreased significantly. While the mortality rate for black NH females also decreased (APC=-7.1), it was not significant.

NATIONAL COMPARISON

Massachusetts incidence rates were compared to national rates reported by the North American Association of Central Cancer Registries (NAACCR). (Please see Appendix D for the 2011-2015 national rates or refer to the fast stats on their website <https://faststats.naaccr.org/>). Only cancers with significant differences compared to the national data are listed in Table 8.

Table 8. Massachusetts Cancers with Significantly Higher or Lower Incidence Rates Compared to US Rates, 2011-2015		
	Significantly Higher	Significantly Lower
Males:		
White NH	lung, liver, bladder	colorectal, leukemia
Black NH	-	colorectal
Asian NH	lung	non Hodgkin lymphoma
Hispanic	lung, liver	colorectal, leukemia
Females:		
White NH	breast, thyroid, uterine, bladder	cervical, leukemia
Black NH	thyroid	leukemia
Asian NH	thyroid	uterine
Hispanic	thyroid	-

CONCLUSIONS

As shown in this report, cancer affects all races and ethnicities. In some cases, it is evenly distributed, but in others there are significant differences. Within the standard race/ethnic groups, there is a diversity of cancer rates. For example, the female breast cancer rate for South Asians was significantly higher compared to Chinese and Vietnamese females while the rate for lung cancer was significantly lower for South Asian males compared to Chinese and Vietnamese males. Colorectal, prostate, lung, and liver cancer rates differed significantly between Puerto Ricans and Dominicans. Notably, prostate cancer rates were significantly higher among Dominican males likely due to the higher percentage of Dominicans identifying as black Hispanic. Variations also existed for certain cancers among Haitian males and females, notably a significantly higher rate of prostate cancer among Haitian males. Although the methodology for recoding Hispanic, NOS described earlier in the report yielded estimated numbers for Puerto Ricans and Dominicans, it is not a replacement for having actual numbers. Still, the importance of using the available data on Dominicans and Puerto Ricans to make these estimations and highlight the differences in incidence rates within the Hispanic category outweighed the limitations placed on us by the current data quality.

Bringing together data on age, stage at diagnosis, incidence rates, and mortality rates resulted in many significant associations in this report. For some cancers, such as myeloma, there is little that can be done in terms of prevention and more in the realm of treatment. Other cancers, such as breast cancer and prostate cancer, while difficult to prevent, can be screened for earlier stage at diagnosis with the intent of earlier treatment and lowered mortality. Black males and Asian NH, black NH, and Hispanic females had significantly lower median ages at diagnosis for prostate and breast cancer, respectively, a fact that is documented by national statistics^{2,3,4} and is important for earlier screening. Finally, cancers such as lung cancer and melanoma can potentially be prevented by smoking cessation and use of sun screen targeting groups with high rates of these cancers.

The disparities in cancer incidence presented in this report are likely related to access to health care, specific health behaviors, environmental exposures, and genetic risk factors while the disparities in mortality presented in this report are related to access to health care and genetic risk factors.² Many of the disparities mentioned in this report echo national disparities as well.³ While cancer treatments have become more effective, it remains troubling that disparities in mortality rates for specific cancers continue to exist.

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DATA SOURCES

Massachusetts Cancer Registry (MCR): All Massachusetts incidence data are provided by the Massachusetts Cancer Registry, which is part of the Massachusetts Department of Public Health (MDPH). The MCR is a population-based cancer registry that began collecting reports of newly-diagnosed cancer cases in 1982. The Massachusetts cancer cases presented in this report are primary cases of invasive cancer—cancers that have spread beyond their area of origin to invade surrounding tissue—that were diagnosed among Massachusetts residents. The 2011-2015 data for this report include cases reported to the MCR as of May 15, 2018. Some of the numbers in this report will differ slightly from the MCR report ‘Cancer Incidence and Mortality in Massachusetts 2011 – 2015’ since this was based on data reported to the MCR earlier in 2018.

Massachusetts Registry of Vital Records and Statistics (MRVRS): Massachusetts mortality data for 2011-2015 were obtained from the MDPH’s Registry of Vital Records and Statistics, which has legal responsibility for collecting reports of deaths of Massachusetts residents.

