

Time Trends

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Background

Changes that occurred in cancer incidence and cancer mortality in Michigan over a ten to fifteen-year period are illustrated in this section. Data on new cancer cases from 1993 to 2007 and deaths due to cancer from 1994 to 2008 were made available from the Michigan Cancer Surveillance Program at the Michigan Department of Community Health.^{1,2} The Estimated Annual Percent Change (EAPC) in age-adjusted incidence and mortality rates over multiple-year periods were calculated by regressing the calendar year on the natural log of age-adjusted incidence and mortality rates.^{3,4} Rates were calculated by direct age-adjustment using the 2000 US population age distribution as the standard population. In the regression equation ($y=mx+b$), x =year and $y=\ln(\text{rate})$. The $EAPC=100*((e^m)-1)$. To test EAPC for statistical significance, t tests were used to test the hypothesis that the slope of the regression line is equal to zero, using two-sided $p=.05$. The EAPC in mortality rates was calculated over the period 1999 to 2008 and EAPC in incidence rates was calculated over the period 1998 to 2007. In order to compare Michigan with the United States, the EAPC in mortality rates was calculated over the period 1998 to 2007.⁵

Summary

Figures 1 through 3 show the EAPC in mortality rates for the total population, and for women and men for the relevant cancer sites. From 1999 to 2008, total mortality rates in Michigan due to breast, cervical, colorectal, lung, prostate, and ovarian cancer all decreased. All changes were statistically significant at $p\leq.05$, except for cervical cancer. Lung cancer mortality rates decreased among men, but increased among women (statistically significant changes at $p\leq.05$).

Figure 4 shows EAPC in mortality rates for Michigan compared to the United States from 1998 to 2007. The estimated annual percent change in Michigan decreased at a greater rate than the United States among prostate cancer mortality rates and among for cervical cancer mortality rates. The annual percent change in mortality rates for lung cancer decreased at a smaller rate in Michigan compared to the United States. The annual percent change in mortality rates for colorectal, breast, and ovarian cancer were comparable between Michigan and the United States.

Figures 5 through 7 follow the yearly mortality rates for each cancer site from 1994 to 2008 for the total population, and women and men separately. Overall, mortality rates for each cancer site

¹ Michigan Cancer Surveillance Program. (2010). *Michigan Cancer Death Public Use File 1985-2008*. Michigan Department of Community Health (MDCH), Division for Vital Records & Health Statistics.

² Michigan Cancer Surveillance Program. (2010). *Michigan Cancer Incidence Public Use File 1985-2007*. Michigan Department of Community Health (MDCH), Division for Vital Records & Health Statistics.

³ Rates were calculated using annual state population estimates based on the actual size of the Michigan population in years 1985 through 2007. Population data is provided by the Michigan Department of Community Health, Division for Vital Records and Statistics.

⁴ Edwards BK, Brown ML, Wingo PA, Howe HL, Ward I, Ries LAG, Schrag D, Jamison PM, Jemal A, Wu XC, Friedman C, Harlan L, Warren J, Anderson RN, Pickle LW. (2005). Annual Report to the Nation on the Status of Cancer, 1975-2002, Featuring Population-Based Trends in Cancer Treatment. *Journal of the National Cancer Institute*. 97:19, 1407-27.

⁵ National Cancer Institute. (2010). *SEER Cancer Statistics Review, 1975-2007*. Retrieved from: www.seer.cancer.gov/csr/1975_2007/index.html

have decreased. Prostate cancer has seen the greatest decrease in mortality over the fifteen year period, while ovarian cancer mortality rates have remained fairly stable. Lung cancer mortality rates among females in Michigan have increased, while colorectal and breast cancer mortality rates have declined among Michigan women. Mortality rates for lung, colorectal, and prostate cancer have declined among Michigan men.

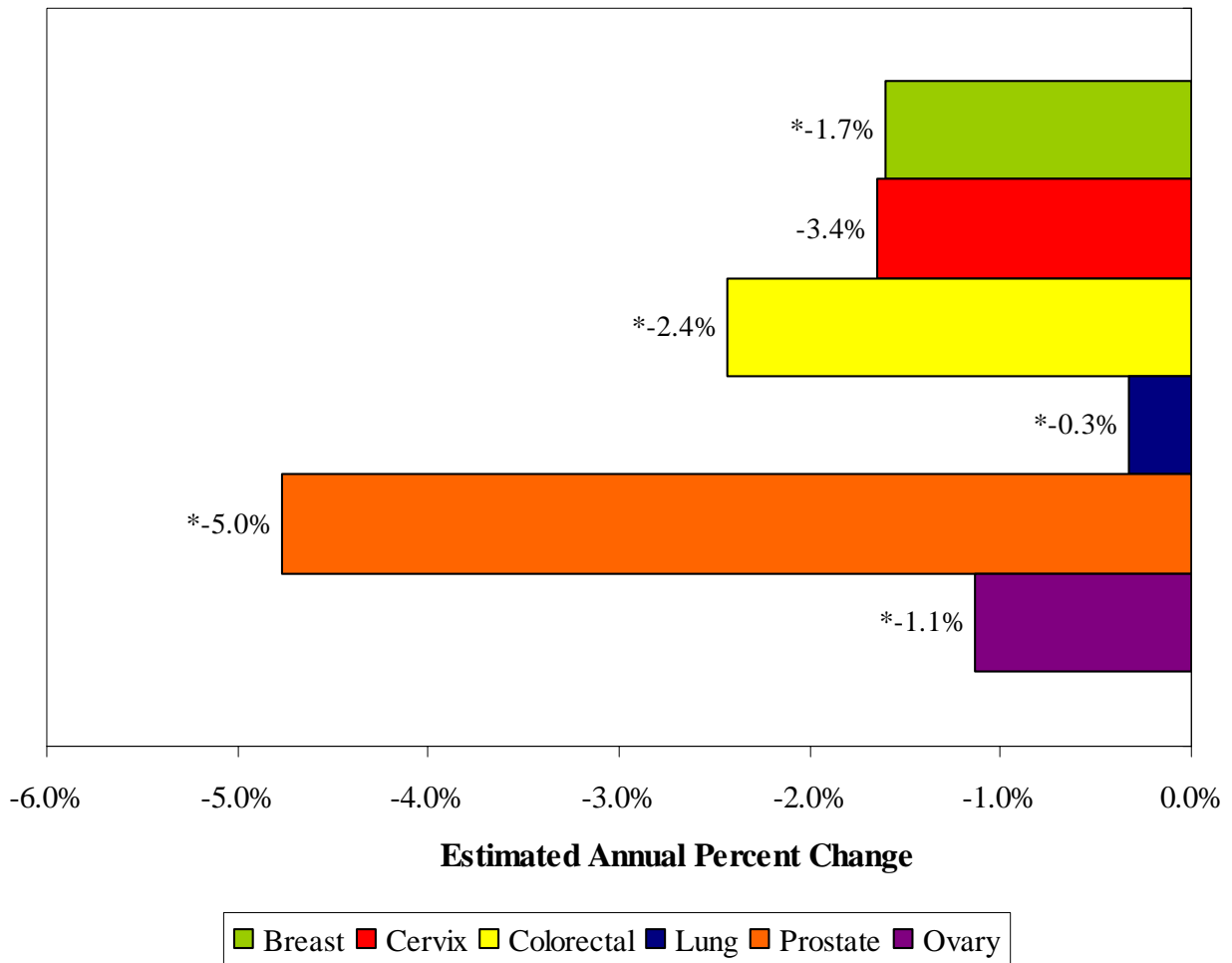
Figures 8 through 10 show the EAPC in cancer incidence rates between 1998 and 2007 for the state's population as a whole, as well as for Michigan women and men separately. As can be seen, the incidence rates for breast, cervical, colorectal, ovarian, and prostate cancer decreased significantly ($p < 0.05$) among the state's total population, while the incidence rate for lung cancer decreased only slightly. When considered separately, the rates for Michigan women showed significant ($p < 0.05$) decreases in breast, cervical, colorectal, and ovarian cancer incidence, but a 0.8% increase in lung cancer incidence. Rates for Michigan men, meanwhile, showed significant ($p < 0.05$) decreases in colorectal, lung and prostate cancer incidence.

Figure 11 shows EAPC in incidence rates for Michigan compared to the United States from 1998 to 2007. The estimated annual percent change in incidence rates between Michigan and the United States for colorectal cancer and breast cancer are comparable. The estimated annual percent change in incidence rates decreased per year at a greater rate in Michigan than the United States for prostate and ovarian cancer. The estimated annual percent change in lung and cervical cancer incidence rates decreased at a smaller rate in Michigan than in the United States.

Figures 12 through 14 follow the yearly incidence rates by cancer site from 1993 to 2007 for the total population, and women and men separately. Overall, incidence rates have declined for each cancer site. Among Michigan females, the incidence rate for lung cancer has increased from 57.2 cases per 100,000 women in 1993 to 63.0 cases per 100,000 in 2007. Among Michigan males, overall incidence rates for colorectal, lung and prostate cancer have all declined from 1993 to 2007, with the greatest decrease in incidence seen within prostate cancer.

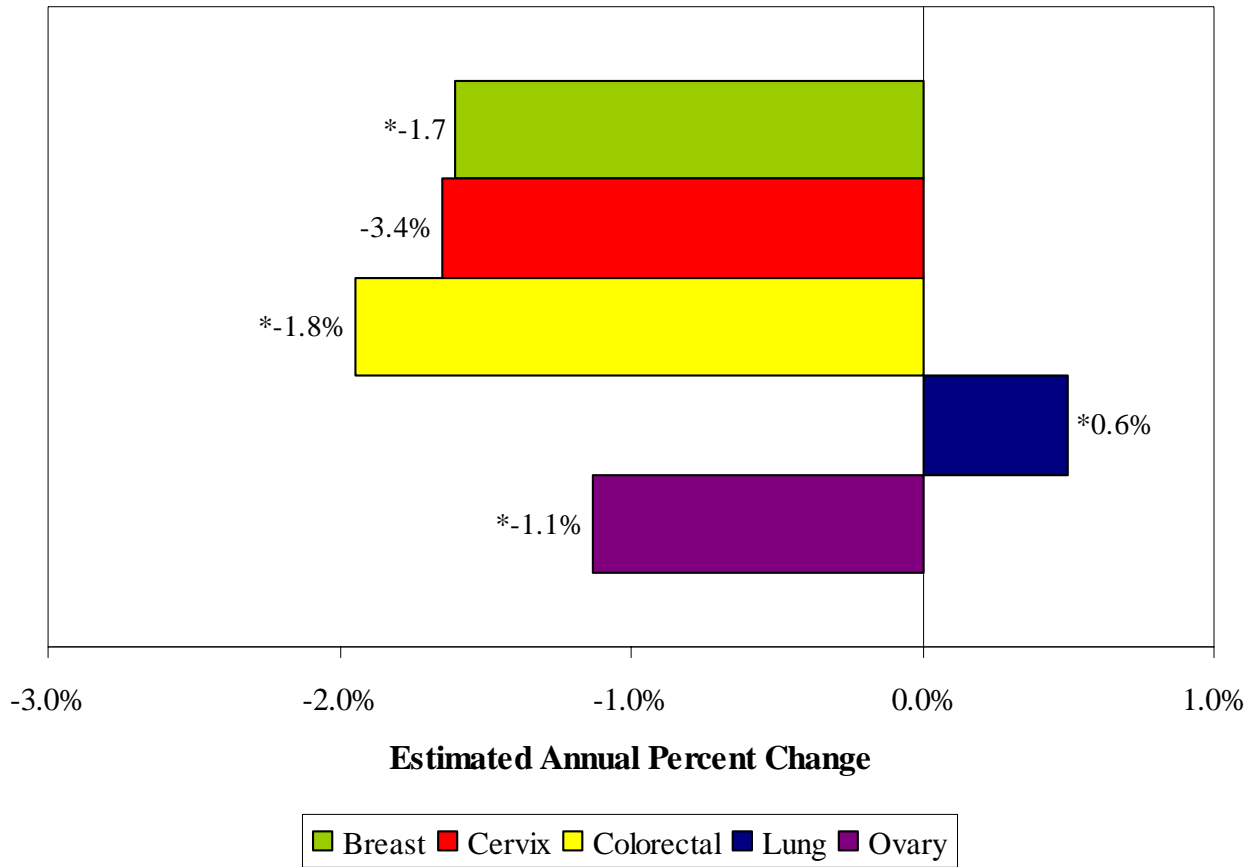
Mortality

Figure 1: Estimated Annual Percent Change in Mortality Rates by Cancer Site, Michigan 1999-2008



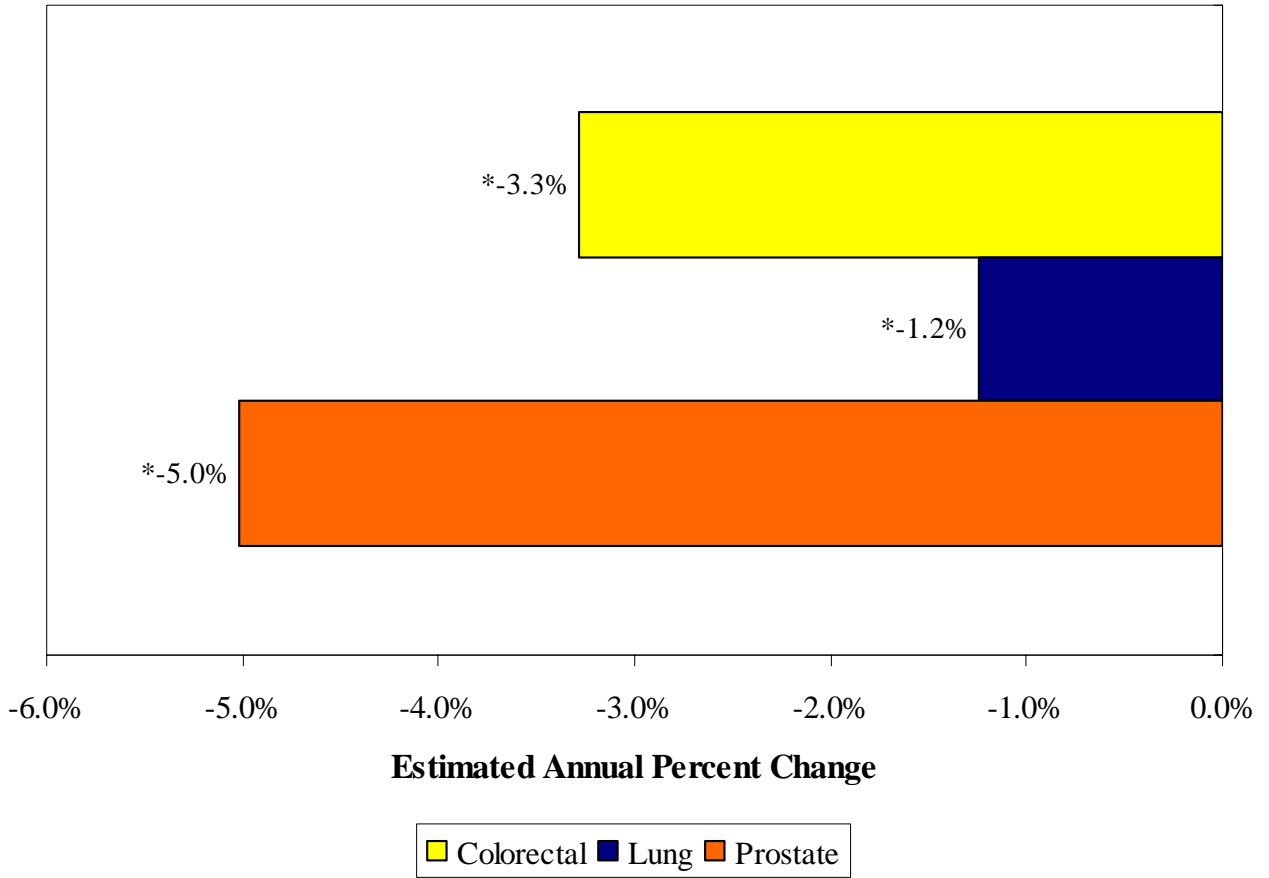
* The EAPC is significantly different from zero ($p \leq .05$).
Rates are age-adjusted and computed by gender for breast, cervical and prostate cancer.