North American Association of Central Cancer Registries (NAACCR): Established in 1987, NAACCR, Inc. is a collaborative umbrella organization for cancer registries, governmental agencies, professional associations, and private groups in North America interested in enhancing the quality and use of cancer registry data. All central cancer registries in the United States and Canada are members. US data from the NAACCR database (2011-2015) were used in this report for comparison purposes.

TECHNICAL NOTES

Age-specific rate – This is a rate among people of a particular age range in a given time period. Age-specific rates were calculated by dividing the number of people in an age group who were newly diagnosed with cancer (incidence) or died of cancer (mortality) by the number of people in that same age group overall.

Age-adjusted rate – This is a rate that takes into account the age structure of an area, allowing for the comparison of areas or population groups with different age distributions. Age-adjusted rates were calculated by weighting the age-specific rates for a given year by the age distribution of the 2000 U.S. standard population. The weighted age-specific rates were then added to produce the

adjusted rate for all ages combined. Rates should only be compared if they have been adjusted to the same standard population.

Annual Percent Change (APC) – Trend data were analyzed using the Joinpoint Regression Program from the National Cancer Institute. This program identifies joined line segments that are connected by points where the trend changes. The APC describes the average change per year over the line segment. A positive APC corresponds to an increasing trend, and a negative APC corresponds to a decreasing trend. Joinpoint analysis determines the APC significance.

Incidence – This is defined as the number of people who are newly diagnosed with a disease, condition, or illness during a particular time period. The incidence data presented here were coded using the International Classification of Disease for Oncology (ICD-O) coding system, 3rd edition.

Invasive cancer – This is a cancer that has spread beyond the layer of tissue in which it developed and is growing into surrounding, healthy tissues. In this report, only invasive cancers are presented, with the exception of urinary bladder cancer, for which both *in situ* and invasive cancers are presented and include in all invasive cancer counts. *In situ* and localized stages can be difficult to distinguish for urinary bladder cancer and tend to be classified at the discretion of the pathologist.

Mortality – This is the number of people who die from a disease, condition, or illness during a particular time period. The mortality data presented here were obtained from the Massachusetts Registry of Vital Records and Statistics and are based on ICD-10 codes.

Median age at diagnosis – This the age at which half of the cancer cases were younger than this age and half of the cancer cases were older than this age at diagnosis.

Population estimates – The population estimates for 2011-2015 used in this report were produced by the National Center for Health Statistics (NCHS) in collaboration with the U.S. Census Bureau's Population Estimation Program. The NCHS takes the Census Bureau population estimates file and reallocates the multiple race categories required by the 1997 Office of Management and Budget (OMB) specifications back into the four race categories specified in the 1977 OMB specifications so that the estimates will be compatible with previous years' populations.³ The estimates are divided into mutually exclusive racial/ethnic categories which the MCR uses. The population estimates for the various ethnic groups in this report (Chinese, Vietnamese, South Asian, and Haitians) were from the US Census 2011-2015 American Community Survey (ACS) estimates. The populations for these ethnic groups can be accessed through the ACS Advanced Search at <https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t>

Race/ethnicity – Incident and mortality cases are only included in one race/ethnicity category. As part of the NAACCR standards for cancer incidence, information on race, Hispanic ethnicity, and country of birth is required on the cancer reporting form.⁴ Since 2000, there have been five race fields to account for those people who identify as multi-racial. Though the reporting of race in all Massachusetts cancer incidence data, based on the medical record, was complete for 98.5% of the cases diagnosed between 2011 and 2015, certain cancers such as invasive melanoma and prostate cancer had higher percentage of unknown race (92.1% and 95.9%, respectively) since a higher percentage of those cancers are reported by pathology labs for outpatient physicians and there is

usually no race data on the lab. Errors in the medical record may lead to incorrect classification of race/ethnicity. Since cases in some racial/ethnic categories may be under-reported, counts and rates may under-represent the true incidence of cancer in these populations. To help correctly classify Hispanic ethnicity, the MCR used the NAACCR Hispanic Identification Algorithm (NHIA) which is applied to cases with an unknown Spanish/Hispanic origin and cases that had been classified as Hispanic based on a Spanish surname only. NHIA uses last name, maiden name, birthplace, race, and sex to determine the ethnicity of these cases. Race/ethnicity data for cancer deaths are based on information from death certificates as reported by next-of-kin and funeral directors. The completeness of the race/ethnicity data for 2015 deaths was 99.8%, over a percentage point more complete than the cancer incidence data.