Figure 2: Estimated Annual Percent Change in Mortality Rates by Cancer Site, Michigan Females 1999-2008



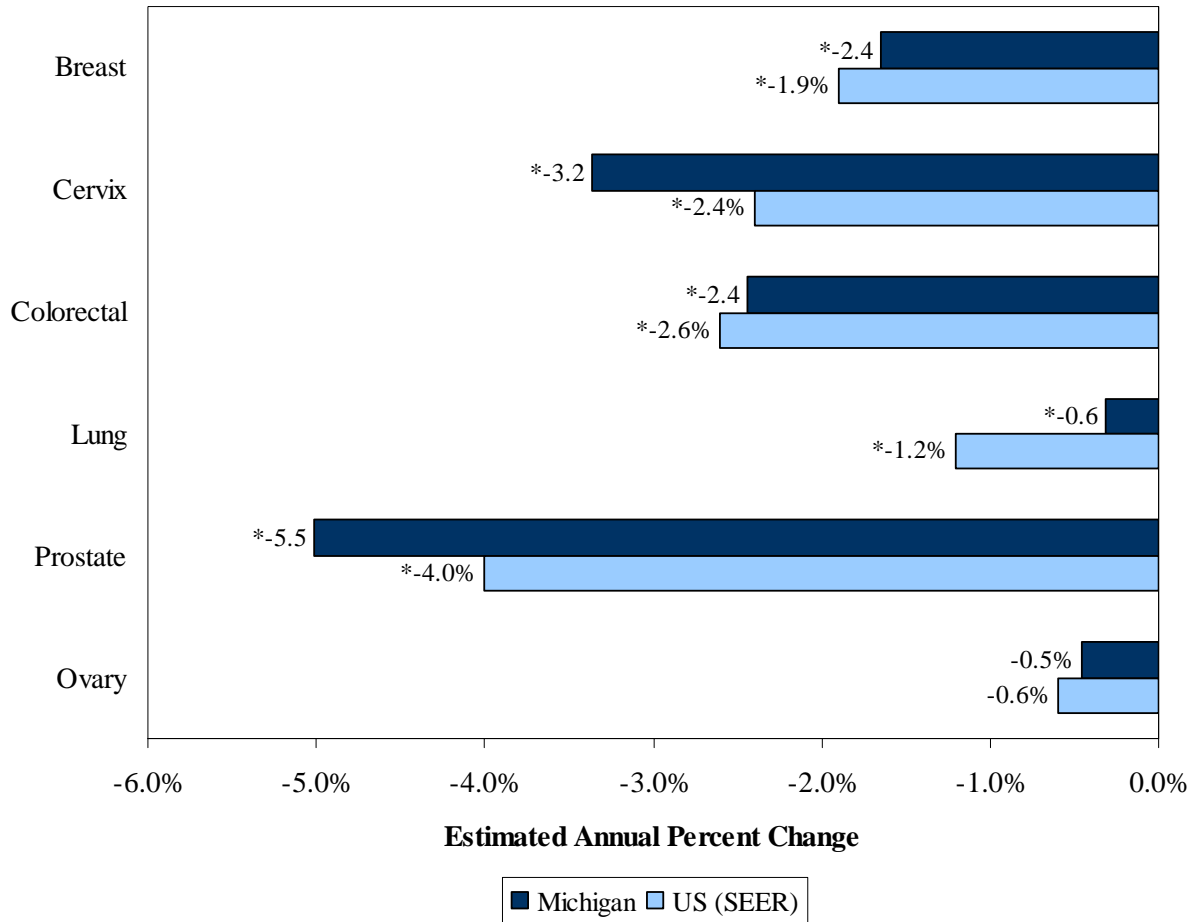
* The EAPC is significantly different from zero ($p \leq .05$).
Rates are age-adjusted and computed by gender.

Figure 3: Estimated Annual Percent Change in Mortality Rates by Cancer Site, Michigan Males 1999-2008



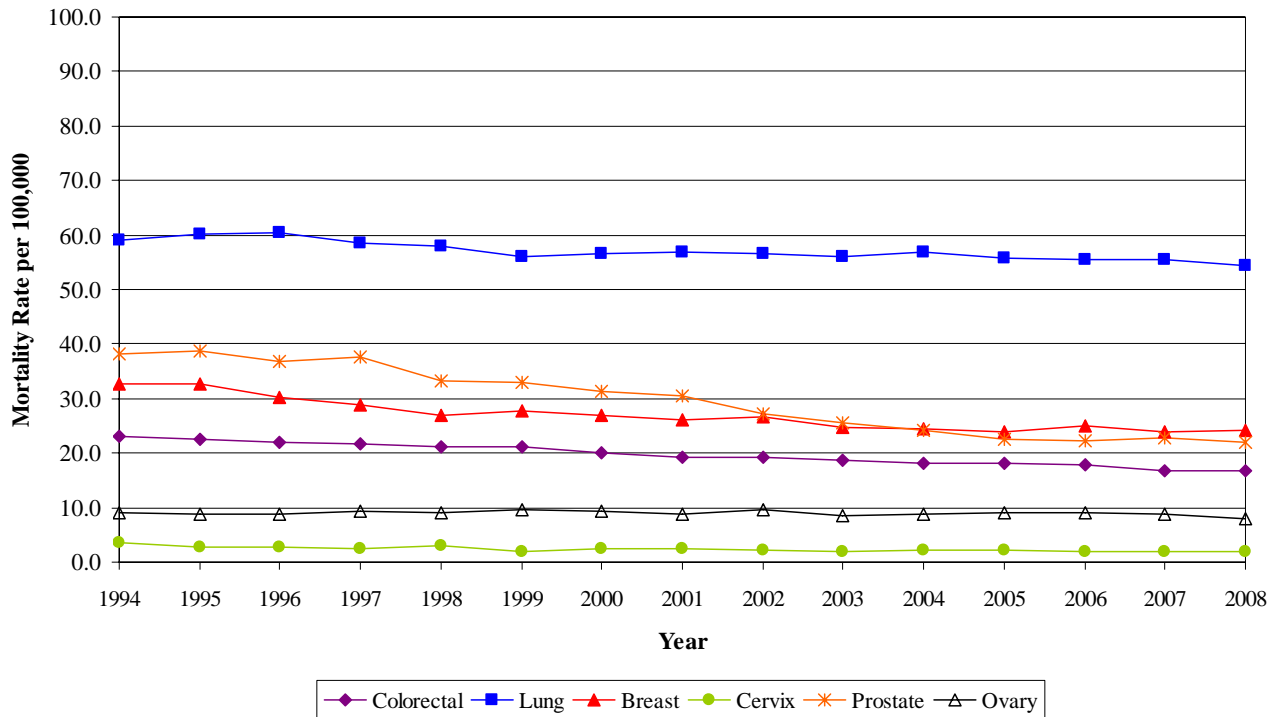
* The EAPC is significantly different from zero ($p \leq .05$).
Rates are age-adjusted and computed by gender.

Figure 4: Estimated Annual Percent Change in Mortality Rates, Michigan vs. US 1998-2007



* The EAPC is significantly different from zero ($p \leq .05$).
 Rates are age-adjusted and computed by gender breast, cervical and prostate cancer.

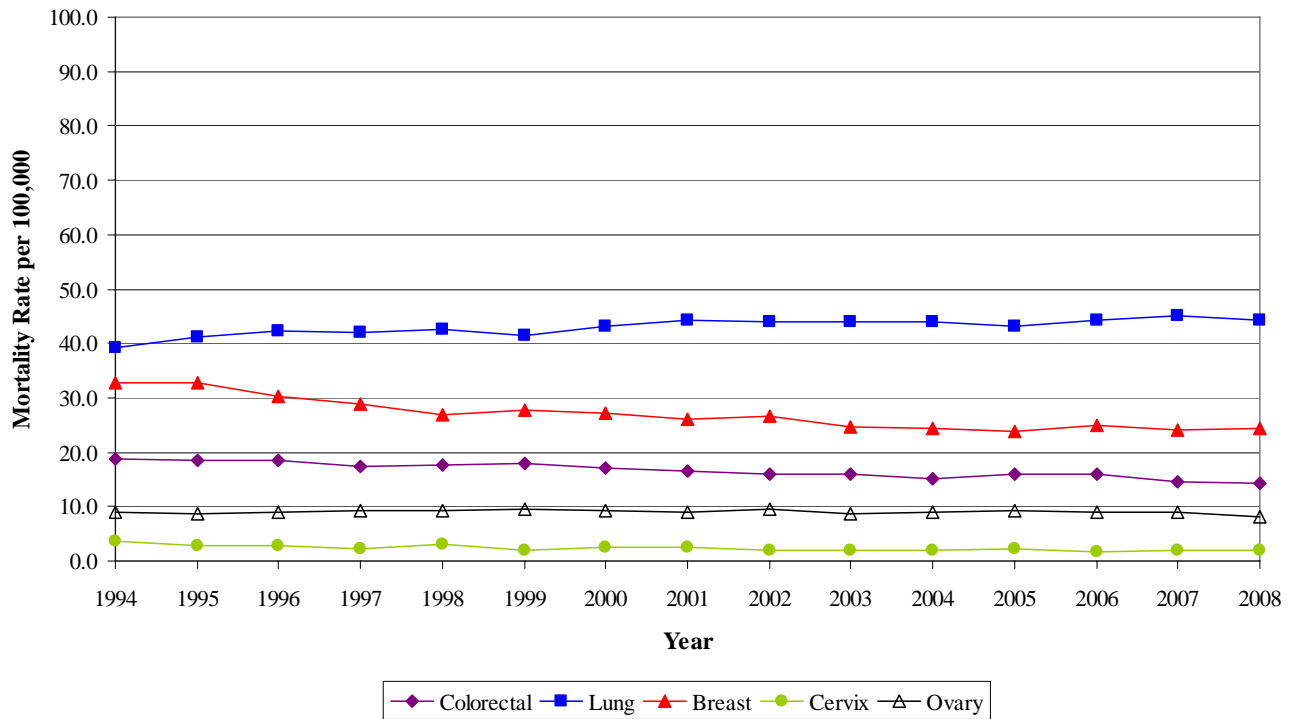
Figure 5: Total Mortality Rates by Cancer Site, Michigan 1994-2008



	Colorectal	Lung	Breast	Cervix	Prostate	Ovary
1994	23.0	58.9	32.7	3.7	38.2	9.1
1995	22.6	60.2	32.8	2.8	38.6	8.7
1996	22.1	60.4	30.3	2.9	36.7	8.9
1997	21.6	58.5	28.9	2.4	37.5	9.4
1998	21.2	57.9	27.0	3.0	33.3	9.1
1999	21.3	56.1	27.8	2.1	33.0	9.6
2000	20.2	56.6	27.1	2.4	31.3	9.3
2001	19.2	56.9	26.2	2.5	30.5	8.8
2002	19.2	56.6	26.7	2.1	27.2	9.6
2003	18.8	56.1	24.7	1.9	25.5	8.6
2004	18.0	56.8	24.3	2.1	24.3	8.8
2005	18.2	55.9	23.8	2.2	22.7	9.2
2006	17.8	55.6	24.9	1.8	22.3	9.1
2007	16.8	55.5	24.0	2.0	22.9	8.9
2008	16.7	54.5	24.2	2.0	21.9	8.0

-Rates are age-adjusted per 100,000 gender-specific population.

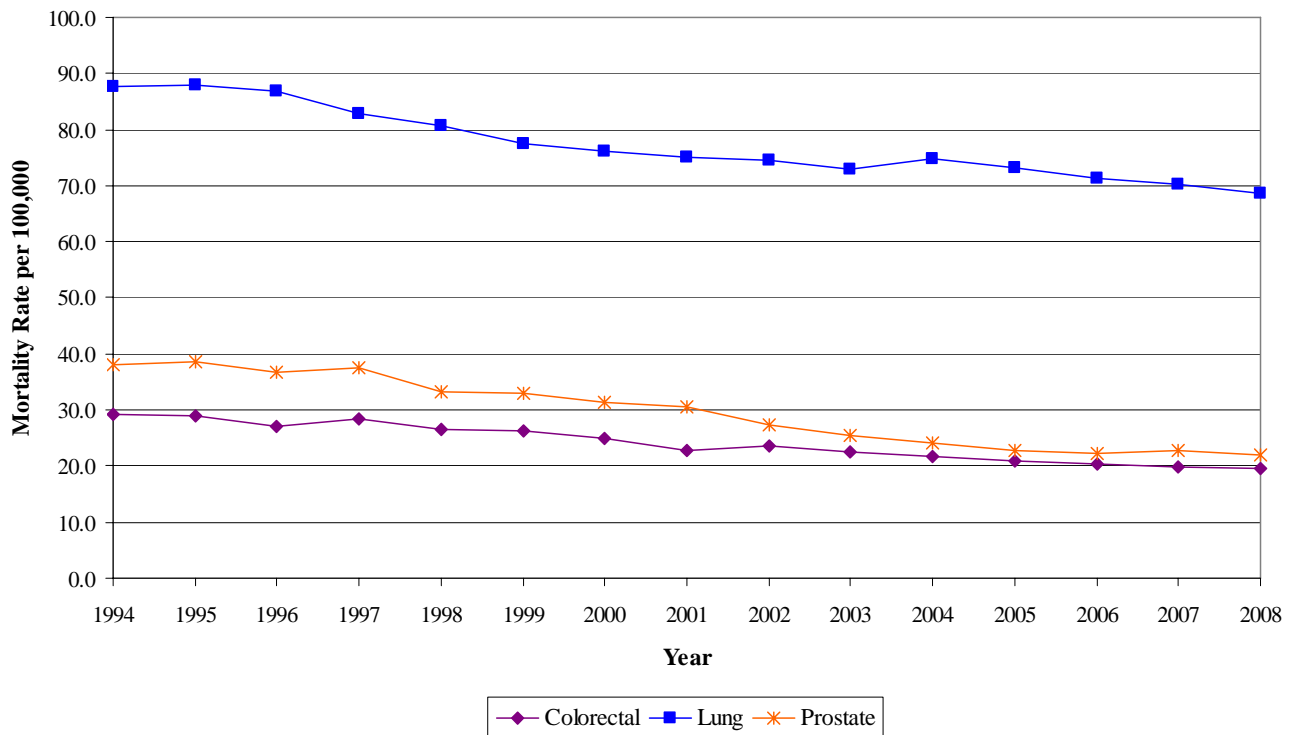
Figure 6: Female Mortality Rates by Cancer Site, Michigan 1994-2008