Significance Testing – A confidence interval (CI) [also called Confidence limits (CLs)] is a range of values determined by the degree of variability of the data, within which the true value should lie. The 95% confidence intervals presented in this report mean 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 numbers of cases yield less precise estimates that have wider confidence intervals. In this report, confidence intervals were used as a conservative statistical test to estimate the difference between the age-adjusted incidence or mortality rates with the probability of error of 5% or less (a p-value less than 0.05). When comparing two rates in this report, the difference was not statistically significant if the confidence intervals overlapped. When comparing percentages between groups, the chi square test for significance was used (p value less than 0.05). For median age comparisons, the Mood's median two sample test was calculated in SAS® using proc npar1way. In this report, all statistically significant associations are described as significant.

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APPENDIX A:

Invasive Cancer Counts by Primary Site and Race/Ethnic Group, Males, Massachusetts, 2011-2015

Primary Site	White NH	Black NH	Asian NH	Hispanic	Total*
TOTAL	76,297	4535	2226	3305	88,256
Anal	251	21	<5	14	293
Bladder (<i>in situ</i> and invasive)	6419	135	89	137	6871
Bone	144	10	8	19	181
Brain	1192	46	32	65	1346
Breast	209	12	11	10	242
Bronchus & Lung	10,800	503	365	275	11,998
Colon / Rectum	6287	404	233	287	7290
Esophagus	1618	58	35	25	1746
Gall Bladder	108	8	10	7	134
Hodgkin Lymphoma	445	32	17	48	547
Kidney/Renal Pelvis	3514	197	80	187	4031
Larynx	895	42	6	56	1013
Leukemia	2440	111	72	104	2792
Liver & Intrahepatic Bile Ducts	1825	197	192	196	2436
Melanoma	4107	8	10	16	4467
Myeloma	1187	119	33	70	1428
Non-Hodgkin Lymphoma	3545	167	95	191	4045
Oral Cavity & Pharynx	2932	129	111	128	3328
Other Biliary	367	21	29	19	438
Other Invasive Cancer	3302	151	85	135	3,737
Pancreas	2276	131	54	77	2556
Prostate	16,743	1697	392	910	20,602
Small Intestine	377	42	12	19	461
Soft Tissue	517	36	25	32	618
Stomach	1265	136	84	112	1622
Testis	931	17	19	60	1045
Thyroid	1567	60	104	74	1851
Unknown Primary Site	1034	309	25	34	1402

* includes all races, known and unknown. Data source: Massachusetts Cancer Registry

APPENDIX B:

Invasive Cancer Counts by Primary Site and Race/Ethnic Group, Females, Massachusetts, 2011-2015

Primary Site	White NH	Black NH	Asian NH	Hispanic	Total*
TOTAL	84,059	4,565	2,777	3,873	96,525
Anal	410	16	<5	30	465
Bladder (<i>in situ</i> and invasive)	2338	76	18	55	2525
Bone	130	12	7	14	163
Brain	1003	49	43	64	1169
Breast	25,183	1393	874	1104	28,731
Bronchus & Lung	12,180	475	257	266	13,237
Cervix	659	93	72	117	948
Colon / Rectum	6315	398	237	271	7266
Esophagus	446	22	9	14	494
Gall Bladder	265	37	8	25	338
Hodgkin Lymphoma	385	22	12	51	472
Kidney/Renal Pelvis	1976	130	41	111	2283
Larynx	284	17	<5	8	316
Leukemia	1762	81	66	104	2063
Liver & Intrahepatic Bile Ducts	647	59	70	60	847
Melanoma	3235	12	6	34	3594
Myeloma	914	150	19	86	1182
Non-Hodgkin Lymphoma	3046	153	89	191	3535
Oral Cavity & Pharynx	1353	59	59	63	1553
Other Biliary	314	21	22	21	379
Other Invasive Cancer	2905	171	100	127	3375
Ovary	2160	107	88	89	2477
Pancreas	2323	141	68	81	2636
Small Intestine	351	37	5	16	412
Soft Tissue	416	36	24	31	513
Stomach	765	94	73	81	1025
Thyroid	4272	275	316	422	5441
Unknown Primary Site	1225	60	25	34	1348
Uterus	5674	309	145	254	6462

* includes all races, known and unknown. Data source: Massachusetts Cancer Registry