	Colorectal	Lung	Breast	Cervix	Ovary
1994	18.9	39.2	32.7	3.7	9.1
1995	18.5	41.3	32.8	2.8	8.7
1996	18.6	42.4	30.3	2.9	8.9
1997	17.3	42.1	28.9	2.4	9.4
1998	17.5	42.5	27.0	3.0	9.1
1999	17.8	41.5	27.8	2.1	9.6
2000	17.0	43.1	27.1	2.4	9.3
2001	16.6	44.3	26.2	2.5	8.8
2002	16.0	44.1	26.7	2.1	9.6
2003	16.0	43.9	24.7	1.9	8.6
2004	15.2	44.0	24.3	2.1	8.8
2005	15.9	43.1	23.8	2.2	9.2
2006	15.9	44.2	24.9	1.8	9.1
2007	14.7	45.0	24.0	2.0	8.9
2008	14.4	44.2	24.2	2.0	8.0

-Rates are age-adjusted per 100,000 gender-specific population.

Figure 7: Male Mortality Rates by Cancer Site, Michigan 1994-2008

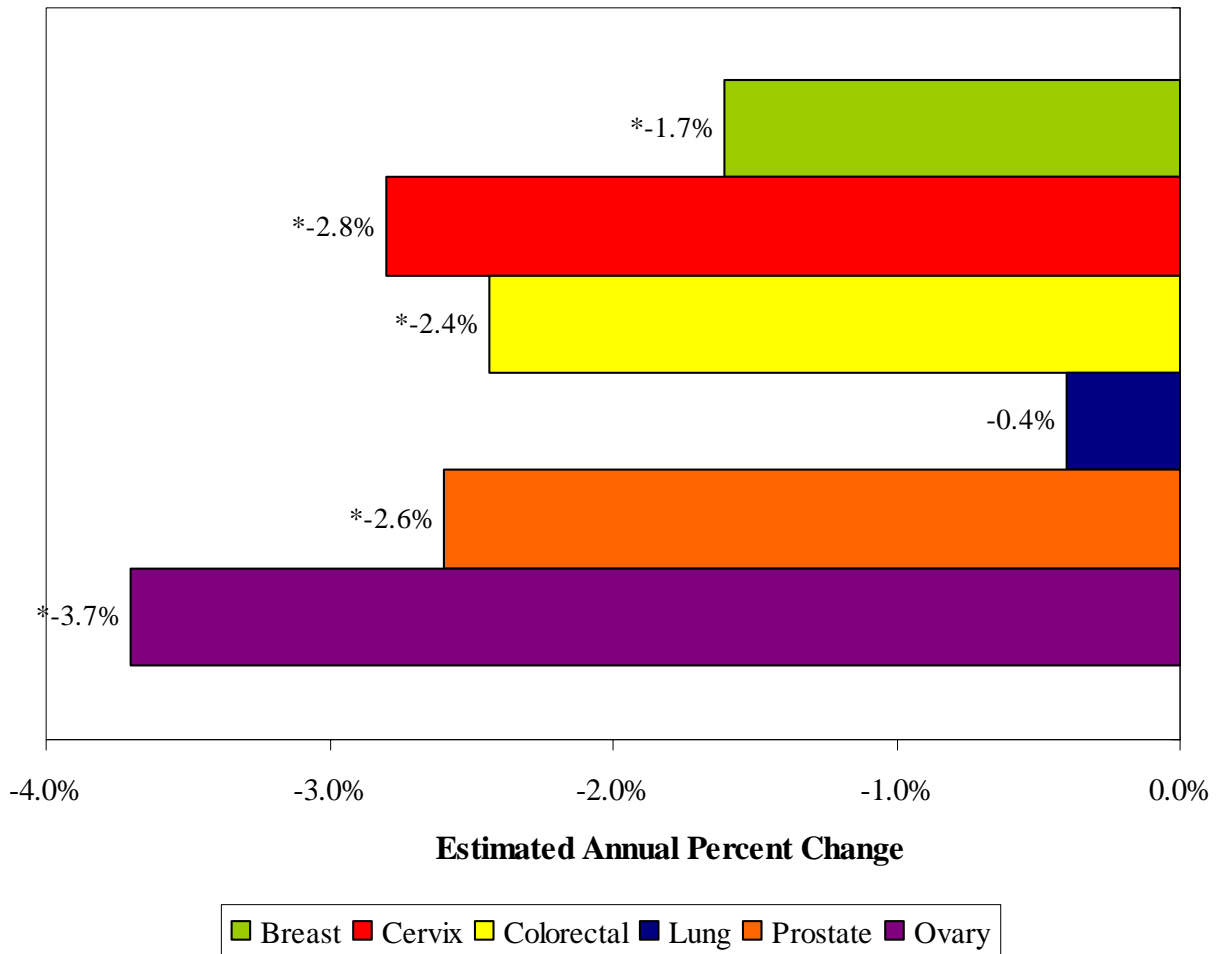


	Colorectal	Lung	Prostate
1994	29.2	87.6	38.2
1995	29.0	88.0	38.6
1996	27.2	86.7	36.7
1997	28.3	82.9	37.5
1998	26.5	80.6	33.3
1999	26.4	77.6	33.0
2000	25.1	76.1	31.3
2001	22.9	75.1	30.5
2002	23.6	74.6	27.2
2003	22.5	72.9	25.5
2004	21.8	74.8	24.3
2005	21.0	73.1	22.7
2006	20.4	71.2	22.3
2007	19.8	70.3	22.9
2008	19.6	68.6	21.9

-Rates are age-adjusted per 100,000 gender-specific population.

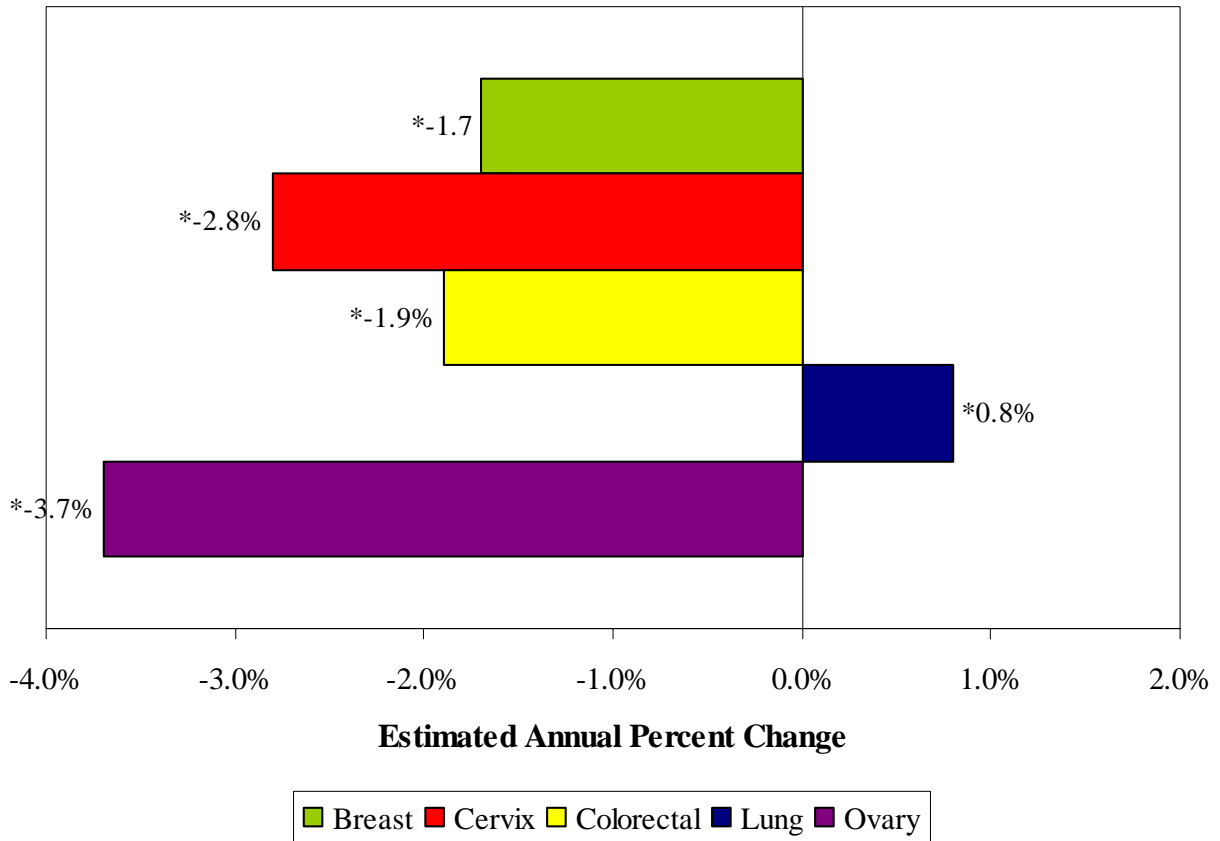
Incidence

Figure 8: Estimated Annual Percent Change in Incidence Rates by Cancer Site, Michigan 1998-2007



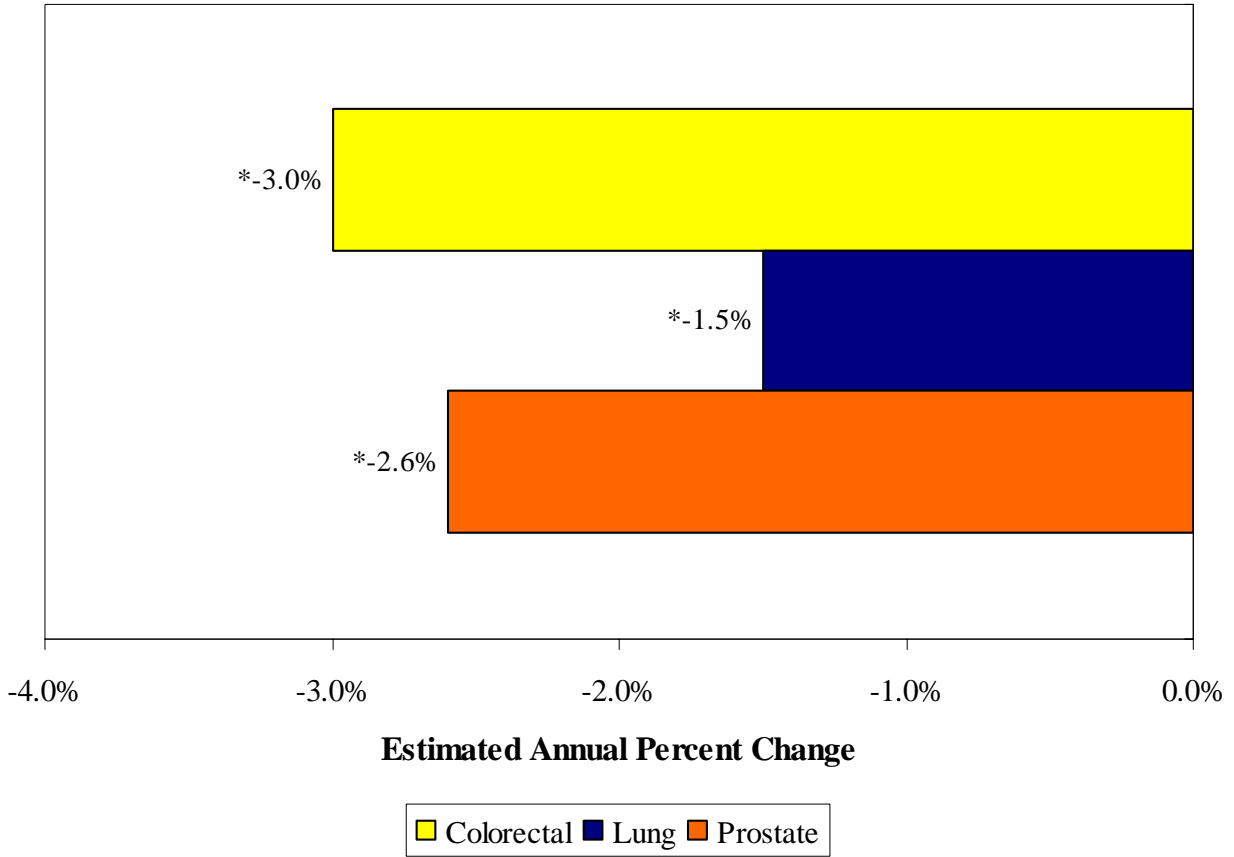
* The EAPC is significantly different from zero ($p \leq .05$).
Rates are age-adjusted and computed by gender for breast, cervical and prostate cancer.

Figure 9: Estimated Annual Percent Change in Incidence Rates by Cancer Site, Michigan Females 1998-2007