APPENDIX C: Comparison of Stage at Diagnosis by Race/Ethnicity, 2011-2015				
Cancer	White NH	Black NH	Asian NH	Hispanic
Male:				
Colorectal: Local	43.4%	39.8%	48.5%	41.2%
Regional/Distant	56.6%	60.2%	51.5%	58.8%
Lung: Local	23.5%	20.3%	27.1%	19.0%
Regional/Distant	76.5%	79.7%	72.8%	81.0%
Stomach: Local	25.9%	26.8%	25.0%	24.3%
Regional/Distant	74.1%	73.2%	75.0%	75.7%
Pancreas: Local	7.4%	6.7%	14.0%	10.8%
Regional/Distant	92.6%	93.3%	86.0%	89.2%
Liver: Local	48.7%	51.1%	53.8%	52.3%
Regional/Distant	51.3%	48.9%	46.2%	47.7%
Kidney: Local	68.3%	79.3%	63.6%	75.8%
Regional/Distant	31.7%	20.7%	36.4%	24.2%
Thyroid: Local	66.4%	83.3%	59.8%	62.0%
Regional/Distant	33.6%	16.7%	40.2%	38.0%
Female:				
Colorectal: Local	42.9%	43.1%	49.4%	40.7%
Regional/Distant	57.1%	56.9%	50.6%	59.3%
Lung: Local	28.7%	29.4%	14.5%	31.1%
Regional/Distant	71.3%	70.6%	85.5%	68.9%
Stomach: Local	31.1%	37.7%	20.9%	29.3%
Regional/Distant	68.9%	62.3%	79.1%	70.7%
Pancreas: Local	9.7%	20.3%	8.8%	14.1%
Regional/Distant	90.3%	79.7%	91.2%	85.9%
Liver: Local	41.0%	50.9%	62.9%	47.4%
Regional/Distant	59.0%	49.1%	37.1%	52.6%
Kidney: Local	70.5%	79.5%	N/A	82.1%
Regional/Distant	29.5%	20.5%	N/A	17.9%
Uterine: Local	72.9%	59.0%	67.3%	72.7%
Regional/Distant	27.1%	41.0%	32.7%	27.3%
Thyroid Local	76.3%	85.3%	68.7%	68.1%
Regional/Distant	23.7%	14.7%	31.3%	31.9%

Data source: Massachusetts Cancer Registry

(Note: Data for breast and prostate cancers are presented in Figures 7 and 8, respectively.)