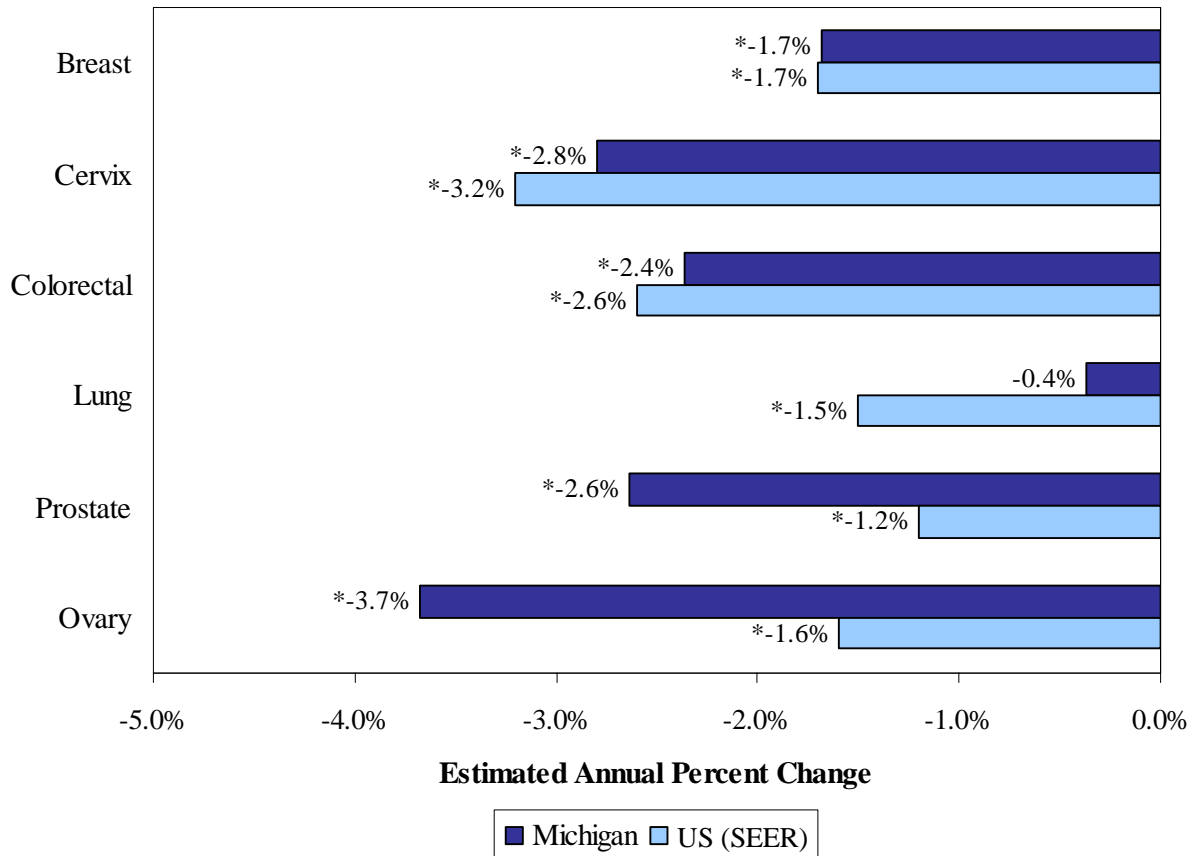
* The EAPC is significantly different from zero ($p \leq .05$).
Rates are age-adjusted and computed by gender.

Figure 10: Estimated Annual Percent Change in Incidence Rates by Cancer Site, Michigan Males 1998-2007



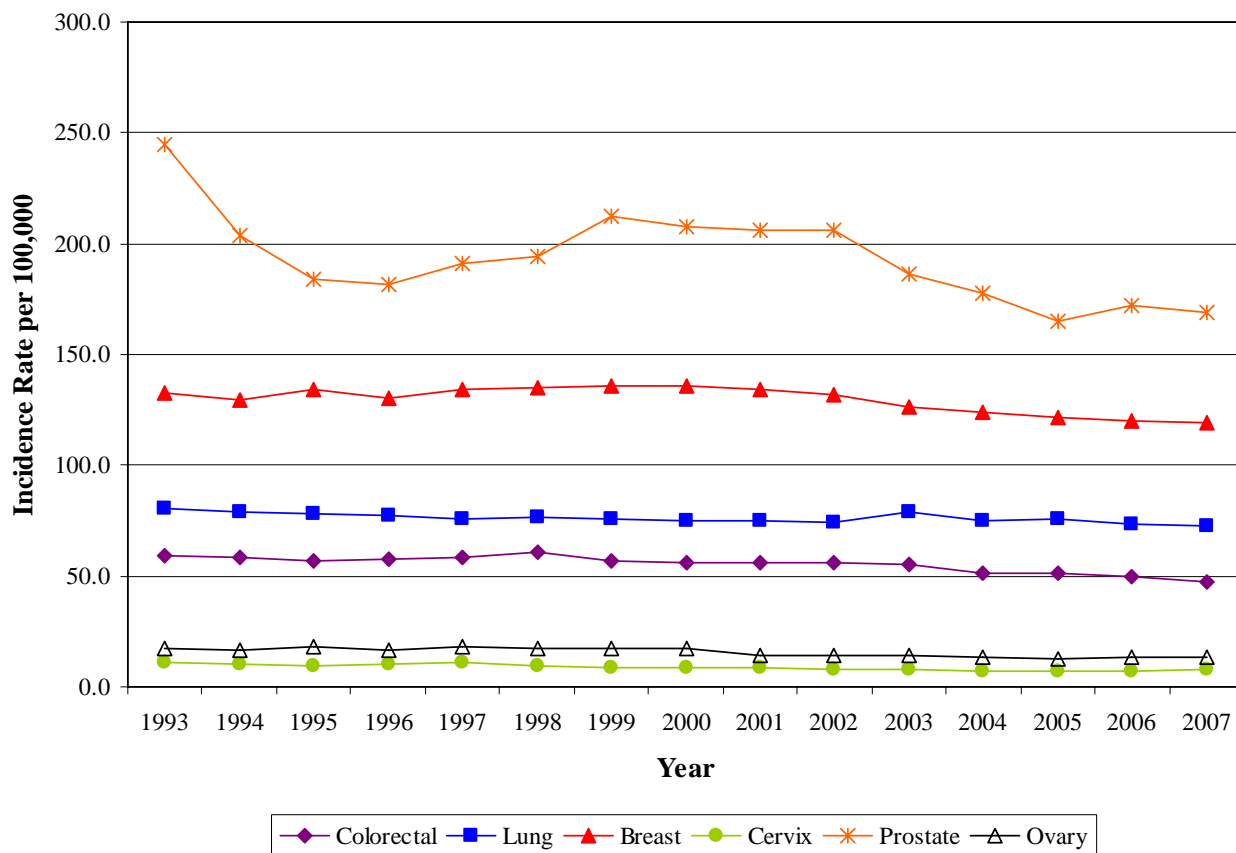
* The EAPC is significantly different from zero ($p \leq .05$).
Rates are age-adjusted and computed by gender.

Figure 11: Estimated Annual Percent Change in Incidence Rates, Michigan vs. US 1998-2007



* The EAPC is significantly different from zero ($p \leq .05$).
Rates are age-adjusted and computed by gender for breast, cervical and prostate cancer.

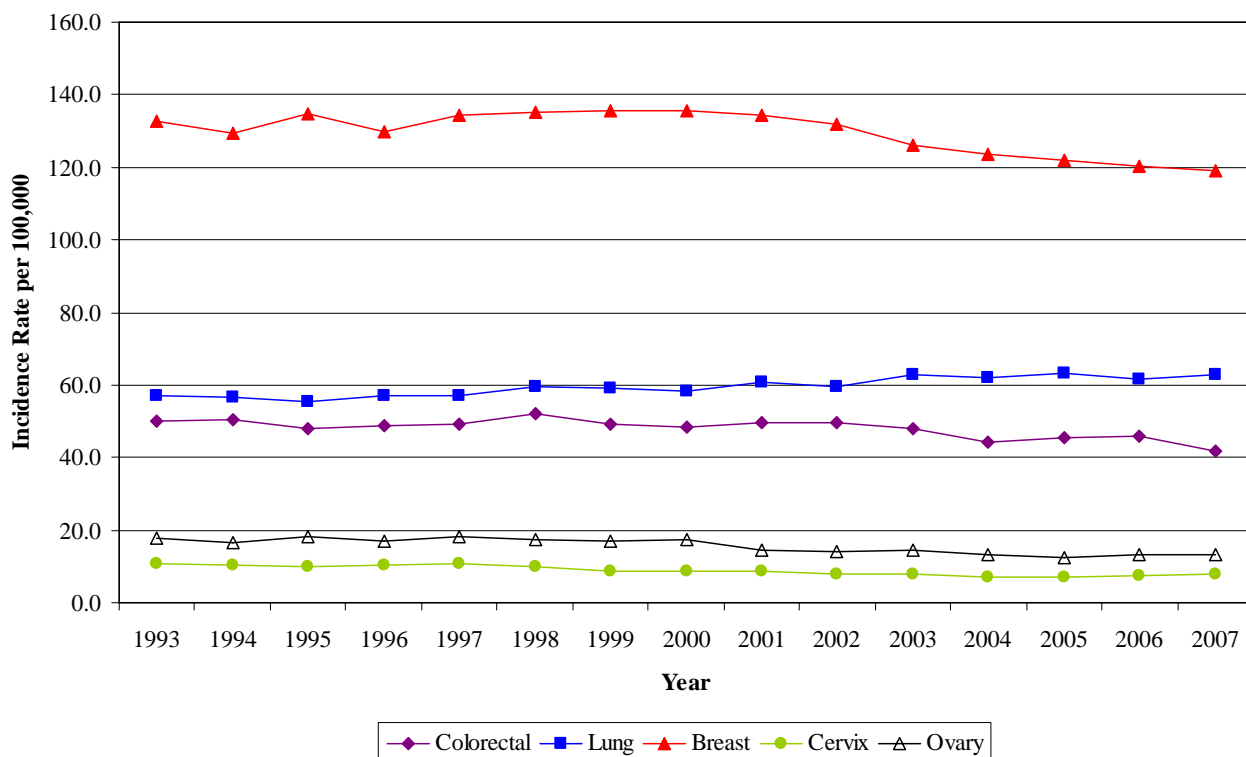
Figure 12: Total Incidence Rates by Cancer Site, Michigan 1993-2007



	Colorectal	Lung	Breast	Cervix	Prostate	Ovary
1993	59.4	80.7	132.6	10.9	244.6	17.7
1994	58.4	78.8	129.3	10.2	204.0	16.7
1995	56.7	78.2	134.6	9.7	183.6	18.2
1996	58.0	77.0	130.0	10.3	181.9	16.8
1997	58.1	75.8	134.4	10.7	191.3	18.1
1998	60.8	76.7	135.1	9.8	193.9	17.3
1999	56.7	75.5	135.5	8.6	212.4	17.1
2000	55.8	75.0	135.6	8.8	207.3	17.4
2001	56.0	74.9	134.3	8.8	205.9	14.4
2002	56.2	73.9	131.9	7.9	206.4	14.0
2003	55.0	78.7	126.1	7.9	186.3	14.4
2004	51.2	74.9	123.6	7.1	178.0	13.4
2005	50.9	75.8	121.8	7.2	165.1	12.5
2006	50.0	73.3	120.1	7.3	171.8	13.1
2007	47.0	72.4	119.2	8.0	168.7	13.2

-Rates are age-adjusted per 100,000 gender-specific population.

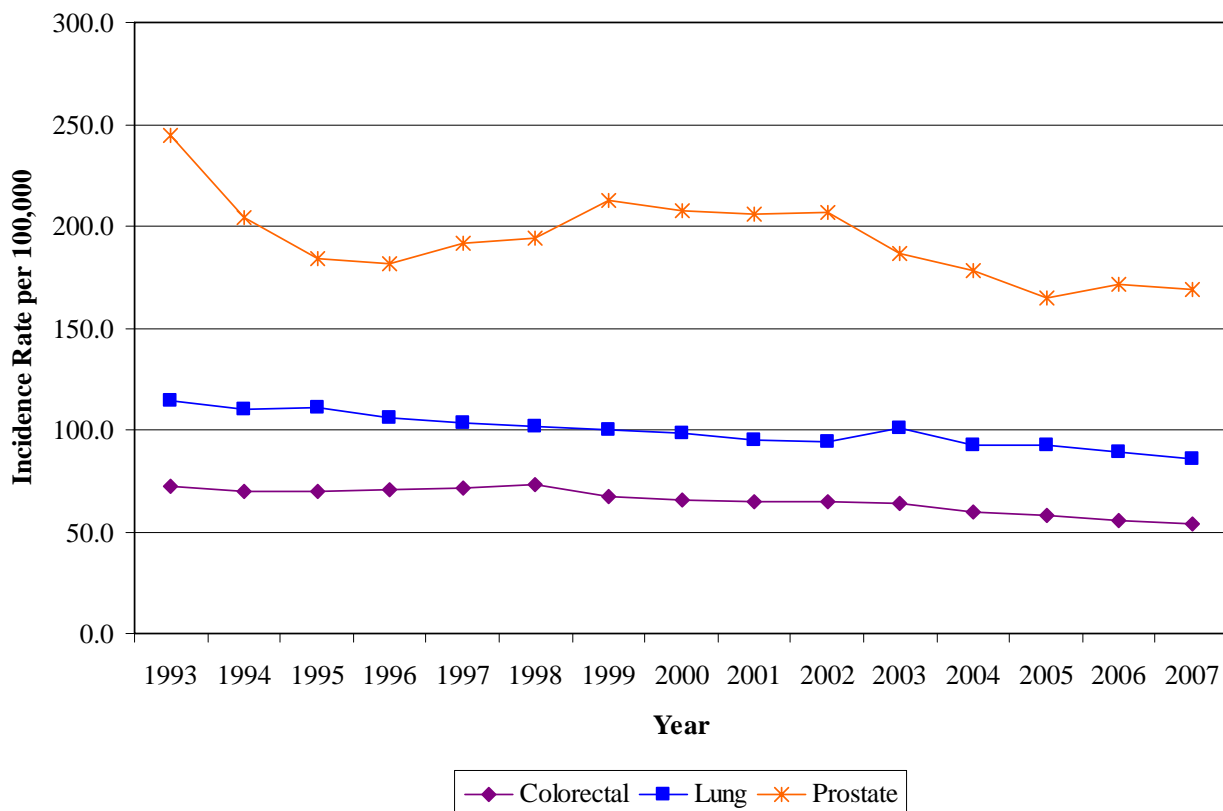
Figure 13: Female Incidence Rates by Cancer Site, Michigan 1993-2007



	Colorectal	Lung	Breast	Cervix	Ovary
1993	49.9	57.2	132.6	10.9	17.7
1994	50.3	56.8	129.3	10.2	16.7
1995	47.9	55.5	134.6	9.7	18.2
1996	48.8	56.9	130.0	10.3	16.8
1997	49.1	57.0	134.4	10.7	18.1
1998	52.1	59.4	135.1	9.8	17.3
1999	49.1	59.1	135.5	8.6	17.1
2000	48.3	58.2	135.6	8.8	17.4
2001	49.5	60.6	134.3	8.8	14.4
2002	49.5	59.7	131.9	7.9	14.0
2003	47.8	62.8	126.1	7.9	14.4
2004	44.4	61.9	123.6	7.1	13.4
2005	45.4	63.3	121.8	7.2	12.5
2006	45.7	61.7	120.1	7.3	13.1
2007	41.9	63.0	119.2	8.0	13.2

-Rates are age-adjusted per 100,000 gender-specific population.

Figure 14: Male Incidence Rates by Cancer Site, Michigan 1993-2007



	Colorectal	Lung	Prostate
1993	72.7	114.7	244.6
1994	70.0	110.3	204.0
1995	69.9	111.0	183.6
1996	70.7	106.0	181.9
1997	71.1	103.1	191.3
1998	73.3	101.7	193.9
1999	67.5	99.6	212.4
2000	65.9	98.4	207.3
2001	64.3	95.1	205.9
2002	64.6	93.8	206.4
2003	64.2	101.0	186.3
2004	60.0	92.8	178.0
2005	58.1	92.7	165.1
2006	55.6	89.4	171.8
2007	53.6	85.9	168.7

Rates are age-adjusted per 100,000 gender-specific population.