**APPENDIX D: NAACCR National Cancer Incidence Rates, Males & Females,
2011-2015**

MALES				
Primary Site	White NH	Black NH	Asian NH	Hispanic
All Invasive Cancers	505.4 (504.8-505.9)	549.0 (547.3-550.8)	298.9 (297.0-300.7)	381.1 (379.7-382.5)
Prostate	101.9 (101.7-102.2)	179.2 (178.2-180.1)	55.9 (55.1-56.7)	99.1 (98.3-99.8)
Colorectal	44.6 (44.4-44.8)	55.1 (54.6-55.7)	36.1 (35.5-36.7)	43.0 (42.5-43.5)
Lung	74.1 (73.8-74.3)	85.4 (84.7-86.1)	44.5 (43.8-45.3)	36.9 (36.5-37.4)
Thyroid	8.1 (8.1-8.2)	3.9 (3.8-4.1)	7.2 (7.0-7.5)	5.9 (5.7-6.0)
Liver	10.3 (10.2-10.3)	17.7 (17.4-18.0)	19.9 (19.5-20.4)	18.9 (18.6-19.2)
Urinary Bladder	39.5 (39.3-39.7)	19.9 (19.5-20.3)	14.8 (14.4-15.3)	18.7 (18.4-19.0)
Melanoma	34.0 (33.9-34.2)	1.1 (1.1-1.2)	1.5 (1.4-1.7)	4.8 (4.6-4.9)
Multiple Myeloma	7.5 (7.4-7.5)	15.9 (15.6-16.2)	4.8 (4.6-5.1)	7.7 (7.4-7.9)
Non Hodgkin Lymphoma	23.9 (23.8-24.1)	17.0 (16.7-17.3)	15.9 (15.4-16.3)	19.1 (18.8-19.4)
Leukemia	18.6 (18.5-18.7)	13.7 (13.4-14.0)	9.7 (9.4-10.0)	12.9 (12.7-13.2)
FEMALES				
Primary Site	White NH	Black NH	Asian NH	Hispanic
All Invasive Cancers	438.3 (437.8-438.8)	407.0 (405.7-408.2)	290.3(288.7-291.8)	327.6(326.4-328.7)
Breast	130.1 (129.8-130.4)	126.4(125.7-127.1)	92.7 (91.8-93.5)	92.9 (92.4-93.5)
Colorectal	34.1 (34.0-34.3)	40.7 (40.3-41.1)	26.4 (26.0-26.9)	29.6 (29.3-30.0)
Lung	57.2 (57.0-57.4)	49.2 (48.7-49.6)	27.8 (27.3-28.3)	22.8 (22.5-23.1)
Thyroid	22.9 (22.8-23.0)	14.1 (13.8-14.3)	21.8 (21.4-22.2)	22.4 (22.1-22.7)
Liver	3.6 (3.5-3.6)	5.3 (5.1-5.4)	7.5 (7.2-7.7)	7.3 (7.2-7.5)
Urinary Bladder	9.7 (9.6-9.8)	6.6 (6.4-6.8)	3.7 (3.5-3.9)	4.9 (4.7-5.0)
Melanoma	22.2 (22.1-22.3)	1.0 (0.9-1.0)	1.3 (1.2-1.4)	4.1 (4.0-4.3)
Multiple Myeloma	4.5 (4.5-4.6)	11.7(11.5-12.0)	2.9 (2.8-3.1)	5.4 (5.3-5.6)
Non Hodgkin Lymphoma	16.3 (16.2-16.4)	12.1 (11.8-12.3)	10.8(10.5-11.1)	14.6 (14.3-14.8)
Leukemia	11.2 (11.1-11.3)	8.9 (8.7-9.1)	6.3 (6.1-6.5)	8.9 (8.8-9.1)
Cervical	7.0 (7.0-7.1)	9.2 (9.0-9.4)	6.1 (5.8-6.3)	9.9 (9.7-10.0)
Uterine	26.9 (26.8-27.1)	26.2 (25.9-26.5)	18.7 (18.3-19.1)	23.1 (22.8-23.4)

Data Source: NAACCR Fast Stats <https://faststats.naaccr.org/>

APPENDIX E: CANCER INCIDENCE BY SELECTED ETHNIC GROUPS

FEMALES					
Cancer	South Asian (n=484)	Chinese (n=1159)	Vietnamese (n=324)	All Asian (n=2226)	
All Invasive	324.9 (296.0-353.9)*	270.1 (254.5-285.6)	369.7 (329.5-410.0)*	309.1 (297.6-320.6)	
Breast	126.5 (108.7,144.4)*	77.2 (69.1-85.3)	83.3 (67.1-99.6)	91.1 (85.1-97.2)	
Colorectal	20.4 (12.7-28.1)	27.6 (22.5-32.7)	22.0 (13.4-30.7)	28.7 (25.0-32.3)	
Lung	NA	33.2 (27.5-38.8)	48.5 (29.8-67.1)	33.1 (29.1-37.2)	
Thyroid	32.4 (24.4-40.5)	27.4 (22.6-32.2)	37.7 (27.2-48.1)	29.7 (26.4-33.0)	
MALES					
Cancer	South Asian (n=373)	Chinese (n=1000)	Vietnamese (n=348)	All Asian (n=2777)	
All Invasive	261.6 (235.0-288.1)	314.0 (294.6-333.5)*	412.5 (369.2-455.8)*	313.9 (300.8-326.9)	
Prostate	62.6 (48.5-76.7)*	68.5 (59.4-77.6)*	42.9 (29.6-56.3)	57.3 (51.8-63.2)	
Colorectal	20.6 (13.0-28.3)	32.8 (26.6-39.0)	52.4 (36.5-68.2)*	32.4 (28.2-36.6)	
Lung	32.3 (22.2-42.4)	62.3 (53.5-71.2)*	106.4 (83.5-129.3)*	57.9 (51.9-63.8)	
Liver	NA	22.3 (17.3-27.3)	70.9 (53.2-88.5)*	26.1 (22.4-29.8)	
FEMALES					
Cancer	Puerto Rican (n=1,767)	Dominican (n=860)	All Hispanic (n=3873)		
All Invasive	360.6 (343.8-377.4)	325.2 (303.5-374.0)	324.1 (313.9-334.3)		
Breast	102.6 (93.8-111.3)	92.5 (81.2-103.8)	88.9 (836-94.1)		
Colorectal	34.7 (29.2-40.2)*	21.7 (16.0-27.3)	25.1 (22.1-28.1)		
Lung	32.6 (27.0-38.3)	26.6 (20.1-33.2)	27.6 (24.3-31.0)		
Thyroid	28.5 (24.4-32.7)	35.3 (28.7-41.9)	28.0 (25.3-30.6)		
MALES					
Cancer	Puerto Rican (n=1,383)	Dominican (n=673)	All Hispanic (n=3305)		
All Invasive	368.4 (349.0-387.9)	396.8 (366.8-426.8)	372.9 (360.2-385.6)		
Prostate	105.3 (94.7-115.9)	167.8 (149.0-186.6)*	106.7 (99.7-113.6)		
Colorectal	43.8 (37.0-50.7)	43.1 (32.5-53.7)	34.7 (30.7-38.7)		
Lung	50.5 (42.7-58.3)*	31.5 (21.8-41.1)	38.1 (33.5-42.5)		
Liver	31.8 (26.4-37.1)*	18.8 (11.6-26.1)	21.3 (18.4-24.3)		
FEMALES					
Cancer	Haitian (n=569)	Total Black NH (n=4,565)			
All Invasive	290.9 (267.0-314.8)	402.9 (391.2-414.6)*			
Breast	94.1 (80.6-107.7)	121.7 (115.3-128.1)*			
Colorectal	29.2 (21.5-36.8)	35.3 (31.8-38.8)			
Lung	16.9 (11.1-22.8)	43.3 (39.4-47.2)*			
Thyroid	19.7 (13.7-25.8)	22.8 (20.1-25.6)			
MALES					
Cancer	Haitian (n=490)	Total Black NH (n=4,535)			
All Invasive	437.4 (398.7-476.1)	514.3 (499.3-529.4)*			
Prostate	231.8 (203.7-259.9)*	182.8 (174.1-191.5)			
Colorectal	30.0 (20.3-39.7)	46.9 (42.3-51.5)*			
Lung	23.6 (13.9-33.3)	64.8 (59.1-70.4)*			
Stomach	21.0 (12.6-29.5)	17.4 (14.5-20.3)			

*-significantly elevated compared to other groups.

APPENDIX F:

POPULATION ESTIMATES BY AGE, RACE/ETHNICITY AND SEX

Massachusetts, 2011-2015

Age Group	White non-Hispanic			Black non-Hispanic			Asian non-Hispanic			Hispanic		
	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total
0-4	599582	572123	1171705	89827	84540	174367	69502	67869	137371	174587	166763	341350
5-9	647533	618894	1266427	89285	84545	173830	68095	67552	135647	160176	154452	314628
10-14	712339	679236	1391575	88149	84700	172849	62596	63726	126322	151779	146428	298207
15-19	818320	800816	1619136	100453	98611	199064	70209	76924	147133	164804	157439	322243
20-24	832986	834697	1667683	109635	107192	216827	90551	97938	188489	175779	166330	342109
25-29	820012	825186	1645198	93392	94324	187716	99234	111954	211188	160076	152239	312315
30-34	749333	759781	1509114	82815	88511	171326	94803	106739	201542	150186	147639	297825
35-39	694231	713345	1407576	76803	83213	160016	86589	95411	182000	128862	133550	262412
40-44	808466	842405	1650871	76304	83508	159812	81411	87656	169067	112245	121365	233610
45-49	938105	975726	1913831	78866	84123	162989	67390	72734	140124	100361	110546	210907
50-54	1019746	1064497	2084243	75759	81341	157100	56875	61950	118825	82382	93083	175465
55-59	956796	1014650	1971446	62403	69649	132052	46583	52775	99358	61788	72103	133891
60-64	823817	896351	1720168	46705	54976	101681	37077	42678	79755	43954	53257	97211
65-69	647698	726488	1374186	31740	40768	72508	25370	29383	54753	29601	38432	68033
70-74	438022	523693	961715	20329	29264	49593	18884	21646	40530	18782	25836	44618
75-79	313303	410083	723386	13806	22188	35994	13580	15533	29113	11642	17619	29261
80-84	240271	364116	604387	8543	15842	24385	8095	10333	18428	6808	11451	18259
85+	229216	489437	718653	7043	16512	23555	5936	9300	15236	5749	10680	16429

Source: US Census Bureau population estimates